DEPARTMENT OF THE ARMY FIELD MANUAL

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WEATHER SUPPORT FOR FIELD ARMY TACTICAL OPERATIONS

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

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WEATHER SUPPORT FOR FIELD ARMY TACTICAL OPERATIONS

CHAPTER 1

INTRODUCTION

1–1. Purpose and Scope

a. This manual provides doctrinal guidance to U.S. Air Force, Air Weather Service (AWS) and field personnel, including commanders and staff officers, who are concerned with the weather support required for army tactical operations. It consolidates and explains U.S. Army and Air Weather Service current doctrinal guidance on weather support services and functions provided for field army tactical operations, and provides guidance to field personnel and USAF staff weather officers and AWS personnel operating with field army headquarters and elements. The information is applicable to general war, limited war, and cold war, to include stability operations.

b. This manual covers weather effects, support requirements, and theoretical aspects of meteorology which concern field army operations. It describes sources of meteorological (met) and weather information, weather services provided, and communications support. This manual does not detail the following:

(1) Met support to garrison operations.

(2) Met support to the U.S. Army Research and Development or to other specialized, nontactical army functions.

(3) Ballistic meteorology. A thorough description of the functions of artillery met teams in providing ballistic met messages is covered in FM 6–15.

(4) Meteorology for army aviation as it pertains to aviation operations. A comprehensive source for this information is TM 1–300.

1–2. Meteorology Basic Principles, Doctrine, Functions and Responsibilities

a. Basic Principles.

(1) Deployment, employment, and logistics of forces are affected by meteorological conditions.

(2) A commander should consider all meteorological factors involved to determine how best to perform his mission. He uses meteorological services as an integral part in his strategic and tactical planning operations.

(3) Meteorological data are highly perishable. Usefulness of observations and forecasts is short-lived because of the continually changing state of the atmosphere.

(4) To be effective, meteorological service requires constant and reliable communications support.

b. Doctrine.

(1) The U.S. Weather Bureau and the foreign national meteorological services are responsible for providing the basic observational network, the basic broad scale analyses and prognoses, and the related facilities within their national territories. Any hemispheric analyses to be used in support of commands in waging worldwide military operations automatically suppose interdependence among nations for meteorological services.

(2) The U.S. military meteorological services are specialized worldwide services organized to satisfy unique military requirements such as support to a mobile field army, to an air strike force, or to a navy carrier task force. Mobility, responsiveness to command, combat readiness, and alertness to new weapon systems concepts are criteria of the military meteorological services.

c. Function and Responsibilities.

(1) The Chief of Staff, U.S. Air Force, through the Commander, Air Weather Service, is responsible for providing meteorological support to all elements of the Air Force and to all army tactical units except as indicated in (2) below.

(2) The Chief of Staff, U.S. Army, is responsible for meteorological support for army artillery fire, observations by army units with organic observing capability, observations forward of division headquarters element (except that brigades will usually include an assigned AWS met team when directed by competent authority), river stage and flood forecasting, and other spe-

cial support which the army can most effectively or efficiently provide. (This determination will be subject to mutual agreement between the Army and the Air Force.)

(3) In discharging its responsibilities, each service will provide—

(*a*) Personnel, equipment and supplies to support operational requirements; planning for the expansion of peacetime met facilities to meet emergency or wartime needs in coordination with appropriate authority.

(*b*) The organization, personnel training, and equipments for joint operations.

(*c*) Assistance to one another in the accomplishment of military met functions, as determined by proper authority.

(*d*) The capability to operate and maintain met facilities organic to its own combat organizations, including organic service elements.

(*e*) The supervision and development of the personnel and material required for those operations for which the service has been assigned specific responsibility.

(4) In joint operations, the responsibilities of the individual services are determined by the—

(*a*) Nature of such operations.

(*b*) Services that provide the forces.

(*c*) Directives of the commanders of unified or specified commands, of the subordinate unified commands, or of other joint force commanders.

(*d*) Appropriate service or joint regulations such as AR 115–10/AFR 105–3.

1–3. References

Appendix A contains a list of publications that provides detailed information relating to material presented herein.

1–4. Definitions

Terms and abbreviations used in this manual are, where possible, in consonance with the latest issue of AR 310–25, AFM 11–1, Volume 1, AR 310–50, and AFM 11–2. Some terms and abbreviations defined in the text where first used; others are contained in the glossary.

1–5. Comments

Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons will be provided for each comment to insure understanding and complete evaluation. Comments should be prepared using DA Form 2028 (Recommended changes to Publications) and forwarded direct to the Commanding Officer, U.S. Army Combat Developments Command Communications-Electronics Agency, ATTN: Doctrine Division, Fort Monmouth, New Jersey 07703. Originators of proposed changes which would constitute a significant modification of approved Army doctrine may send an information copy, through command channels, to the Commanding General, U.S. Army Combat Developments Command, Fort Belvoir, Virginia 22060, to facilitate review and follow-up.

CHAPTER 2

INFORMATION, INTELLIGENCE, AND SUPPORT REQUIREMENTS

Section I. TYPES OF WEATHER INFORMATION

2-1. Description

Weather information concerns the condition of the atmosphere over a given point or area at a given time. It may consist of any or all of the following:

a. Weather observations.

b. Weather forecasts.

c. Climatic studies.

d. Weather summaries.

e. Climatic summaries.

2-2. Weather Observations (fig. 2-1)

A listing of types, parameters, and sources of weather observations is given in figure 2-1. Weather observations contain information on existing weather conditions or specific weather elements. There are two basic types—

a. Observations oriented directly to user requirements. Almost all weather observations from army organic units are of this type.

b. Observations oriented toward establishing an understanding of the meteorological fluctuations and changes in atmospheric dynamics. These observations are essential to the preparation of weather forecasts and are acquired by AWS weather teams. This type observation is also made by the national weather services of all countries. When communications permit, these observations also are obtained and used by the Air Weather Service weather teams (WETM).

2-3. Weather forecasts

A weather forecast is a statement of expected weather conditions at a point, along a route, or within an area at a specified future time, or during a specified period. See figures 2-2, 2-3, and 2-4 for contents of weather forecasts.

a. Forecasts are based upon weather charts and data, the application of forecasting rules, theories, and hypotheses, combined with the forecaster's experience and his knowledge of terrain and similar external factors. The current state of the meteorological science restricts most forecasts to a 48-hour period. In addition, a 3-to 5-day forecast also can be supplied to supplement the 48-hour operational forecast. Beyond 5 days, climatology is used, normally. Local area forecasts may depend on observations from the larger surrounding area; usually these are detailed enough to permit inferences of local conditions. Forecasts are prepared by AWS for the Army on both a routine and a special basis. Forecasts are based on the information forwarded to the weather team at the Field Army Tactical Operations Center (FATOC) by the worldwide weather facilities of the Air Weather Service (AWS), and on local meteorological data collected within the field army area. See figures 2-2, 2-3, and 2-4 for a detailed listing of weather forecasts provided the tactical army.

b. The accuracy of a forecast depends on many factors, including length of the forecast period, amount and reliability of weather data, location of the area, type of terrain, season, detail required, reliability of weather communications, and experience of the forecaster. When weather observations are few, or the meteorological situation is complex, a forecast of conditions 2 or 3 hours ahead may be inaccurate. When reports are complete and the meteorological situation is relatively simple, or static, conditions may be forecast with reasonable accuracy for as long as 5

Figure 2-1. Current field army sources of meteorological information—observations.

(Located in back of manual)

days; however, reliability of forecasts generally decreases as the forecast period increases. Because a forecast is issued for specific time, usually beginning soon after issue, it rapidly loses its value unless received by the user. Consequently, forecasts are disseminated by electrical or other rapid means.

c. The forecasts are classified according to the length of the forecast period or the specialized use of the forecast. The classifications according to length of the periods covered are as follows:

(1) Short-period forecasts give detailed values of the weather elements expected to occur during the period and the time of anticipated weather changes. They are sufficiently reliable for use in detailed short-range planning. The accuracy usually decreases as the period increases. Short-period forecasts also are referred to by the period covered; for example, 12-hour, 24-hour, or 48-hour forecasts.

(2) Extended period forecasts are less detailed and less specific than short period forecasts. Usually the weather information is expressed in terms of departure from normal conditions and is suitable only for preliminary planning purposes. Extended period forecasts are also known as 3- to 5-day forecasts.

(3) Weather outlooks cover from 5 days to a month in advance and are based largely on climatic data. They predict future weather in general terms, expected departures from normal conditions, and expected times of significant changes. These predictions normally are useful only for preliminary planning and are classed as climatic studies. (See app B for a typical extended period weather forecast.)

d. Weather forecasts are also classified either as general, covering a wide range of weather elements, or special. All forecasts are user-oriented, the special forecast covering a few elements in greater detail for a specific user. A description of the various general and special forecasts is given in figures 2–3 and 2–4.

(1) General forecasts are used by the majority of army units for day-to-day operations. They are developed from reports received from a widespread network of stations which make simultaneous observations at prescribed times. The data resulting from the observations are transmitted to specific users and to weather centers and WETM for analysis. Forecasting techniques are applied to these data to produce the forecast product, which is then forwarded to the operating units concerned. This type of forecast requires that the system of communication be dependable and that observers be located over a wide area, including, if possible, territory in possession of the enemy.

(2) Special forecasts include forecasts for use of nuclear weapons, aviation flight, route and terminal for individual army aviation flights, micro-meteorological for employment of toxic chemicals and biological agents, and severe weather warnings.

(3) Forecasts of fallout winds are special forecasts of winds aloft to determine the area that would be covered by nuclear fallout. The information is presented in a numerical code form or a graphic plot.

(4) Severe weather warnings alert army personnel of weather conditions which will create unusual difficulties. Examples of severe weather include tropical storms, hurricanes, thunderstorms, tornadoes, strong and gusty surface winds, heavy precipitation, and extremes of temperature. These warnings are provided by Air Weather Service. The basic criteria for these warnings is furnished by the army commander. The *critical* conditions vary with the type of unit or installation. For example, one unit may require warnings of winds in excess of 15 to 20 knots, while another may not be adversely affected by wind until the speed reaches 35 to 40 knots or more.

e. Weather forecasts may be presented in coded (numerical), graphical (pictorial), or written (plain language) format. Normally, weather forecasts for use by army units will be issued in plain language form. Abbreviations, which are used extensively in weather messages, are contained in JANAP 169 and in the Federal Aviation Agency publication, *Contractions*.

2–4. Climatological Information

Climatological information deals with weather conditions and variations from normal for a particular place or area during a specified period of the year. Two types of climatological information are: climatic studies and climatic summaries.

a. A climatic study is derived from the application of climatological information in a manner to reveal the probable effects of climate and weather elements on a specific operation or activity.

b. A climatic summary is a statistical expression of weather elements in terms of averages, extremes, and frequencies of occurrences over a

given period of time (app C). Refer also to figures 2–3 and 2–4 for a list of the weather elements usually found in a climatic study. This summary highlights those features of the climate which may impose problems in military operations, and it is of value to the field commander in preparing to meet such problems.

c. Climatic summaries and studies supplement information contained in intelligence surveys. The summaries should be available to a commander at least 6 months prior to the period covered by the report. When staff members or the technical services plan an operation, they may require certain items of information which describe a region. Examples of such requirements are: the relationship between precipitation, snow cover and thaw dates used by the engineers when they prepare charts of soil trafficability, or the wind and cloud patterns expected at the surface and aloft during a certain season which staff sections need in planning airborne operations.

2–5. Climatic Studies

a. Based upon the records of past weather in a given area compiled over a long period of time, these studies range in scope from investigating a variety of weather conditions over a country to analyzing the local effects of a single atmospheric parameter on a particular operation or problem. For example, analyzing surface wind data for optimum runway orientation.

b. These studies are used in preliminary planning to provide knowledge of mean and extreme weather conditions which may be expected during the period of proposed operations. Climatic studies are of particular value to ordnance, engineering, transportation, and other services in anticipating engineering and logistical problems which may arise in a projected campaign. Such studies for most of the strategic areas of the world are available in section 23 of the National Intelligence Surveys (NIS). Climatic studies for specific areas and problems are prepared by air weather service units.

c. Although the weather elements presented in a climatic study of a specific area will vary according to the needs of the user, the information presented generally will include, but not be limited to the following:

(1) Brief general description of prevailing weather for the period covered by the report.

(2) Expected temperatures and temperature variations for the period, including both the variations during a 24-hour day and the variations of the daily average.

(3) Expected precipitation: rain or snow, total expected, frequency and intensity, frequency and duration of wet or dry spells, probability of cloudbursts or blizzards or droughts, and probable standing snow cover on level ground and in drifts.

(4) Expected winds: direction and intensity (attach wind rose); maximum winds which might be expected with severe weather.

(5) Cloudiness: data on any seasonal periods of protracted cloudiness of clear weather.

(6) Humidity.

(7) Severe weather: probability of hurricanes, typhoons, thunderstorms, tornadoes, or dust storms.

(8) Effect of weather and atmospheric cloudiness concerning the transmission through the air of instantaneous nuclear and thermal radiation; the movement and concentration of contaminated clouds and dust; and the spread of surface fires and other phenomena connected with nuclear warfare and the use of CBR weapons and agents.

d. Special climatic studies may be prepared to solve a specific engineering or logistics problem or to investigate in detail the effects of pertinent weather conditions on a particular operation. Such studies have been made, for example, to provide data for use in determining:

(1) Degradation in lift capability of helicopters.

(2) Optimum runway orientation.

(3) Planning factors for construction schedules.

(4) Wind chill factors for clothing requirements.

(5) Location of camps, training areas, and landing fields.

(6) Coastal areas most suitable for amphibious operations.

Figure 2–2. Current field army sources of meteorological information—forecasts/climatology.

(Located in back of manual)

ELEMENTS OF WEATHER FORECASTS, CLIMATE STUDIES, AND WEATHER AND CLIMATE SUMMARIES

Notes:
1. Weather section of Intelligence Summary (ISUM) is derived from this forecast.
2. Data provided on an "as required" basis only.
3. Data provided only for specific operations having weather effect criteria.
4. Based on predetermination of what "severe weather" means.
5. Climate data contents are established locally. Listed elements are typical.

Element	Description	Weather Forecasts: General: 12 Hour	General: 24 Hour[1]	General: 48 Hour	General: 72 Hour	General: 3 - 5 Day Extended Period	Special: Aviation: Route	Special: Aviation: 12 Hour Area	Special: Aviation: 24 Hour Area	Special: Aviation: 12 Hour Terminal	Special: Aviation: 24 Hour Terminal	Special: Artillery[2]	Special: CBR: Low Level	Special: CBR: Fallout	Special: Dropzone[2]	Special: Engineer	Special: Military Police	Special: Signal	Special: Special Warfare	Special: Transportation	Special: Mission Control[3]	Special: Severe Weather Warnings[4]	Climate Studies: Analysis of Area of Operations	Climate Studies: Intelligence Estimate	Climate Studies: Engineer Intelligence Annex	Climate Studies: Terrain Study	Climate Studies: Special Area Study	Climate Summary: Weather Summary for Engineers	Climate Summary
HUMIDITY AND DEW POINT	Relative humidity in percent.	X	X										X										X	X				X	
	Relative humidity in general terms – humid, dry, etc.			X	X																					X			
	Surface dew point temperature in degrees Fahrenheit.						X			X	X																		
	Relative humidity in percent, from the surface to 15 km.											X																	
WINDS	Surface winds, average speed in knots, direction in tens of degrees, significant changes thereof, maximum wind speeds and gusts.	X	X	X	X	X	X			X	X				X														
	Wind direction to eight points of the compass, wind speed in miles per hour.																						X	X					
	Frequency of occurrence of specified wind directions and speeds.																									X	X		X
	Surface to four meters – effective wind direction in degrees and wind speed in knots.																												
	Wind direction in degrees and speed in knots at surface and at 2,000 feet above the terrain.							X	X						X		X												
	Flight level winds – direction in tens of degrees and speed in knots.						X	X	X												< AS	< AS							
	Wind direction in tens of degrees and speed to nearest five knots at 2,000 foot intervals to 30,000 feet.							X	X												REQUIRED	REQUIRED							
	Wind direction in tens of mils and wind speed in knots for 2,000 meter zones to 30 km.													X							>	>							
	Effective winds for estimating movement of nuclear clouds.																						X	X					X
	Wind direction in degrees and speed in knots from the surface to 30 km.											X																	
PRESSURE AND DENSITY	Altimeter setting and density altitude.						X			X					X														
	Pressure in millibars for from the surface to 30 km.											X																	
	Sea level pressure in millibars.																						X	X					
SURFACE CONDITIONS	State of the ground in general terms – wet, dry, snow covered, icy, etc.	X	X	X	X	X										X												X	
TURBULENCE AND ICING ALOFT	Type and relative intensity.						X	X	X																				
INDEX OF ANOMALOUS PROPAGATION	Qualitative and quantitative.																	X	X										
LIGHT DATA	Moon phases, moon rise and set.																						X		X	X			
	Beginning and end of nautical and civil twilight.																						X			X			
	Sunrise and sunset.																								X	X			
SEA CONDITIONS (Where needed)	State of sea and surf including direction, period and height of waves, direction of swell, and height of breakers.															X			X	X									

FM31-3-3-②

Part 1 of 2

Figure 2–3. Elements of weather forecasts, climate studies, and weather and climate summaries, part 1 of 2.

ELEMENTS OF WEATHER FORECASTS, CLIMATE STUDIES, AND WEATHER AND CLIMATE SUMMARIES

Notes:
1. Weather section of Intelligence Summary [ISUM] is derived from this forecast.
2. Data provided on an "as required" basis only.
3. Data provided only for specific operations having weather effect criteria.
4. Based on predetermination of what "severe weather" means.
5. Climate data contents are established locally. Listed elements are typical.

Element	Description	Weather Forecasts: General: 12 Hour	24 Hour[1]	48 Hour	72 Hour	3 - 5 Day Extended Period	Special: Aviation: Route	12 Hour Area	24 Hour Area	12 Hour Terminal	24 Hour Terminal	Artillery[2]	CBR: Low Level	Fallout	Dropzone[2]	Engineer	Military Police	Signal	Special Warfare	Transportation	Mission Control[3]	Severe Weather Warnings[4]	Climate Data Studies: Analysis of Area of Operations	Intelligence Estimate	Engineer Intelligence Annex	Terrain Study	Special Area Study	Weather Summary for Engineers	Climate Summary
SYNOPTIC SITUATION	Frontal types, location, movements and intensities; location and movement of major surface High and Low pressure systems.	X	X	X	X		X	X	X																				
SKY CONDITION	Cloud cover in eights, height of bases and tops above the surface in hundreds and thousands of feet, times of significant changes.	X	X				X	X	X	X	X		X		X														
	Cloud types.	X	X				X	X	X	X	X				X														
	Cloud cover, height of bases and amount in general terms.			X	X	X																						X	
	Frequency of occurrence of various cloud conditions.																									X			
	Sky conditions in general terms - fair, cloudy, etc.																						X	X	X	X			X
VISIBILITY AND OBSTRUCTIONS TO VISIBILITY	Surface horizontal visibility in miles and fractions of miles, time of significant change, Obstructions.	X	X	X	X	X	X	X	X	X	X		X		X														
	Surface visibility in general terms with Obstructions.																						X	X	X	X	X		X
	Flight level visibility.						X	X	X						X														
PRECIPITATION	Type, location, character, intensity, time of beginning and end.	X	X	X	X	X	X	X	X	X	X		X		X	X	X			X	AS REQUIRED	AS REQUIRED						X	
	Accumulation.															X													
	Character and intensity in general terms.																						X	X	X		X		X
	Frequency of occurrence by type and amount.																									X			
WEATHER PHENOMENA	Tornadoes, thunderstorms, lightning, squalls, hail, etc.	X	X	X	X	X	X	X	X	X	X				X	X							X	X					X
TEMPERATURE	Surface temperature, daily maximum and minimum in degrees Fahrenheit, abrupt changes and times thereof including freezing, thawing, and wind chill factor.	X	X	X	X	X		X	X						X													X	
	Surface temperature in degrees Fahrenheit and temperature gradient, as a reflection of stability, between 0.5 and 2 meters.												X																
	Aviation terminal temperatures in degrees Fahrenheit.									X	X																		
	Surface temperatures in general terms - cold, warm, etc.																								X				X
	Surface temperature range.																						X	X			X		
	Frequency of occurrence of temperatures.																									X			
	Flight level temperatures in degrees centigrade.						X	X	X																				
	Temperature variations from a mean.																												X
	Temperatures aloft in degrees centigrade, to 30,000 feet above sea level, at 2,000 foot intervals.							X	X																				
	Temperature profile - from the surface to 30 km.											X																	

FM31-3-3 (1)

Part 2 of 2

Figure 2–3—Continued.

(7) Seasonal fuel requirements by weight, quantity, and type.

e. Requests to Air Weather Service for climatic studies should provide all pertinent information on the operation or problem, including—

(1) Nature of the mission or statement of the operational problem.

(2) Geographical area and time of interest.

(3) Operational limits.

(4) Degree of flexibility permitted in accomplishing the directive.

(5) Recommended form of presentation.

(6) Date study is to be completed.

2–6. Analysis of Area of Operations

An analysis of the area of operations is required for each mission. It shows the effects of the characteristics of the area on the general course of action that the enemy and friendly forces may adopt. Appendix D contains an example of an analysis of the area of operations; paragraph 2a of this analysis gives the items of weather information, which are provided by the staff weather officer (SWO) and have military significance. For further information, see FM 30–5 and FM 101–5.

2–7. Special Area Studies

Special area studies usually are issued by a higher headquarters during the early stages of planning. Figures 2–3 and 2–4 list the general contents of special area studies. The weather elements included in this study will vary widely, depending on the planning requirements. Special area studies usually include the following weather information, which may be supplemented by detailed tables:

a. Climate. type, general description, seasonal changes, various climatic regions.

b. Temperature. annual ranges at various meteorological stations and localities, seasonal changes.

c. Winds and Rains. variation and amount of precipitation and its seasonal distribution, periods of storms and typhoons, prevailing winds and their velocity, and times of occurrence.

d. Visibility. periods and zones of fogs and mists, cloudy season, percentage of overcast skies.

2–8. Weather Information in Terrain Studies

Weather information in terrain studies covers the following:

a. Climate.

(1) Terrain features are affected by the climate, which includes such elements as visibility, temperature, precipitation, humidity, winds, clouds, and electrical disturbances. The manner of description and the specific factors described varies with the area, time, and type of operation planned.

(2) The area of operations influences the description of the climate. Terrain features also influence the climate of an area. A description of the climate of a large area can consider these terrain influences only generally, whereas a description of a small area, such as a single valley, can be quite specific. Further, the importance of certain elements of climate depends upon the area.

(3) The scheduled beginning time of a specific operation determines the type of intelligence presented in the description. Climatic data must be used if the starting date is more than a week or two in the future. (48-hour forecasts in conjunction with 3- to 5-day extended period forecasts will be used by G2 in the terrain estimate for periods of 5 days or less.)

(4) The type of operations planned determines the pertinent elements of climatological information to be furnished. Planning of airborne operations, amphibious operations, and other special operations requires knowledge of weather elements not usually required in normal ground operations.

(5) Exact descriptions of humidity are not usually necessary, but the effects of humidity on operations are described when significant. The description should consider fog conditions and the effect of humidity in reducing the efficiency of personnel or in creating problems of storage and maintenance of supplies and equipment.

(6) Data based on climatic records signify the approximate number of days during a specific period that a certain amount of cloud cover can be expected. Also, there is an indication as to what time of the day or night certain cloud coverage can be expected. Related conditions such as storms and fog are also described when applicable.

(7) Thunderstorms should be discussed because they can have an important effect on proposed operations. The type, period of occurrence, duration, and the effect on planned operations are described in the text when pertinent.

(8) Winds at or near the surface of the earth have been classified and their characteris-

tics are known and predictable. Some surface winds are deep. Some, such as the land breeze, are shallow. These may extend only a few hundred feet above the surface. The winds aloft may blow in a direction opposite to that of the surface winds, and the velocity may vary with different elevations.

(9) Sea swell and surf conditions are influenced by wind velocity, duration of the wind, distance spanned by the wind, and decay distance.

(10) Temperature generally is presented in tabular form in the text of the terrain study. The presentation will vary depending on the source of the data.

(*a*) Temperature predictions, based solely on climatic studies, describe the range of temperatures in two ways. The first method describes the mean temperature, mean maximum, mean minimum, absolute maximum, and absolute minimum temperatures expected for the period. The mean temperature alone has little significance since it gives no indication of the range of the temperature variation. The second method tabulates the number of days during the period when the temperature can be expected to exceed or fall below the stated temperatures.

(*b*) Temperature effects, when significant, should be described adequately. The effect of temperature on soil trafficability and freezing or thawing of water bodies is particularly significant.

(11) Precipitation is expressed in—

(*a*) Type and amount which may be encountered during a particular period.

(*b*) Number of days within that period on which certain amounts of precipitation can be expected.

(*c*) Variability of precipitation from year to year. A statement of the total amount of precipitation which can be expected over a period of time has little significance in itself, since a 3-inch rainfall means one thing when spread over 30 days and a totally different thing when concentrated in 1 day during a 30-day period. The effect of precipitation on terrain, particularly water bodies and the trafficability of soils, should be described in the text.

b. Light Data.

(1) Light data is necessary for the selection of courses of action in the conduct of military activities. The beginning of morning nautical twilight (BMNT) and the end of evening nautical twilight (EENT) are the beginning and end, respectively, of enough light for limited visibility. The beginning of morning civil twilight (BMCT) and the end of evening civil twilight (EECT) are the beginning and the end, respectively, of adequate light for large scale operations. At BMNT, enough light, under ideal conditions, is available for infantry to effect close coordination among individuals while approaching an enemy position unobserved. EENT is the last time for enough light for such coordination. As a general rule, visibility at BMNT is about 400 yards (365.7 meters). At about halfway between BMNT and BMCT (or EECT and EENT), there is enough light for ground adjustment of close-in artillery fires and airstrikes. Visibility also is affected by factors such as weather, position of the observer with respect to the object and sources of light terrain, configuration, and color and reflection quality of clothing, vehicles, and other material.

(2) Moon phases and other phenomena, such as atmospheric conditions and star brilliance, influence night operations. During full moonlight, visibility sometimes approaches that of daylight. Such conditions must be anticipated as they influence friendly and enemy courses of action such as attacks, patrolling, and changes in tactical disposition at night.

2–9. Weather and Climatic Summaries

a. A weather summary is a description of the weather which has occurred at a point, along a route, or within an area, during the past day, week, or other specified recent period. Weather summaries are useful in analyzing the effect of weather on future operations and are essential to the preparation of engineer forecasts of stream flow, condition of ground, and trafficability.

b. A climatic summary gives statistical data on normal weather conditions, and variations from the normal, at a specified place during a specified period (month, season, or typical meteorological situation). Climatic summaries are compiled from historical records of weather observations over long periods. They do not forecast day-to-day weather conditions, but they do provide a basis for estimates and plans.

Section II. WEATHER INTELLIGENCE

2–10. Weather As a Part of Combat Intelligence

a. The wide dispersion of Army forces on the modern battlefield and the complexity of current weapon systems have increased the requirements for information on atmospheric conditions. Weather varies with time and locality, and as a military unit moves from one area to another, the weather must be constantly reappraised to retain its usefulness in combat intelligence. Weather conditions will affect various types of military units in different ways and will be of varying significance as intelligence, according to the type of mission to be accomplished by a particular unit.

b. Weather intelligence is an analysis of the effect of weather upon our own forces and the enemy. It is a part of combat intelligence and is one of the bases for estimates made by the commander and his staff. The answer sought is the best use of the weather by our own forces in order to increase our chances for success, and to assist in deducing the most likely capability of the enemy. The main sources of weather information for planners are climatic data and weather forecasts. Climatic data, weather forecasts, and weather observations (or met data) are collectively classed as weather information.

c. When the military commander plans and executes a mission, he must consider the effects of weather on such things as personnel, equipment, supplies, terrain, enemy capabilities, tactical operations, and employment and effects of chemical, biological, and nuclear weapons. He must acquire a precise, detailed briefing on anticipated weather over his area of operations and on the possible impact of this weather on the accomplishment of his mission. Finally, the commander must consider these weather effects with the other essential elements of information when formulating his plans. The SWO with the G2 at army, corps, and division must assure that the necessary weather information is available when required by the commander and his staff.

2–11. Weather As Intelligence

a. Weather information in the form of forecasts and climatic data is provided by an appropriate element of AWS. The intelligence officer receives this information through the appropriate staff weather officer.

b. To fulfill intelligence requirements, all commanders require information on weather and the intelligence derived from that information. The production of weather intelligence is based on the need for the information, its intended use, and the particular weather effects which are important to the command and to the enemy. The weather information obtained is evaluated, interpreted, and disseminated in terms of these requirements.

c. It is important to determine, through climate data in weather annexes, intelligence studies, and other sources, the effects of the climate in the area of operations based on human behavior patterns. The long, hot summer syndrome and siestas, combined with short tempers and violence are, for example, social characteristics common in hot weather areas.

2–12. Weather, Climate, and Terrain

a. Weather, climate, and terrain are so interrelated that they must be considered together when contemplating ground and air operations. Weather elements are capable of drastically altering terrain features and trafficability. Conversely, terrain features, of themselves, exert some influence on local weather. This relationship of both the weather and terrain must be carefully correlated so that accurate terrain intelligence can be evolved.

b. Changes in natural terrain features, caused by factors other than weather, usually are gradual and limited in scope. By contrast, weather changes and terrain changes, directly attributable to the weather can be sudden, widespread, and drastic. Therefore, weather intelligence makes a major contribution to terrain intelligence.

c. The scope of terrain intelligence is classified according to the mission and level of the command at which it is used. While these categories at times may overlap, they are considered broadly as strategic, and combat or tactical.

(1) *Strategic terrain intelligence.* This intelligence is concerned with the requirements of large-scale plans and may include intelligence concerning the military capabilities and vulnerabilities of entire nations. It is the intelligence produced for major agencies of the Department of Defense. Strategic intelligence is produced continuously and requires the compilation and interpretation of detailed information by highly specialized personnel. Included in strategic terrain studies are descriptions and analyses of beaches,

water terminals, rivers, towns, and major terrain features; transportation and communication systems; and cross-country movement conditions, soils, rock types, underground installations, climate and weather, vegetation, state of ground and hydrography. The principal compilation of these studies is the National Intelligence Survey. Upon the outbreak of hostilities, such studies provide field commanders with their initial intelligence concerning the area of operations.

(2) *Combat terrain intelligence.* This intelligence is produced for use in planning and conducting tactical operations. It is based upon information secured locally or provided by higher headquarters and is concerned primarily with the effects of weather and terrain upon the particular operations of the unit. Combat terrain intelligence usually is developed by the G2 with the staff engineer and SWO.

d. In general, the presentation of a specific terrain intelligence study requires an interpretation and evaluation of several or all of the following subjects:

(1) Geology, soil, surface configuration and shape, vegetation, ground condition, hydrology, water supply, hydrography, and climatic conditions.

(2) Routes of communication including roads, railroads, inland waterways, ports and beaches, and airfields; and probable climate effects upon them.

(3) Urban areas, hydraulic structures, excavations, electric power, pipelines, defenses, and other manmade structures.

(4) Cross-country movement; suitability for airfield, highway, and underground construction; airborne operations data; effects of special weapons; results of terrain and works of man; and probable climate effects upon them.

e. Detailed and reliable terrain intelligence is required for all logistical plans, particularly those prepared for special operations to be conducted under extremes of climate. Special studies, prepared from a logistical viewpoint, are essential in planning in mountain, jungle, desert, snow, extreme cold, airborne, and amphibious operations.

f. Staff coordination between G2 and SWO and the staff engineer, is the key to the successful completion of weather and terrain studies and estimates.

2–13. Terrain Intelligence Responsibilities

a. Terrain intelligence is provided by the unit intelligence officer, who is also responsible for making an analysis of the area of operations. Normally this analysis is based upon a terrain study produced by the staff engineer, with assistance from the SWO. Appendix E contains a sample Engineer Intelligence Annex. The intelligence officer must plan and coordinate the collection of terrain information as well as the production, maintenance, and dissemination of terrain intelligence. He must keep the staff engineer informed of the advance planning, in progress or anticipated, so that the engineer can obtain and compile the required terrain information.

b. Current weather observations and reports of terrain conditions are sources of information from which intelligence is produced. They are not to be confused with official weather forecasts, terrain studies, or maps which in themselves, are sources of weather and terrain information. At lower echelons, where local weather and terrain play an important role in tactical operations, the intelligence officer must be constantly alert to the significance of changes.

2–14. Weather Intelligence Responsibilities

The Intelligence Officer (G2) is responsible for evaluating weather information in terms of intelligence, and does not discharge his weather responsibilities merely by disseminating verbatim the weather forecast which he receives from the SWO. He must, with assistance from the SWO, interpret this information in relation to the weather effects upon, and requirements of, particular operations. The intelligence officer at each echelon is responsible for—

a. Initiating, coordinating, and consolidating Army requirements for weather information and service with the SWO.

b. Informing subordinate Army units of weather observations requested by the SWO. The G2/S2 must instruct these units as to what weather information is required, where and when it is required, and how this information is to be forwarded.

c. Receiving required weather information from the SWO.

d. Keeping the SWO informed on the advance planning which is in progress or in prospect so that the SWO can orient the weather forecast to

the operation. This includes keeping the SWO informed of terrain intelligence.

e. Providing required interpretations of weather information in terms of weather intelligence along with those interpretations of the SWO.

f. Coordinating the dissemination of weather information, including weather warnings and weather intelligence. A section of the intelligence summary (INTSUM) is devoted to weather and terrain conditions. Appendix F is a typical format for an INTSUM. Refer to FM 30–5 for detailed information.

g. Coordinating with G3/S3 in weather training of subordinate units.

h. Insuring liaison between the SWO and other staff sections in regard to operational planning.

i. Assuring that the WETM, within the organization's area of responsibility, are provided authorized communications, logistics, and administrative support by the Army.

j. Receiving from the Chemical Staff Officer chemical, biological, and radiological (CBR) interpretations of fallout predictions and travel of fallout clouds. These fallout predictions are based on met data provided by artillery met sections and/or AWS weather teams.

k. Receiving, from the Engineer Staff Officer, terrain intelligence including trafficability, river stages, and flood predictions. Terrain intelligence, to a large extent, is based on weather information provided by AWS weather teams.

2–15. Brigade S2 Weather Intelligence Responsibilities

Several types of weather information, including forecasts, originate at division or higher headquarters, and are disseminated through intelligence channels. The S2 at brigade level is responsible for weather information and for interpreting all weather information received from higher headquarters. The S2 also collects local observations, relays them to WETM/DTOC, and disseminates all weather reports to subordinate elements of the command.

2–16. Battalion Weather Intelligence Responsibilities

The battalion S2 has staff responsibility for keeping all concerned fully informed on matters pertaining to combat intelligence and counterintelligence. He collects, evaluates, and interprets information to determine the influence of weather, as well as other effects, on the mission. In addition to performing duties in the unit staff similar to those of the G2, the battalion S2, within his primary staff responsibility, does the following: plans, supervises, and insures briefing of reconnaissance patrols; furnishes information on the weather, terrain, and enemy for all patrols; insures that all combat and reconnaissance patrols are briefed and debriefed with specific attention to weather observations and terrain trafficability; and, insures preparation and dissemination of patrol reports.

2–17. Presentation of Tactical Weather and Terrain Studies

a. The format for a formal, written, tactical study of the weather and terrain is prescribed in FM 30–5. See figures 2–3 and 2–4 for a listing of the weather elements usually found in a terrain study. That format specifies four major headings, arranged in a logical sequence, designed respectively to explain the purpose of the study, describe the terrain in general terms, discuss the military aspects of the area, and to state the conclusions concerning the effect of the weather and terrain upon military operations. Appropriate subheadings allow for detailed treatment of all subject matter pertinent to such a study.

b. If the extent of the area and the purpose of the study are too broad, this type of weather and terrain information may become lengthy and cumbersome. While a voluminous study with annexes and appendixes to provide all possible detail may be desirable at higher echelons, it is too lengthy for effective use by units below division level. As a result, the intelligence officer below division level must develop brief, concise, and graphic weather terrain studies which provide the commander and other staff members with basic data and conclusions necessary for the accomplishment of the mission. Paragraph 2 of the intelligence estimate provides for all weather and terrain information necessary at this level, except for special operations. G and H contain a typical example of an intelligence estimate and the content and format for same. For details and additional information, see FM 30–5 and FM 101–5.)

c. Tactical studies of the weather and terrain may be presented orally or in written form. Below division level, they usually will be oral. As a general format, paragraph 2 of the intelligence estimate provides for virtually all of the information contained in a tactical study. This is done

without the necessity of a separate document or format for oral presentation, except for special operations such as amphibious landings or airborne missions. The G2/S2 is charged with primary staff responsibility for initiating, coordinating, and insuring timely completion of such a study.

d. The G2/S2, assisted by the SWO, points out the influence of weather and terrain on possible friendly and enemy courses of action, dispositions, tactics, peculiarities, and weaknesses. In addition, the G2/S2 must anticipate the commander's requirements to allow the SWO and engineer to collect and report effective terrain and weather information.

2–18. Sources of Weather Information for S2

Weather forecasts available from the SWO of higher headquarters are the major sources of weather information at levels below division. The following are additional sources which may be exploited by the S2:

a. Subordinate Units. For information on the current weather at any specified point or area.

b. Climatic Studies. Required from the AWS WETMs.

c. Special Weather Information. Published by higher headquarters or civilian agencies; includes chemical data; ballistic data; surf and swell forecasts; time, tide, and light data; and stream level and soil trafficability data. See figure 2–3 for a listing and description of weather elements.

2–19. Staff Engineer Responsibilities

Under the general supervision of the G2, the staff engineer—

a. Produces and maintains terrain studies based upon terrain analyses. These involve—

(1) Determining the requirements for terrain information, based upon requests from the G2.

(2) Collecting and evaluating terrain information.

(3) Assembling terrain and weather intelligence into a terrain study. The staff engineer is assisted by the SWO in preparing a terrain study.

b. Provides technical interpretation of the terrain, including such factors of military significance as obstacles, routes and avenues of approach, cover and concealment, landforms, hydrology, cross-country movement, and related subjects.

c. Disseminates terrain studies and other technically evaluated information through appropriate channels.

2–20. Formal Studies of Weather and Terrain

Appendix I contains an outline of a terrain study. Detailed knowledge of weather and terrain, together with the analysis thereof, is important to commanders and staff members at all levels of command. Only at corps and at higher echelons, however, is there generally a need for extensive, detailed, written terrain and weather studies. Special operations, such as amphibious or airborne, to be conducted by lower echelons often will require extensive weather studies. For complete description of such studies prepared at Corps or Army headquarters, see FM 30–10.

2–21. Combat Service Support Use of Weather

Accurate, complete, and timely weather intelligence is just as essential to combat services support operations as it is to tactical operations. In both cases, the commanders must consider weather intelligence in formulating plans and making operational decisions. Because weather intelligence is oriented to a specific plan or operations, the information on which it is based must also be user-oriented. This is accomplished at each combat service support command by establishing the following:

a. Weather factors which affect that command's operations (including the particular weather elements and criteria).

b. Essential weather information, including type of information, frequency, and if necessary, formats required.

c. How, where, and to whom this weather information is to be communicated. This data should include schedule, communication channels, and specific receiving units.

Section III. WEATHER SUPPORT REQUIREMENTS

2–22. Army Activities Requiring Meteorological Information

The weather support requirements of a tactical army, its agencies and elements, are listed in figure 2–4. Figure 2–3 describes the general and special forecast and climatic elements of the Army's weather support requirements.

2–23. General and Special Weather Support Requirements

The general and special weather support require-

FIELD ARMY AGENCIES AND ELEMENTS REQUIRING METEOROLOGICAL INFORMATION

	Command and Staff	Air Defense Artillery	Armor	Aviation	CBR	Engineer	Field Artillery	G2 [Intelligence]	Infantry	Medical	Military Police	Ordnance	Psychological Operations	Quartermaster	Signal	Transportation	Unconventional Warfare
I - WEATHER OBSERVATIONS																	
A. Surface																	
1. Current observations	---	---	---	acd	---	---	---	---	---	---	---	---	---	acd	---	---	---
2. Selected data*	---	---	e_{12}	acd_1	acd_1	acd	cd_1	---	d_{13}	acd_4	acd	---	acdf	---	---	acd_1	f
3. Forward Area Observations	---	---	---	e_1	---	ac	---	---	e	---	---	---	f	---	---	---	f_1
B. Low Level - Selected Data*	---	---	---	---	acd	---	cde_1	---	---	---	---	---	acdf	---	---	---	f
C. Upper Air																	
1. Current Observations	---	---	---	---	---	---	cd_1	---	---	---	---	---	---	---	---	---	---
2. Selected Data*	---	a	---	---	acd	a	cd_1	---	d_3	---	---	---	f	---	---	---	f
II - WEATHER FORECASTS/BRIEFINGS/ CLIMATOLOGY																	
A. General Forecasts																	
1. 12 hour	cd	cd	cd	cd	cd	cd	cd	cd	cd	cd	cd	cd	cd	cd	cd	cd	cd
2. 24 hour	acd	acd	acd	acd	acd	acd	acd	acd	acd	acd	acd	acd	acd	acd	acd	acd	acd
3. 48 hour	acd	acd	acd	acd	acd	acd	acd	acd	acd	acd	acd	acd	acdf	acd	acd	acd	acd
4. 72 hour	acd	acd	acd	acd	acd	acd	acd	acd	acd	acd	acd	acd	acdf	acd	acd	acd	acd
5. 3 - 5 day	acd	acd	acd	acd	acd	acd	acd	acd	acd	acd	acd	acd	acdf	acd	acd	acd	acd
B. Special Forecasts of Selected Parameters																	
1. Fallout Winds	---	---	---	---	acd	---	---	acd	---	---	---	---	---	---	---	---	---
2. Aviation Route and Terminal	---	---	d_4	acd	---	---	cde_4	---	d_4	acd_4	---	---	---	---	---	acd_4	f_4
3. 12 hour Aviation	---	---	d_4	acd	---	---	cde_4	---	d_4	acd_4	---	---	---	---	---	acd_4	f
4. 24 hour Aviation	---	---	d_4	acd	---	---	cde_4	---	d_4	acd_4	---	---	---	---	---	acd_4	f
5. Stability to 2 meters and Surface Winds	---	---	---	---	acd	---	---	---	---	---	---	---	---	---	---	---	---
6. Winds - Surface to 2,000 feet	---	---	---	acd	cd	---	---	---	---	acd_4	acd	---	acdef	---	---	---	f
7. Precipitation Type and Amount	---	---	---	acd	cd	acdf	---	---	---	acd_4	acd	---	acdef	---	---	acd	---
8. Special Mission Forecasts	acd	---	---	---	acd	---	cd	acd	---	---	---	---	f	---	---	---	f
9. Upper Air for Ballistic Corrections	---	---	---	---	---	---	cd	---	---	---	---	---	---	---	---	---	---
10. Refractive Index	---	---	---	---	acd	acd	acd	acd	---	---	---	---	---	---	acd	---	f
11. Dropzone	---	---	---	acd	---	acd	---	acd	acd_3	---	---	---	ocdef	---	---	---	f
12. Sea Swell and Surf	---	---	---	---	---	acd	---	acd	---	---	---	---	---	---	---	a	f
13. Severe Weather Warnings	acde	acd	acd	acd	acd	acd	acd	acd	acd	acd	acd	acd	acdef	ocd	acd	acd	f
C. Weather Briefings and Display	acd	---	---	acd	acd	---	---	acd	---	---	---	---	---	---	---	---	---
D. Climatology/Summaries																	
1. Climatic Summaries	ac	---	---	---	ac	---	---	ac	---	---	---	---	acf	---	---	---	---
2. Climatic Studies	ac	---	---	---	ac	---	---	ac	---	---	---	---	acf	---	---	---	f
3. Engineer Climate Information	---	---	---	---	---	acd	---	---	---	---	---	---	---	---	---	---	---
4. Weather Summaries	---	---	---	---	---	acd	---	acd	---	---	---	---	---	---	---	---	---

* "Selected Data" are observations of selected weather elements taken at locations and times, as required, by the user.

Legend:
- a = Army area of interest.
- c = Corps area of interest.
- d = Division area of interest.
- e = Interest area of units below division.
- f = Interest area for operations deep in enemy held territory.

Footnotes:
- 1 = Provided by organization requiring information.
- 2 = Armored Cavalry Regiments only.
- 3 = Airborne Infantry only.
- 4 = Required only by organic aviation.

FM31-3-4

Figure 2–4. Field army agencies and elements requiring meteorological information.

ments indicated in figure 3–1 are panoramic in nature. They must be construed as being definitive requirements for each army unit. Actual requirements for a specific army operation must, of necessity, vary with the mission and the climatic area in which the operation is conducted. The engineer service, for example, may not require data on precipitation for consideration of the trafficability factor, or flood prediction, in those areas where poor trafficability due to weather is not a significant problem. The requirements indicated in this section, therefore, should be considered as a guideline only. The specific weather support requirements for each organization should be clearly indicated in appropriate SOP. All armies, corps, and divisions should have a weather support annex to their unit SOP. This annex, usually prepared by the G2 and SWO, should specify the weather support requirements, indicating in detail—

a. Weather support required.

b. Who provides this support.

c. How and when the support is to be provided.

d. Schedule and frequency of each type of forecast.

e. Geographical area covered by each type forecast.

f. Criteria for issuing and revising forecasts.

g. Precisely how these forecasts are to be communicated to the users.

CHAPTER 3

SOURCES OF METEOROLOGICAL INFORMATION

Section I. TABULATION OF SOURCES

3–1. General Observing Capability

There are almost as many sources of meteorological information within the Field Army as there are organizations using the information. These sources, both Army and Air Force, acquire met data from locations throughout the Army area, with primary observing capability located forward of the division tactical operations center (TOC). Figures 3–2 through 3–5 show both the points of origin and the weather elements observed by AWS and organic Army units. The observations range from intermittent measurements of a few elements for a specific tactical operation to detailed observations of many elements by accredited weather observers on a regular schedule. The latter data comprise the raw material from which weather forecasts are derived.

3–2. Diagram of Current Field Army Sources of Meteorological Information

a. The numerous sources of meteorological information in the Army are shown in figures 2–1 and 2–2. As indicated in these figures, there are six fundamental classes of met information available in the tactical army:

(1) *Observations.*
  (*a*) Surface/low level.
  (*b*) Upper air.
  (*c*) Indirect or reconnaissance.

(2) *Reporting.*
  (*a*) Analysis/forecasting.
  (*b*) Climatology/summaries.
  (*c*) Weather briefing.

b. Each of these is subdivided on the charts, and analyzed by type, valid period and scheduling, parameters involved, organizations in a type field army, and the authority on which the activity is based.

c. The remainder of this section describes the sources of meteorological information other than AWS and artillery meteorological sections, which are full-time weather organizations. Information of a general nature on the operations of both AWS and artillery meteorological sections are discussed in paragraphs 3–3 through 3–8. Details of AWS weather support are given in chapter 5. The detailed operations of artillery meteorological sections are described in FM 6–15.

d. Other sources of limited meteorological data in the Army and shown in figures 2–1 and 2–2 are—

(1) Field artillery target acquisition battalion (FATAB) sound-ranging platoons.
(2) Aviations units.
(3) Smoke generator organizations.
(4) Engineer and artillery survey elements.
(5) Medical air ambulance companies.
(6) Airborne division command and control battalions.
(7) Engineer flood prediction service.

Figure 3–1. Organic army weather observing capabilities.
(Located in back of manual)

Figure 3–2. Army area weather observing capabilities.
(Located in back of manual)

Figure 3–3. Corps area weather observing capabilities.
(Located in back of manual)

Figure 3–4. Division area weather observing capabilities.
(Located in back of manual)

(8) Airborne infantry pathfinder detachments.

(9) Honest John rocket battalions.

(10) Pilot reports from all aircraft.

(11) Army ground-based aircraft control and search radar.

(12) Interrogation of prisoners of war.

(13) National intelligence surveys.

(14) Engineer topographic battalions.

(15) Special Forces groups.

e. Collectively, these organizations and activities provide the following meteorological information on an unscheduled basis:

(1) Onsite observations of surface temperature, dewpoint temperature, wind directions and speed, wind chill, surface pressure, altimeter setting, visibility and obstructions to visibility, special phenomena, low cloud height, precipitation amount, soil moisture content, and winds aloft.

(2) Indirect observations from aircraft, and ground radars that could give information on sky cover, cloud amount, visibility and obstructions to visibility, precipitation amount, and special phenomena over both friendly and enemy held territories.

f. The potential meteorological capabilities of each of the meteorological sources are as follows:

(1) *Field artillery target acquisition battery sound-ranging platoons.*

(*a*) Electronic sound-ranging meteorological messages normally are provided to the sound ranging platoons by the artillery met sections in the field artillery target acquisition battalion headquarters battery. DA Form 6–48, Weather Data for Sound Ranging, is prepared by artillery meteorological sections. This form contains observed data (at 200 meter intervals from the surface to 800 meters) of the following meteorological elements:

Pressure.

Wind direction (tens of mils).

Virtual and effective (or sonic) temperatures.

Wind speed in knots.

Effective wind.

(*b*) The sound ranging platoon has the equipment and trained personnel to obtain this meteorological data if necessary. These personnel can measure air temperature and wet bulb temperature on which data from lapse rate tables is imposed to estimate sonic temperatures (determined from temperature and relative humidity) at 200 meters. Sound-ranging platoons can also take pilot balloon observations to determine winds aloft.

(*c*) This meterological data is required by the soundranging platoon because the speed and direction of a sound wave traveling through the atmosphere is affected by weather conditions. Therefore, existing weather conditions must be determined so that corrections may be applied to compensate for deviations from standard weather conditions.

(2) *Aviation units.* Some aviation units are authorized meteorological instruments for the measurement of surface pressure, ambient dry and wet-bulb temperatures, and surface-wind velocity. In addition, flight crews, flight operations personnel, and control tower operators visually estimate horizontal visibility, obstructions to visibility, and observe such special phenomena as lightning, thunderstorms, and tornadoes. Control tower operators are trained by USAF Air Weather Service personnel to make limited weather observations.

(3) *Smoke generator organizations.* The chemical smoke generator companies are authorized a wind-measuring set (AN/PMQ–3). This set permits observations of surface winds to estimate speed and direction of smoke travel.

(4) *Engineer and artillery survey elements.* These elements use aneroid barometers. Survey elements measure changes in altitude by relating changes in height to changes in barometer readings. They take direct met observations to correct for atmospheric conditions which affect the light and radio wave propagation of electronic distance-measuring equipment such as tellurometers and geodimeters. Accurate temperature/time data are recorded in distance measuring by conventional taping procedures. Visibility information is an inherent by-product of triangulation or leveling operations. Astronomical observations involve cloud cover data.

(5) *Medical air ambulance companies.* Each company is authorized a thermometer, altimeter, and wind-measuring set with which they can obtain weather observations of surface temperature, pressure, altimeter setting, and surface-wind velocity.

(6) *Airborne division command and control battalion.* Each company has an anemometer and ceiling light projector, with which measurements of wind velocity (direction and speed) and nighttime height of cloud bases may be obtained.

(7) *Engineer flood prediction service.* This

service has the responsibility, within the tactical army, of providing stream flow measurements and predictions of river stages and floods. The engineer flood prediction service (EFPS) relies on AWS observation teams for precipitation data acquired at army, corps, and division airfields, and on the WETM/FATOC for precipitation forecasts. The EFPS also measures precipitation and soil moisture content at points of its own choosing. Specific weather-related data provided by engineers includes:

(*a*) *River crossing.* In connection with a deliberate tactical river crossing, not airborne, against enemy resistance, the engineers would furnish data on:

1. Impact of predicted weather upon the operation, with special reference to possible flooding of the river, or the movement of ice or debris on a scale that would jeopardize the crossing.

2. Trafficability of the soil, existing or under any weather conditions that may be expected during the operation, with special attention to areas adjacent to the proposed crossing sites and along the routes of approach thereto.

(*b*) *Airhead.* In connection with the seizure of an airhead, the engineers would furnish data on—

1. Impact of weather predicted for the operation, with special reference to high winds, fog, heavy rain, or other conditions that might affect air landings and airdrops. (Weather information supplied through engineer intelligence is based on data from historical compilations. Preparation of meteorological forecasts is not a responsibility of the engineers.)

2. Trafficability of the soil, both existing and predicted, under any weather conditions that may be expected during the capture and occupation of the airhead.

(*c*) *Defensive position.* If the commander plans an advance into enemy-held territory, followed by the organization of a defensive position therein, the following data may be obtained from engineers in connection with organizing the position:

1. Weather (based on historical compilations) to be expected over the period of the organization and occupation of the position, with special attention to extremes of heat and cold, and to drought and precipitation.

2. A trafficability map, based on weather forecasts and colored or marked to indicate degrees of trafficability, effectively showing areas suitable for cross-country movement.

(8) *Airborne infantry pathfinder detachments.* These detachments are equipped with the portable met equipment needed to take observations of surface winds at drop zones and landing zones. In addition, these detachments are capable of reporting estimated surface visibilities, obstructions to visibility, and special phenomena. The mission of Army pathfinders is to provide navigational assistance to Army aircraft through the operation of air-landing or air-delivery facilities on or over enemy-dominated or enemy-threatened areas.

(9) *Honest John rocket battalions.* These battalions have equipment for measuring wind velocity at a level of 50 feet (15.24 meters) in the air. They also use special firing tables to derive low-level wind corrections.

(10) *Pilot reports.* Pilot reports (PIREPS) from all aircraft, military and civilian are a highly valuable source of such weather information as sky cover, cloud height and amount, visibility and obstructions to visibility, temperature, icing, turbulence, special phenomena, and winds aloft. This information may extend over enemy territory as well as friendly areas and, with the large number of military aircraft involved in field army activities, the data may be almost continuous. Another valuable attribute of these pilot weather reports is that the pilots and observers, as a group, are probably the most cognizant and weather-sensitive segment of the army.

(11) *Army ground based aircraft control and search radar.* An army uses numerous aircraft control and search radars in the field. These ground radars have the capability of providing information of precipitation and the location of such special phenomena as thunderstorms.

(12) *Interrogation of PW's, national intelligence surveys.* These activities acquire weather data from outside sources. In the interrogation of PW's, any weather information obtained is considered usable for direct tactical application and for referral to weather support activities. Reports of damage to enemy installations, due to flooding or high winds, usually will be of greater value to army intelligence than to weather support activities. National intelligence surveys, derived from federal climatological sources, are prepared in advance of an operation and normally are used for planning purposes.

(13) *Engineer topographic battalion.* These

battalions are authorized altimeters, barometers, psychrometers, and thermometers; and prepare engineer intelligence annexes containing climatic information which is based on historical compilations. The Army battalion frequently has an attached terrain team.

(14) *Special forces groups.* These groups are authorized windmeasuring sets and are able to provide general weather information from widely separated locations. This data may provide useful information for developing surface weather charts of remote areas.

Section II. MAJOR INFORMATION SOURCES

3–3. Scope of Organizational Weather Support

Weather information can be broken down into two broad complementary areas:

a. Information provided by the Air Weather Service.

b. Observational data provided by organic army units.

3–4. General Air Weather Service

a. The Air Weather Service is the organization responsible for obtaining, evaluating, and disseminating weather information for the army to the extent indicated in AR 115–10/AFR 105–3. AWS weather teams observe, record, and transmit weather data for the use of all weather information users. They have available, at all times, a picture of the weather situation over a wide area as well as the latest forecast of weather conditions.

b. Weather forecasts and special studies are provided by agencies of the AWS to all needful elements of the Army. Usually, direct support is provided by a weather central at theater headquarters, weather center (WECEN) at Joint Army Group/numbered AF or joint task force (JTF) headquarters, and a WETM/TOC at Army, corps, and division headquarters. Army units at division level, and below, receive weather forecasts from AWS/SWO and through intelligence channels.

c. The AWS operates on a global scale and its mission is to provide weather information for both the Army and the Air Force. Such information includes observations, forecasts, and climatological information. A wide variety of weather phenomena is encountered by AWS personnel stationed throughout the world. Thus, they have a continual need for both surface and upper air data. The raw data needed to make forecasts must be provided at specified intervals by hundreds of observing stations. The AWS uses the data from the U.S. weather bureau and allied meteorological services, as well as data furnished within the Army by artillery met sections, army aviation, and other army organizations, when feasible. A reliable forecast depends on an accurate description of the atmosphere over a large geographical region. In certain parts of the world, where many land areas are inaccessible, data is secured by aerial reconnaissance flights. Ships at sea provide data over ocean areas.

d. Because of the temporary nature of weather information, a rapid and dependable means of acquiring and exchanging raw, analyzed, and forecast information must be available at all times. (The volume of weather information traffic within an army in the field will vary with the composition and mission of the command.) Communication means for this met data in the Army (teletypewriter, radio, facsimile and telephone) must be available and reliable because adequate weather communications are a prerequisite for satisfactory weather service. (See chapter 4 for a further discussion on AWS operations and chapter 5 for an explanation of weather communication.)

3–5. Army Weather Information Collection

Although weather service is provided to the Army by AWS, the Army itself is responsible for producing some weather information, including ballistic meteorological data. This is the responsibility of the Army organizations, listed in section I of this chapter, and field artillery met sections.

3–6. Artillery Meteorological Sections

a. Within an army in the field, there is a network of artillery meteorological sections for the purpose of conducting atmospheric soundings and disseminating current meteorological data. Each division artillery has one meteorological section. The corps field artillery target acquisition battalion has two. Thus, a 12-division, 3-corps army has 18 meteorological sections continuously processing atmospheric data. These sections are not trained or equipped to make weather forecasts.

For a complete description of artillery meteorological section operations, refer to FM 6–15.

b. The mission of artillery meteorological sections is to support the needs of the Army by providing, as required:

(1) Ballistic messages.

(2) Meteorological data for fallout prediction.

(3) Sound-ranging messages.

(4) Meteorological data to AWS units with the field army.

(5) Computer meteorological messages.

c. The mission requirements, stated in *b*(1) through (5) above, can be fulfilled simultaneously by preparing the basic artillery upper air message in four different formats; that is, ballistic, fallout, computer, and AWS. Mission requirement given in *b*(3) above can be fulfilled by obtaining low-level wind and temperature observations.

d. Many types of observation equipment and many methods used by AWS are identical with those in use by artillery met sections. The data obtained by an artillery met section is of value to the weather forecaster. Similarly, data collected by the AWS will help the artillery met section perform its mission. Therefore, corps and division SOP should specify the frequency, scheduling, and mode of communication for expeditious exchange of data.

e. Each artillery meteorological section should maintain contact with a WETM/TOC to insure that artillery units are informed of the current status of the weather over the area and of any major changes expected. The WETM/TOC should keep informed of artillery rawinsonde flight schedules to derive full usefulness of artillery upper-air data. The WETM/TOC, through the G2, may request changes in such flight schedules to acquire upper–air data needed for special forecasts.

f. In the event of capability loss by artillery meteorological sections, meteorological data for artillery support is obtainable from the WETM/TOC. Such data may be obtained from this AWS source in the appropriate code.

3–7. Distribution of Artillery Meteorological Messages

a. Artillery meteorological sections must have readily available communications to expedite the distribution of messages. The corps artillery fire-direction center distributes messages to artillery units within the corps. The messages for sound-ranging platoons are sent through the target acquisition battalion headquarters communication system. Fallout wind messages and AWS messages are normally sent through the division and corps fire support coordination elements (fig 3–5).

b. Sound-ranging messages are routinely transmitted every 2 hours and ballistic messages every 4 hours. Fallout wind messages and AWS messages are required at least every 6 hours within each corps. When weather conditions over an area are not changing or are changing slowly, this routine time schedule provides adequate data for using units. During periods of frontal passage, severe turbulence, thundershowers, or during passage of air masses of varying characteristics, variations in the routine time schedule may be necessary.

c. The incapabilities of present equipment and the lengthy computations inherent in present techniques make it impossible for a single artillery meteorological section to obtain and transmit a ballistic meteorological message more frequently than once every 2 hours. Sound-ranging messages can be obtained every half hour, if necessary; but one every hour should be sufficient.

d. The artillery meteorological section should maintain a schedule for reporting data to Air Weather Service. When possible, the data reported to AWS should be that obtained during flights made to fulfill fallout wind requirements.

3–8. Air Force Aircraft Weather Support

a. The availability of weather data in most areas adjacent to army in the field operations is severely limited and often is undependable in both content and delivery. This requires that weather reconnaissance be furnished to support AWS operations.

b. Aircraft weather reports are available from several sources: Air Weather Service, Tactical Air Command weather reconnaissance aircraft, and Air Force tactical flying units. Air Weather Service and Tactical Air Command aircraft are especially equipped and manned for collecting weather data. These aircraft are normally used for special missions on a priority basis. A requirement for these special aircraft should be

Figure 3–5. Typical weather support communications.
(Located in back of manual)

stated well in advance as priorities are usually determined by the Joint Chiefs of Staff.

c. Local arrangements may be made with combat aircraft units for limited reconnaissance. Combat aircraft are not equipped to obtain all the data which can be produced by specially equipped weather reconnaissance aircraft; but, in certain combat situations, high performance combat aircraft may be the only vehicles which can survive, and may be required to obtain limited weather data.

CHAPTER 4

AIR WEATHER SERVICE SUPPORT

Section I. AWS SUPPORT—GENERAL

4–1. Introduction

a. The Air Weather Service of the U.S. Air Force supplies units properly organized, equipped, and trained to provide observations and to fulfill the requirements of the Army for weather forecasts and climatic studies plus weather and climatic summaries. Forecasts are prepared by AWS for the Army on both a routine and a special basis. Routine operational forecasts normally cover periods ranging from 12 to 48 hours with extended period forecasts covering periods from 3 to 5 days. Forecasts are based on the information forwarded to the AWS weather center by the worldwide weather facilities of the AWS, and on local observational data collected within the Army area by both AWS and Army personnel.

b. The AWS support of the Army is provided through an Air Force staff weather officer at division, corps, and army headquarters. Each SWO is supported by AWS weather teams which include weather observers and forecasters. Teletypewriter and facsimile circuits are provided to the WETM by the signal unit organic to the supported command. See figure 3–5 for a graphic presentation of weather communications and the AWS units in the field. The SWO advises the commander and his staff on matters relating to weather and climate. He arranges, through AWS channels, for climatic studies and summaries as required, and serves as the liaison officer between the AWS weather support force (WSF) and the Army.

4–2. Air Weather Service Mission

The mission of Air Weather Service is to provide—

a. Specialized meteorological service to the Air Force, including weather observations and forecasts, climatic studies, and staff assistance.

b. Specialized support to the Air Force in closely related scientific fields, including astrophysics and geophysics, as directed by the Chief of Staff, USAF.

c. Meteorological service to the Department of the Army, as directed by the Chief of Staff, USAF, in accordance with the provisions of AR 115–10/AFR 105–3.

d. Atmospheric sampling services and daily airborne operations as the single manager for the Department of Defense.

4–3. Organizational Elements and Objectives

a. AWS units are organized to provide supervision over all assigned weather facilities. The organization will consist of Headquarters AWS, and such units as may be constituted by authority of the Chief of Staff, USAF, and of the Commander, Military Airlift Command (MAC).

b. The organization of AWS subordinate ground units will normally parallel, to the extent practicable, the operational chain of command of the supported commands. The top echelons of AWS field organization are associated with the unified and specified commanders, where appropriate, in accordance with JCS directives and memoranda. Figure 4–1 shows the current Army Weather Support structure.

c. AWS aerial reconnaissance and atmospheric sampling units will provide specialized services in accordance with mission priorities and requirements established by the Chief of Staff, USAF.

d. The Commander, AWS:

(1) Establishes and administers AWS meteorological ground units and aerial weather reconnaissance units, and supervises their technical functions.

(2) Prepares and issues missions of subordinate units.

(3) Prepares statements of requirements for

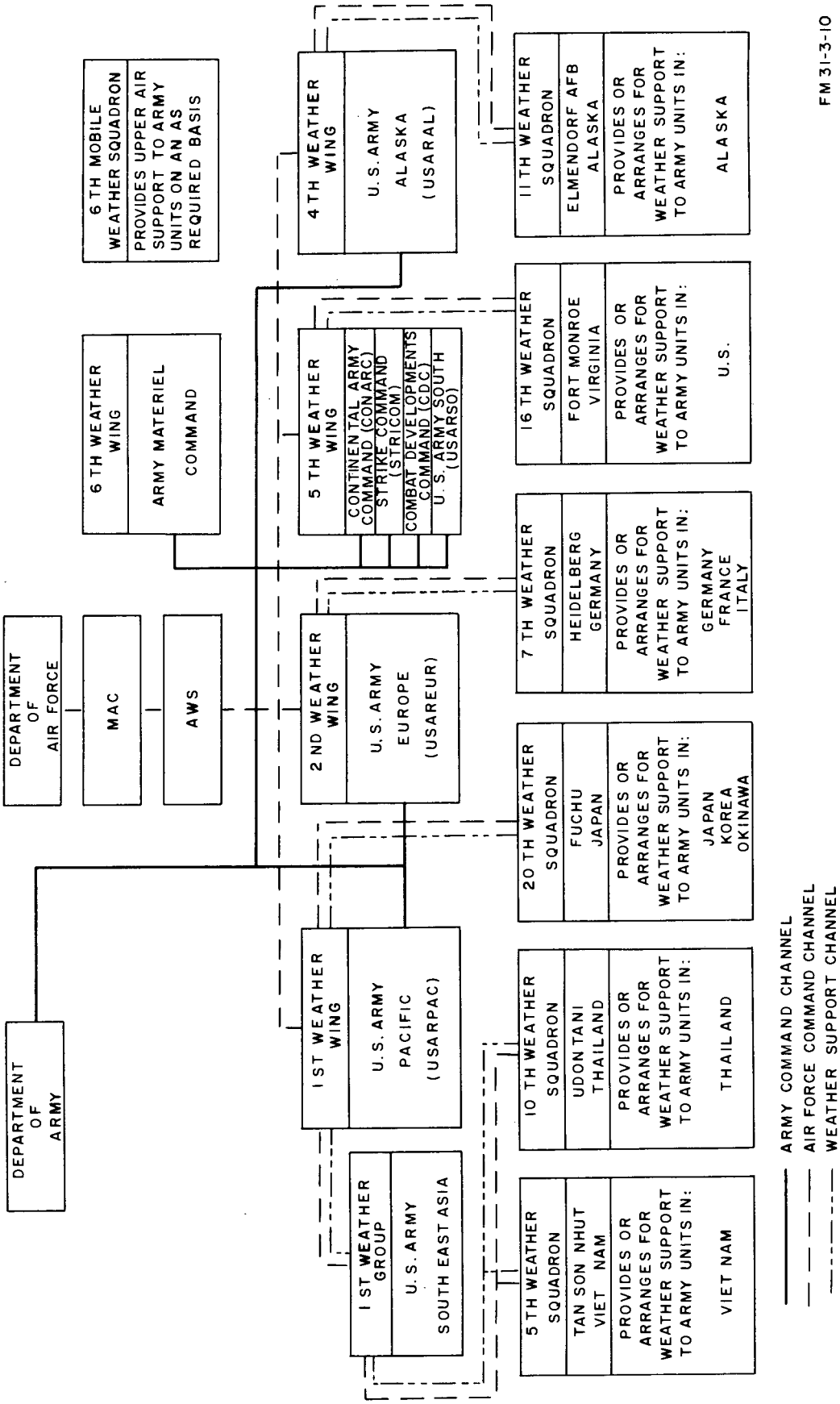

Figure 4-1. Current army weather support structure.

research and development to support AWS in fulfilling its mission.

(4) Plans, programs, and provides meteorological/aerospace environmental service in the Department of the Army. If additional personnel authorizations or facilities will be required, such service will be programed only when directed by HQ USAF.

(5) Exercises command jurisdiction over AWS units.

e. The Department of the Army, by written agreement, will furnish full communications support and local services to AWS units operating in the Army in the field.

4–4. Concept of AWS Operations

The Air Weather Service is organized to support Air Force and Army forces throughout the world. It meets meteorological or changing weather support requirements by maintaining close contact with army operational planning groups and, through realistic planning, insures timely support to the Army in the field. There must be extensive coordination with other military weather organizations, with the U.S. Weather Bureau, and with the weather services of friendly countries, to insure mutual understanding and to avoid duplication. This requirement necessitates simplification and standardization of planning and procedures to the maximum extent practicable.

4–5. Responsibilities of AWS to the Army in the Field

These responsibilities are to—

a. Respond to the Army requirements for weather service for an army in the field.

b. Establish a basic weather support concept to provide this service.

c. Delineate associated weather support responsibilities.

d. Provide planning procedures for AWS Commanders and staff weather officers.

Section II. ESSENTIALS OF WEATHER SUPPORT

4–6. Weather Support Phases

The weather support requirements must be viewed in phases beginning with initial planning through direct support of combat operations. The following requirement areas are considered most important:

a. Army in the field operations entail highly complex planning by several commands and echelons. Staff weather actions are required at each planning level. These actions must be taken systematically and must have continuity with those of higher levels, all leading to the development of tailored support.

b. Army long-range planning involves the consideration of route selection for deployments, feasibility of a variety of ground operations over specified terrains and seasons, internal defense operations, and selection of drop zones and times of day for paradrop assaults in objective areas. All of these require the consideration of climatological factors involving many weather parameters. On-the-spot staff weather advice is required to interpret the weather implications of long-range planning requirements. The request for climatological information should be forwarded by the SWO to appropriate AWS units.

4–7. Weather Support System Tailoring

a. Today's complex Army operations demand a standard weather support system, which must meet the following criteria:

(1) Have flexibility comparable to the organization supported.

(2) Consist of weather support elements which are integral to supported Army forces, maintained in the same readiness, deployed with the forces, and augmented in the areas where the elements will operate.

(3) Have a forecast facility to support the elements of the system with centralized information to insure coordinated briefings.

(4) Possess trained personnel and suitable equipment to provide support immediately upon arrival in operational areas.

b. The above requirements are applicable to the entire spectrum of Army-in-the-field operations. A weather organization must be tailored to Army operations for the specific purpose of supporting the forces involved. Tailoring includes all aspects of weather planning, personnel, and logistics, needed to provide the required support.

4–8. General Goals of Weather Service Support

These goals are to provide—

a. Command and staff at all echelons, from army down, with the best available estimates of future weather conditions for use in operations and planning.

b. Command, staff, and troops with timely warnings of expected weather conditions which might adversely affect operations or which could be a hazard to personnel or materiel.

c. Command, staff, and troops with the best available information on atmospheric conditions which affect the employment of weapons or weapons systems.

d. Command, control, and operational aviation personnel with information on current and expected weather conditions for routes and terminals.

Section III. AIR WEATHER SERVICE SUPPORT ORGANIZATIONS

4–9. AWS Support—Joint Regulation

In accordance with Joint Regulation AR 115–10/AFR 105–3, the Air Weather Service of the U.S. Air Force provides properly organized, technically equipped, and professionally trained units to fulfill the requirements of the Army for weather forecasts and climatic studies in addition to climatic and weather summaries.

4–10. Weather Support Force Tactical Concept

a. The Weather Support Force, which is echeloned from Joint command through Army and Air Force levels, provides direct weather support to joint Army/Air Force operating in the field. A WSF can support various Army echelons to include Military Assistance Advisory Group (MAAG), Missions, and separate subordinate unified commands. WSF support in counterinsurgency operational environments is important because of the nature of weather encountered and the increased reliance on air support and weather information for operational planning. Figures 3–2 through 3–5 present graphic representations of the WSF units at Army echelons; the flow of weather information to these units is shown in figure 4–2.

b. The WSF command concept for support of Army tactical operations is to develop a compatible weather unit which is as reactive and flexible as the unit supported. Within this principle, no effort is made to establish a definitive organization because of the variable units supported. The need for mobility in deployment of tactical weather personnel dictates that *hardcore* AWS units be attached to each army, corps, and division. These *hardcore* weather units will be augmented with AWS personnel acquired from the theater to which the supported army unit deploys. The use of weather personnel familiar with theater weather insures a well-balanced technical capability for immediate weather support in the operational area. Specific, full-strength complements for each WETM or for the entire WSF cannot be indicated because this depends on such variables as the type operation and the specific weather support requirements of the supported command, the climatic area of operations, and available army communications. A possible deployment of WSF units in a type field army is shown in figure 3–5.

c. Weather support service is most effective when the weather personnel know the mission, capabilities, plans, and procedures of the organizations they serve. The demands placed upon the weather support organizations will be most realistic when commanders and personnel using these services understand the basic principles of meteorology, and recognize the capabilities, limitations, and support requirements of the weather service in the field.

4–11. Weather Support Force Concepts

A weather support force will—

a. Employ centralized forecasting for support of weather sensitive operations. These forecasts, collectively called mission control forecasts (MCF), are provided at headquarters level.

b. Provide for briefing support to operational units down to division, major Army airfields, and at brigade level when directed by competent authority.

c. Make maximum use of weather observing

Figure 4–2. Flow of basic information in a type weather support force supporting the army.
(Located in back of manual)

support from organic Army sources, and from other U.S. and friendly foreign weather services operating within and adjacent to the Army area of interest.

d. Collect, distribute, and make maximum use of weather information acquired by WSF observing teams, by aerial weather reconnaissance, and by weather satellites.

4–12. Weather Support Force Planning

Weather support is planned along with all other phases of operational planning. The overall WSF system must be fully coordinated with, and understood by, G2 sections and by each SWO so that weather support can be provided on an effective and timely basis. WSF planning functions consist of the following:

a. Climatology. This function, in its broadest sense, is the scientific study of climate. The two major climatological subdivisions in Army weather support are climatic studies and climatic summaries. For detailed description refer to paragraphs 2–4 through 2–9 and figure 2–3. These studies and summaries, tailored to operational requirements, are introduced into the planning cycle in its earliest stages. These data are considered by the commander and his staff in developing operational plans and tactics. The preparation of climatic studies and summaries normally is not a local effort because of the many ramifications of the problem. Rather, it is a team effort using the best available resources of AWS. Many studies require the selective handling of a data-volume so great that its processing is done best by electronic computer at a central climatic facility. Climatic service is most effective when all persons concerned are fully cognizant of the operational problem and understand the application of climatology with respect to the problem.

b. Forecasting Services. All weather teams in the Army in the field depend on the WECEN through the WETM/FATOC for short and extended-period forecasting services. To be effective, the WETM/FATOC must have detailed knowledge of all aspects of tactical operations to tailor its forecasts to weather needs of each particular mission and to the general battle plan. This means that SWO must keep the WETM/FATOC continuously aware, down to defining essential mission control criteria, of specific tactical missions. WETM/FATOC forecasts fall into the following categories:

(1) Routine operational forecasts normally originate at the WETM/FATOC. These forecasts cover all weather parameters of interest to the Army for periods of up to 48 hours and are used in conjunction with a 3- to 5-day forecast. They are sufficiently comprehensive to fulfill the briefing requirements set forth in AR 115–10/AFR 105–3. Routine forecasts are disseminated in a predetermined format to assure fulfillment of user requirements and to save message transmission time. Routine forecasts may be subdivided into *general forecasts* which satisfy the weather support needs of the majority of Army users, and *special forecasts* which are tailored for such specific Army activities as aviation and CBR (para 2–3*d*(1) and (2)). Some special forecasts, such as those prepared for CBR, are issued at regular intervals, while others are furnished *as requested.* These forecasts are identified by type, by content, and by user in figures 2–3 and 2–4.

(2) Mission control forecasts are provided by the WETM/FATOC to support a specific mission. MCF contents, format, and time of issue are tailored to satisfy the weather support requirements of such missions as paradrop and special warfare.

(3) Weather warnings and met watch advisories for the operational area are a responsibility of WECEN–WETM/FATOC. Specific criteria for these are determined by the Army, coordinated with the Weather Support Force Commander, and established in a WSF SOP. WSF operations are concerned only with that part of meteorological watch which provides for keeping operations personnel advised of current and short range forecast weather for those specific locations of operational concern. This aspect of meteorological watch is most critical to those agencies interested in the minute-by-minute progress of the operation.

c. AWS observing services. These services are required at designated airfields, in forward areas, in drop zones, and in areas where complete, representative observations are needed. Upper air observations are required to fill gaps in available upper-air data, and in direct support of airborne operations. It is vital to overall weather support that all observations be furnished the WETM/FATOC promptly over the weather teletypewriter nets.

d. AWS Services at Flight Operations Center. All FOC are stations on the Army-Corps weather teletypewriter net (fig 3–5). Through this network, all FOCs are kept informed of current weather conditions of aviation area and terminal

forecasts prepared by the WETM/FATOC, and of short-range terminal forecasts prepared by the WETM/AFLD.

4–13. Basic Composition of WSF

The AWS units under the WSF are the weather centers at the joint Army group/numbered AF or JTF headquarters echelon, and weather teams at all echelons down to division, major Army airfields, and at brigade level when directed by competent authority. These units are composed of varying combinations of professional meteorologists who possess three basic meteorological skill classifications as follows:

a. Airmen weather observers provide the basic meteorological input for weather support to the tactical army. They continuously monitor the state of the atmosphere within range of their instruments and vision. This constant weather surveillance is essential to satisfy army aviation requirements for current weather information.

(1) Surface observations consist of measurements, either instrumental or visual, of the following weather elements:

(*a*) Sky condition, including cloud types, cloud amount, heights of cloud bases, and direction of movement.

(*b*) Visibility, including prevailing and runway.

(*c*) Obstructions to vision.

(*d*) Precipitation, by type, character, intensity, and cumulative amounts.

(*e*) Weather phenomena, such as tornadoes, water spouts, thunderstorms, and lightning.

(*f*) Surface temperatures, measured approximately 5 feet (1.5 meters) above the terrain.

(*g*) Dewpoint temperature, derived from dry- and wet-bulb temperature readings.

(*h*) Surface winds, which are not actually measured at the surface, but at 6 to 14 feet (1.8 to 4.3 meters) above the terrain. Wind chill factor is obtained from inputs of both windspeed and ambient temperature.

(*i*) Surface pressure, from which sea level pressure and altimeter setting are derived.

(*j*) Observations to other weather elements, depending upon the local requirement. These observations may include surface conditions (such as icy, frozen, wet, dry, etc) or estimates of tops of clouds.

(2) Weather observers must make certain that the latest transmitted observations from their site are representative of the current state of the atmosphere. This is accomplished by transmitting a complete surface observation of the elements listed in (1) (*a*) above at a scheduled time each hour and, if a significant change in any of these elements occurs, between scheduled transmissions, by transmitting a special observation indicating the extent of the change. All observation transmissions, over the weather teletypewriter nets, should be handled as urgent traffic to assure prompt receipt by the WETM/FATOC and all other WETM serving the Army. In this way the command, staff, and army aviation can be kept informed of latest reported weather over the entire army area.

(3) Weather observers operate the facsimile and teletypewriter equipment of all WETM; they plot and graph meteorological data in a form suitable for the analysis and forecasting functions, and they assist the forecaster in the general operation of the weather station. Weather observers deal in observed or current weather data.

(4) When provided special rawinsonde equipment, the weather observer can track ascending balloons carrying small radiosonde transmitters. This instrument delivers data on winds, pressures, temperatures, and humidities aloft. A weather team with radiosonde tracking capability is called a WETM/RAWIN. The WETM/RAWIN and the artillery met section perform similar meteorological functions. WETM/RAWIN will only be deployed in army areas void of artillery meteorological sections.

b. A weather support force weather forecaster, either officer or airman, is the specialist who applies the weather analysis and forecasting tools to the basic weather observation data. It is the job of the weather forecaster to produce the primary product of the weather support system—the weather forecast. Militarily, the user-oriented weather forecast is the most valuable output of the weather support force. Scientifically, it is the most difficult. Weather analysis, the intervening step between weather observing and forecasting, is based on synoptic observations. This synoptic concept requires that all observations, both surface and upper air, from all sites inside and outside the army area, be taken on a predetermined time schedule. While analysis and forecasting is so dependent on synoptic or scheduled observations, the unscheduled observational data, acquired by many organic army units in support of their unit operations, is most important to the forecaster who may be advising command and staff in these varied operations. Weather fore-

casting is echeloned in army support with the largest single group of weather forecasters and the least mobile weather support equipment at the WETM/FATOC; this group comprises the major forecast capability in the Army. At the WETM/CTOC, smaller groups of weather forecasters adapt the WECEN forecasts to the particular requirements of the army units in their area of responsibility. The ranking weather forecaster at the WETM/CTOC commands the weather units in that TOC area of responsibility and is also the SWO to that TOC.

c. The staff weather officer is a weather forecaster with the specialized function of providing briefing service and other required weather support to the command and staff of the echelon to which he is attached. The SWO is the contact between the command and its weather support (para 4–16).

4–14. Weather Support Force Readiness Posture

A WSF supporting joint operations in the field is comparable to a weather squadron. The readiness posture and mobility of the different weather units comprising the WSF are at least as reactive and mobile as the army and air force echelon they support. Therefore, the weather teams at the division tactical operations centers are the smallest and most mobile of the TOC weather teams. The WSF command/control structure is identical with that shown for the sole-user circuit of the communication diagram (fig 3–5).

4–15. Air Weather Service Support at Army, Corps, and Division

a. Field Army. The field army (FA) area of influence is extensive—so extensive as to require a considerable amount of weather information to permit effective support. (See fig 4–1 for flow of weather information.) The WETM/FATOC at army level provides technical meteorological liaison with the WECEN or Theater Weather Central and provides planning guidance, coordination, and technical and logistical support for WETM detachments at lower army echelons. The Theater Weather Central, WECEN, and WETM/FATOC furnish army units general and special forecasts for periods up to 5 days; climatological information; facilities for editing observations; and weather summaries within the army area.

b. Corps and Division. The weather support required by corps and divisions differs from that required by a field army because of the smaller area and more limited range of operations considered at the lower echelons. Corps and divisions require shorter range general weather forecasts and less climatic information than army. Observations of current weather, forecasts of 24-hours or less, are of particular value at and below division level. The importance placed on individual weather elements in a forecast or climatic summary will vary considerably between the different command levels and even between different organizations at the same echelon. Army plans and tactics may, for example, suggest different critical weather factors from corps or division. Similarly, critical weather factors for CBR operations have little application to engineers or aviation. Corps or division WETM do not attempt to satisfy the wide range of specialized user requirements indicated in figures 2–3 and 2–4. Instead, they rely on the WETM/FATOC, WECEN, and Theater Weather Central (TWC) to provide the basic forecasts. Requests for assistance or services beyond the capabilities of a WETM at any echelon are forwarded to the WETM/FATOC. All WETM depend on the higher weather support echelon for assistance. When this assistance is not available because of the tactical situation or lack of communications, the quality of weather support will inevitably deteriorate.

c. MAAG, Missions, Subordinate Commands. Generally, weather support required will be similar to that received by corps and divisions. Weather information will be required for tactical ground operations, airborne and airmobile operations, engineer support, use of defoliants, plus a wider range of specialized user requirements indicated in figures 2–3 and 2–4. Weather support required in a receiving state (RS) (in support of MAAG, Missions, subordinate unified commands, and US and RS armed forces) varies with—

(1) The size of the RS.

(2) Intensity of operations.

(3) Impact and characteristics of weather in the country.

4–16. Air Force Staff Weather Officer

The Air Weather Service Weather Support Force supports the army in the field through an SWO at division, corps, and army headquarters. Each SWO is supported by a WETM/TOC. Communication support, to include both teletypewriter and facsimile circuits, is provided to the AWS detachment by the signal unit organic to the supported command. The SWO is a member of the special staff, under the general staff supervision of G2.

At corps and division headquarters, the SWO may be the WETM/TOC commander. He advises the commander and his staff on matters relating to weather and climate. The SWO—

a. Arranges, through AWS channels, for climatic studies and summaries as required; for the delivery of routine forecasts, weather warnings, meteorological watch advisories, and mission control forecasts; and serves as the liaison officer between the AWS detachment and the army element.

b. Advises the commander of the functions, organization, and capabilities of the supporting weather facilities.

c. Keeps abreast of plans to insure that adequate facilities are provided to meet weather service requirements.

d. Insures that requirements for weather observing and reporting are clearly defined and thoroughly coordinated with the organizations that are providing these reports.

e. Insures that weather service requirements for communications, administrative, and logistical support are made known to the agencies responsible for providing this support.

f. Makes concerted efforts to obtain the critical weather criteria upon which each of the proposed army tactics are contingent. Tailored weather support, required by the G2 to develop weather intelligence, necessitates determining the specific criteria that have a direct effect on a specific tactic. Examples of critical weather criteria related to tactics, which must be established, are—

(1) Maximum winds in which paradrop assaults can occur.

(2) Minimum visibility in which various ground operations by infantry, mechanized, or armored divisions can be conducted.

(3) Minimum ceiling and visibility below which aerial photo reconnaissance cannot be conducted.

(4) Critical wind directions and speed for the employment of chemical, biological, or radiological agents.

(5) Critical precipitation amount that will severely reduce trafficability.

4–17. Air Weather Service Weather Facilities

Ten principal types of technical facilities are provided by the AWS to meet the weather requirements of army forces within a theater of operations. See figure 3–5 for a graphic representation of the AWS weather facilities in the army.

a. Theater Weather Central. This diversified facility is capable of preparing weather analyses and forecasts covering an entire hemisphere. It is assigned to the air force weather wing which serves theater army forces. The weather central serves as a source of weather information for use in theater planning and provides technical meteorological support to the WECEN and WETM/TOC in the theater. This support includes the following:

(1) Preparing and disseminating facsimile weather charts for the theater area and other areas of operational interest.

(2) Providing climatic summaries and studies.

(3) Providing basic forecast guidance to assure compatibility of tailored forecasts prepared at lower echelons.

(4) Providing operational and planning forecasts for periods which exceed the capability of WECEN (usually for periods over 48 hours).

(5) Disseminating basic weather data by means of the theater weather data facsimile and teletypewriter nets.

b. Weather Center. This mobile or semimobile facility provides service to the army group, numbered air force, or joint task force. This is the center of the WSF system and has the greatest capability for overall weather support to the tactical weather support units. This center prepares and issues forecasts on a scheduled basis to meet the general needs of WSF elements, and provides special forecasts as required in support of specific WSF operations. The WECEN is an integral part of the headquarters, army group/numbered air force or joint task force with which it is positioned. This is essential to provide direct support, and to have access to command communications. The WECEN support to the army in the field consists of—

(1) Tailoring the theater weather central/center weather support products in light of user requirements and further disseminating these products to the WETM/FATOC.

(2) Preparing and disseminating user orientated weather forecasts and summaries.

c. Weather Team at Field Army Tactical Operations Center. This mobile facility provides service for the army in the field, including its components and support organizations. This tactical forecast facility is located at army headquarters and has comparable mobility. It is the central agency for the collection, evaluation, and further

dissemination of weather and climatological information within the army area of responsibility. The WETM/FATOC prepares weather summaries, and with the assistance of the WECEN, prepares forecasts for periods up to 48 hours. It provides forecasting service for the army area as required. The SWO operating from this facility furnishes staff briefing service to the army commander and his staff.

d. Functions and Responsibilities of WETM/-FATOC. The WETM/FATOC is the only facility that conducts a comprehensive meteorological watch over the entire Army area, and gives special attention to areas of operational concern to the Army. At the first opportunity after the WECEN is operational, a positive system of meteorological watch is established to include every available source of data. The sources of data are conventional weather air reconnaissance with specially equipped aircraft; covert weather air reconnaissance with tactical aircraft; pilot reports, and after-mission reports from mobile weather radars and from Army aircraft control and search radars; Army, corps, and division WETM surface weather reports; pibal and rawinsonde data; weather satellite data, drop zone, and landing zone surface winds and winds aloft reports; and any other data such as reports from civil weather sources and aircraft. The WETM/FATOC has the responsibility of providing mission control forecasts, met watch advisories, weather warnings, and fallout wind forecasts. Because of the urgent operational nature of weather warnings, the WETM/FATOC must take immediate action to assure that all G2 and flight operations center (FOC) within the army are notified. This action consists of the following:

(1) Transmitting weather warnings over the weather teletype net to all WETM/TOC and WETM/AFLD. Subordinate WETM will immediately relay this data to the appropriate G2 or operations officer. WETM may add to these special forecasts in order to amplify sections of primary concern to their specific organization; subordinate WETM do not make decisions or changes without prior coordination with the issuing agency.

(2) Notifying the SWO at army and, through the SWO, the G2 section at the FATOC of the weather warning. All weather warnings will be transmitted over internal army communications channels to subordinate G2/G3 sections.

(3) Notifying the FOC at army who will in turn notify subordinate FOC.

e. Corps Tactical Operations Center Weather Team. The WETM/CTOC serves corps headquarters and operational agencies such as the corps fire support element (FSE), and the chemical, biological, and radiological element (CBRE). The WETM/CTOC provides support to division WETM and subordinate elements of the corps (fig 3–5). The CTOC weather team—

(1) Maintains continuous surveillance over weather conditions in the corps area and adjacent areas of interest and, through the SWO, advises the corps commander and his staff on matters pertaining to weather.

(2) Disseminates pertinent weather forecasts, advisories, and other information over the weather teletypewriter net to the division WETM and other subordinate elements of the corps.

(3) Provides weather observing and forecasting service for army aviation elements at the major corps and division airfields, and such other weather information as is required by aviation elements.

(4) Collects, evaluates, and further disseminates weather data generated within the division and corps area.

(5) Assures that the corps FOC is receiving adequate weather support.

f. Division Tactical Operations Center Weather Team. The WETM/DTOC serves division headquarters with a mission similar to that of the WETM/CTOC. Its functions are to—

(1) Provide weather support to the division commander and staff, through the SWO.

(2) Provide fallout wind forecast and low level weather forecasts for the CBRE (fig 2–3).

(3) Provide special weather summaries and forecasts to the engineers.

(4) Provide special forecasts and MCF as required.

(5) Exchange upper air observations with artillery meteorological sections. The artillery meteorological section observations for AWS use are transmitted by WETM/DTOC over the weather teletypewriter net for WSF use, so that all weather support units in the Army can use the data.

g. Airfield Weather Team. Weather service in the combat zone is provided to Army aviation by weather teams at army, corps, and division major airfields. Normally attached to the headquarters and headquarters company, aviation battalion (army, corps, or division) for administrative and logistical support, the WETM/AFLD is adjacent

to or included as part of airfield operations. This close association is necessary to facilitate—

(1) Briefing and debriefing of aviators.

(2) Ready access to communication facilities for dissemination of weather information to the airfield traffic control team (tower), the ground control approach (GCA) team, and other army aviation installations.

(3) Assistance to the commander in analyzing and fulfilling command requirements for weather training.

(4) Providing aviation area, route, and terminal forecasts for major airfield operations and, on request, for aviation operations conducted from minor airfields.

(5) Conducting a meteorological watch during periods when there is flying activity in the area of responsibility.

(6) Providing weather support to the FOC at corps or army, as directed by the WETM/CTOC or the WETM/FATOC.

h. Tactical Weather Observing Facilities. In addition to WETM/AFLD at army, corps, and division, two additional types of tactical weather observing facilities supplement other sources of weather data in a theater of operations. The tactical observing team (WETM/OBS) is a mobile team equipped to provide atmospheric sounding data of wind, temperature, and moisture distribution aloft. It operates in army areas not supported by artillery meteorological sections and has similar equipment and capability.

i. Unconventional Warfare Weather Team. The WETM/UW are attached to Special Forces Groups as necessary and provide direct support to unconventional warfare activities and psychological operations. WETM/UW train special forces in making and reporting limited weather observations, and provide weather support to activities in the field.

j. Weather Reconnaissance by AWS. This action is taken to obtain weather data over areas from which weather reports are not available.

(1) AWS weather reconnaissance obtains data for use in preparing weather analyses and forecasts. These missions fall into two classes: scheduled missions which acquire weather observations, including atmospheric soundings at predetermined locations and at scheduled times; and unscheduled missions to investigate doubtful weather conditions.

(2) In tactical weather reconnaissance, tactical aircraft crews obtain special reports of weather conditions along the routes to, and in the vicinity of, targets for proposed operations. These reconnaissance weather reports are required to provide weather intelligence for making immediate operational decisions.

k. Mobile Weather Satellite Readout. This capability exists at the theater weather central and WECEN and, if required, may be at the WETM/FATOC as well. Satellite weather pictures must be analyzed and interpreted by specially trained weather personnel before they are of value to the WETM and SWO. After analysis, appropriately interpreted weather satellite information is transmitted army-wide over the weather facsimile nets.

4–18. Fragmentation of the Weather Teams

a. All tactical operations centers in the army in the field, including both U.S. and RS forces operating in counterinsurgency operational environments, will have alternate TOC to provide backup support. Alternate TOC (at army, corps, and division) have communication facilities (including weather facsimile nets, teletypewriter nets and terminal equipment) equivalent to the main TOC, and are manned so that they can perform essential TOC functions for a limited time. The WETM/FATOC, the WETM/CTOC, and the WETM/DTOC possess the capability to fragment, so that essential weather support can be provided at the alternate TOC when the main TOC are in transit or otherwise inoperable. This fragmentation will be carried out in the following manner:

(1) A limited stock of essential WETM/FATOC meteorological equipment and supplies for analysis and forecasting will be stocked at the alternate FATOC.

(2) The WSF commander will make arrangements for off-duty WETM/TOC personnel to bivouac in the vicinity of the alternate WECEN and TOC for WETM manning.

b. Other WETM will not be fragmented. If a WETM/AFLD becomes inoperative, the WSF commander will furnish a replacement. In the interim, the WETM/AFLD functions will be taken over either by the WETM/DTOC or another WETM/AFLD (at corps or army).

Section IV. WEATHER SUPPORT FORCE LOGISTICS

4–19. General

Each element of the weather support force must maintain the same degree of flexibility, mobility, and responsiveness as the command it supports. To accomplish this, logistic support for elements of the WSF operating within the army will be comparable with army logistic support and will utilize it to the maximum degree possible. Logistic support for WSF elements with the army fall into two general categories—

a. Army Logistic Support. This constitutes the preponderance of supplies and services furnished these elements.

b. Air Weather Service Logistic Support. This consists primarily of specialized meteorological supplies and maintenance.

4–20. Army Logistic Support to WSF Elements

Army logistic support for the WSF elements operating within the army consists of the following:

a. Communications, including teletypewriter, facsimile, terminal equipment and maintenance. Chapter 5 provides details of communications support furnished by the Army.

b. Electric power, as necessary, for lighting and operation of communication equipment.

c. TOE designated vehicles, administrative vehicles, POL, and vehicular maintenance described in AR 115–10/AFR 105–3. Drivers may be furnished by the WETM to which these vehicles are assigned.

d. Field rations and equipment to include tentage for both personnel and equipment, weapons, and parachute equipment, when required, for dropzone weather personnel.

e. Facilities for instrument maintenance, where AWS weather maintenance personnel may repair meteorological equipment.

f. Adequate working space for the WETM at army, corps, division, and airfields.

g. Processing requisitions for common item supplies and for disposals.

h. Such administrative support as army exchange (PX), commissary, medical, dental, chapel, and mortuary.

4–21. AWS Logistic Support to WSF Elements

AWS will provide, supply, and maintain all tactical meteorological observing and forecasting equipment used by WSF elements operating in the army. A special AWS meteorological equipment unit, assigned to the WECEN and operating in the army, is responsible to the WECEN and WETM/FATOC for AWS meteorological equipment maintenance. This same unit is also responsible for assuring that proper levels of expendable meteorological operating supplies and equipment spare parts are maintained. AWS will retain accountability for all meteorological equipment used by AWS personnel. AWS logistic support includes—

a. Providing and maintaining weather observing instruments and other meteorological equipment.

b. Furnishing weather charts and graphs.

Section V. WEATHER SUPPORT FORCE RESPONSIBILITIES

4–22. Determination of Equipment Requirements

Requirements for mobile meteorological equipment to support weather support forces are determined by the Theater Air Force Weather Wing or Senior USAF Commander in coordination with the Theater Army Component Commander. Tactical equipment is prepositioned with the operational unit being supported.

4–23. Weather Support Force Commander/G2 Responsibilities

a. USAF Support. This support includes—

(1) *Tactical meteorological equipment.* The Field Army Staff Weather Officer will assure that all WETMs are properly equipped to fulfill their responsibilities. All tactical meteorological equipment will be periodically checked for completeness and operability. A 2-week supply of meteorological equipment spare parts and expendables, such as weather charts and forms, will be maintained.

(2) *Weather SOP.* WETM SOP for internal use (and as annexes to army field SOP) will be current, complete, and readily available to all concerned.

(3) *Field training.* The Field Army Staff Weather Officer will assure that all weather per-

sonnel are adequately trained in field procedures involved in performing defense operations, and in rapidly assembling and dismantling weather stations and tents in the field.

(4) *Training.* Weather personnel in the field must be adept in providing user-oriented weather support. This requires that weather personnel be trained to work with topographic charts, military grids, and map coordinates to properly localize their forecasts. Local area topographic charts will enhance their capability to anticipate such details as temperature effects of north-facing vs south-facing slopes, areas of cold air drainage, and probable orientation of mountain and valley breezes important in forecasting weather in a micro scale.

b. Army Support. The commander, usually through the G2, at army must assure that the WSF is provided all authorized communications, logistics, and administrative support by the army. This authorized equipment support normally is detailed in the Tables of Organization and Equipment (TOE) of appropriate army, corps, and division headquarters and headquarters companies.

Section VI. CENTRALIZED FACILITIES

4–24. Concept of Operation

a. Weather support to the army in the field is provided under the centralization concept in which centralized facilities prepare and disseminate timely analyses and prognoses for the area required.

b. The individual WETM, with forecast capability, will be able to analyze weather over an area large enough and sufficiently detailed to support terminal forecasts up to about 12 hours. The primary purpose of transmitting WECEN centralized facilities (CF) products is to give WETM graphical analyses and forecasts which will permit them to provide the Army weather support required with minimum delay.

c. Established centralized facilities, and the use of CF products at weather units, offer seven principal advantages to the army in the field. These advantages—

(1) Provide a more consistent meteorological product.

(2) Limit the size of the weather-communication complex.

(3) Concentrate highly-skilled meteorological capabilities.

(4) Make feasible the use of large electronic computers.

(5) Assist and guide the WETM forecasters.

(6) Save time at operating levels.

(7) Make available more processed information.

4–25. Weather Team Use of Centralized Facilities Charts

The steps in army support use of CF charts are—

a. The CF charts are studied concurrently with appropriate raw data, (that is, for area of major interest) and additional locally prepared weather charts to establish the synoptic picture.

b. The CF analysis is revised, if necessary, with reference to the area of major interest to the G2 or other weather support user. This revision normally will be based on later data.

c. A tailored forecast is prepared for a specific purpose, as established by the G2 or other staff section.

4–26. Local Preparation of Analyses

The role of facsimile charts in the local preparation of analyses is primarily one of guidance. The WSF must recognize that the predominant features of displayed analyses for a given map time must be essentially the same in all WETM to avoid confusing the army users (at different command levels) preparing for the same operation. However, it is impossible to portray (in the small scale of the large area facsimile charts) the amount of detail required in the preparation of routine, high-quality local area forecasts of 12 hours or less. The detailed local-chart analyses must be done on large-scale sectional charts. For examples of weather facsimile charts and symbols used, see TM 1–300.

4–27. Operational Forecast Preparation

Preparation of the operational forecast is the function of the WETM at the operational level. There is a need for centralization of the production of basic forecasts; but, fundamentally, the field forecaster tells the user what the weather is going to be. He is in the best position to tailor the forecast to the specific needs of his customers. The primary and immediate roll of facsimile charts is

to give the operational forecaster the best available prognostic charts from which he takes, or develops, his weather forecasts. On the other hand, the overall CF support is broader than that, for it may include—

a. The actual forecast in a form that can be used directly by the operational user with little or no information added by the local forecaster.

b. Prognostic charts from which the needed operational weather parameters can be inferred.

c. Analyzed charts which can be used to forecast specific changes in the area of local responsibility.

4–28. Weather Data Processing

a. Data processing in the AWS system involves the handling of information, manually or by machine, in a logical sequence to convert physical measurements of atmospheric parameters into analyses, forecasts, and other useful forms. The volume of data has become so great that the use of computer data processing at theater weather centrals (TWC) has become necessary. Army requirements for additional forecast parameters, wider geographic coverage, and an increased number of altitudes of interest (plus the necessity of shorter preparation time) demand that as much weather data as possible be prepared by automated techniques. Automation will be most efficient for these products if the ADP facilities are centralized

b. However, it must be noted that no machine process yet devised can approach the capability of the human intellect to adapt to changing requirements or unanticipated demands. The TWC computers and computerized procedures (particularly those which permit rapid, repetitive handling of large masses of data) are conceived only as methods to insure that the WECEN and WETM can concentrate on nonroutine tasks and judgements to which the human is best adapted. The trend toward machine handling of meteorological data, from sensor to forecast, is expected to be accelerated by the advent of new army weapons and command systems. These steadily increase the demands of timely, more accurate, and a greater volume of weather support information.

c. The trend in forecast preparation and service will be toward more direct weather central response to support needs. Information will be provided as required, rather than as a blanket dissemination at scheduled periods. The National Operational Meteorological Satellite System (NOMSS) enhances the capability to provide this service.

Section VII. LIMITATIONS OF WEATHER SUPPORT

4–29. Accuracy of Weather Product

a. Observations. The foundation for all forecasting is a reasonably accurate and detailed knowledge of the three-dimensional state of the atmosphere at a previous specific time. The relationships are simple and direct. The more recent the time, the more precise the definition of the atmosphere, generally, the more accurate the forecast. Consequently, any degradation in the knowledge of initial conditions is significant. Degrading factors include—

(1) The presence of large silent areas where weather data is not available or is denied.

(2) The disruption of both observation and communications during hostilities.

(3) The scarcity (in fluid tactical situations) of sufficient dependable weather equipment to obtain continuous, detailed knowledge.

(4) Human or instrumentation errors in observations.

b. Forecasting Capability. The current state-of-the-art in forecasting, including the vast improvement made possible by electronic computers, does not always permit the routine production of accurate detailed operational forecasts. Even short-period forecasts of only 1 to 2 hours are not always accurate. The accuracy of any forecast up to 72 hours depends largely on the type of weather regime existing at the time the forecast is prepared. In general, it is not feasible to issue detailed forecasts beyond 72 hours. The recent improvment in forecasting for periods from 12 to 72 hours should continue. However, any significant enhancement in the highly detailed short-period forecast, and the longer-range planning forecast (beyond 72 hours) will have to await increased understanding. This added knowledge must come from—

(1) Basic research of atmospheric processes.

(2) Improved computer capabilities and mathematical techniques to process more complex operational atmospheric models.

(3) Improvements in the quality and density of meteorological observations on a global basis.

c. Climatological Support. The accuracy of climatic information depends on the quantity and quality of basic meteorological statistics from which the information was derived. Significant limitations of climatological data include—

(1) Insufficient period of record or total number of observations of a particular parameter. Ten or more years of data is desirable; 5 years is the minimum length of record that merits any degree of confidence.

(2) Inconsistency of climatic records due to instrumentation or station changes.

(3) Lack of hourly and night-time observations.

(4) Scarcity of representative observations of significant weather elements such as winds aloft, cloud bases and tops, etc.

4–30. Use of Non-AWS Facilities

a. National. Air Weather Service utilizes the products of the U.S. Weather Bureau, and national weather services overseas wherever they meet requirements for timely and accurate products.

b. International. The following are some of the global problems which affect the quality and timeliness of AWS support to the Army:

(1) Density of the global observing network.

(2) Frequency of observations.

(3) Errors inherent in various types of observing equipment and conversion of units of measurements.

(4) Nonrepresentative observations, with respect both to geography and to the atmospheric parameters or elements (time, space, scale) under consideration.

(5) Inconsistent climatic records at many stations due to instrumentation change or to changes of the stations' physical locations.

4–31. Communications

Providing timely forecasts, climatic data, and current weather observations to the user depends almost entirely on effective standardized operating procedures and rapid and reliable communications. For example, an accurately timed forecast for severe terminal weather might be totally ineffective because of the inability to transmit the information to using elements due to lack of suitable communications and/or operational procedures.

4–32. Survivability

The supporting AWS unit should have a survivability equal to that of the army organization it serves. In the event of nuclear war, weather information will be required to maximize the effectiveness of the surviving forces. The amount and extent of dissemination of this information will depend on the surviving communication capabilities.

CHAPTER 5

WEATHER SUPPORT COMMUNICATIONS

Section I. GENERAL

5–1. Weather Support Dependence on Responsive Communications

The ability of the Air Weather Service weather support force to provide effective support to the Army in the field is directly dependent upon a specialized, complex, and highly responsive Army weather communications system. The responsiveness of weather support to the Army and weather communications provided by the Army are so interrelated that they are practically inseparable. Weather support dependence on communications is attributable to the following:

a. The extreme perishability of weather data necessitates immediately responsive communications. A weather observation delayed for a few minutes in transit may, in a rapidly changing meteorological situation, give a completely erroneous picture of current weather. This could result in costly losses. A capability to rapidly update weather observations can prevent such an occurrence.

b. Round-the-clock weather observing and forecasting requirements continue, regardless of specific tactical operations or tactical force configurations. This unending requirement for weather support necessitates continuous operation of highly responsive tactical weather communications.

c. An extremely large number of specialized weather forecasts, weather summaries, and climatological reports are required by numerous elements and activities at various echelons of the Army in the field. Figures 2–3 and 2–4 provide a listing of these weather support requirements. The volume, high priority, and a large number of recipients of special weather information combine to create a burden on Army weather communications.

d. The mass of surface and upper air weather data that must be exchanged between the various WETM is enormous. It has been estimated that in a 2-corps, 8-division army, a 100-wpm teletypewriter net connecting the various WETM would be printing approximately 22½ hours out of each 24-hour period. In part, this volume is caused by the very nature of weather forecasts which customarily deal in four dimensions, (time being the fourth), requiring detailed, plain language transmissions.

e. The large number of WETM relying on each other for support necessitates a correspondingly large number of transmit/receive teletypewriter stations on the weather nets, operating at army, corps, division, and below division level.

f. The random occurrence of natural atmospheric fluctuations generates peak loads in communications traffic during situations when timely exchange of weather information is the most critical. Normally, meteorological parameters remain relatively stable for periods of several days followed by rapid weather changes of decided operational significance over a period of but a few hours. These rapid weather changes require numerous special observations, resulting in peak communications loads. Invariably, during these periods of greatest demand on weather communications, the most urgent operational requirement for current meteorological data exists. The frequency, intensity, and extent of these operationally significant atmospheric fluctuations (and resulting weather communications requirements) vary with climatic region, with the season of the year, and with the topography.

5–2. Air Weather Service Dependence on Army and Air Force Communications

Since the AWS does not possess organic communication facilities, it must depend on other agencies for required communication support. Normally, the Air Force Communications Service (AFCS) provides long-line facilities for intertheater exchange of weather data. In support of the army in the field, AFCS is responsible for providing long-line weather communications down to the WETM/FATOC at army level. Beyond this point,

successful weather support operations rely to a critical extent upon army communications facilities for the local collection and exchange of weather data, and for the dissemination of forecasts and current weather reports. In contingencies, exercises, or other operations where a field army is not employed, USAF is responsible for mobile communications down to the major tactical maneuver force (TOC); frequently corps and sometimes division or separate brigade.

5–3. Communication Needs for Two Basic Types of Meteorological Support

a. The quantitative reliance of weather support on tactical communications varies with the complexity of the weather information required by army users. Most army users require general or special weather forecasts. The forecasts are processed from information derived from a network of surface and upper air observations. Requirements also exist for limited observations to be applied directly to mission support.

b. Overall tactical weather communications must provide specialized services for two distinct types of weather information, each with its own special needs. These two types of weather information and a third type, which is a combination of the first two, are required concurrently in the army in the field (fig 3–4).

(1) Direct weather observation support at the surface and aloft is acquired in the vicinity of the army tactical using activity and prepared in applicable (tailored) formats for immediate use. This observational support consists of meteorological parameters of immediate operational concern. It is employed only when and where the user has a direct need for it. Almost all weather observations acquired by army organic units fall into this category. (Fig 2–1 and 3–1 through 3–4 provide a list of these observations, their parameters, and the army units that obtain them.) This type of direct observational support requires only limited communications and is normally disseminated over the operational using activity communications links.

(2) Processed weather support derives from another basic category of both surface and upper air weather observations prepared primarily as the raw material (inputs) to which more sophisticated processing is applied. This processing consisting of weather analysis and forecasting, requires a large number of surface and upper air observations made at scheduled times at many sites within, and far outside the army area of interest. The scheduling of these observations is necessarily established on a continuing basis without regard to specific army operations. These operations contain many parameters and are the raw material to which the WECEN applies meteorological techniques and procedures. The object of this processing is to provide a forecast oriented to the users' needs. (Major sources of these observations are indicated in figs 2–1, 2–2, 3–5, and 4–2.) Required to do this processing are sole-user, full-period, highly responsive weather support teletypewriter and facsimile nets for huge areas both inside and outside the army area.

(3) Some weather observations serve a dual purpose when the observation is provided directly to the tactical user, in an operational format, and is simultaneously prepared in a specialized meteorological format for use in the preparation of weather analyses and forecasts. This is often the case with the upper air observations acquired by artillery meteorological sections for ballistic corrections, and with surface and upper air observations prepared by the AWS weather observing teams for army aviation. In this situation, the operationally oriented observation is disseminated locally over the user communication circuits. At the same time, the observation in special format for analysis and forecasting, is disseminated over the weather communication nets.

Section II. SPECIFIC WEATHER SUPPORT COMMUNICATIONS

5–4. Categories of Weather Support Communications

Weather support communications in the army in the field may be divided into four separate categories:

a. Communications nets designed for the exclusive use of the WSF. These nets support internal WSF operation. Except in the case of army aviation airfields, these nets are not used for direct WSF to user support. At the army airfield, the communications terminal facilities are usually provided by TOE equipment allocations of the army aviation organization stationed at the airfield directly supported by a WETM/AFLD. The linking teletypewriter and telephone circuits to these terminal facilities are provided through the area communications system as sole-user circuits.

b. Artillery communications nets which dis-

seminate artillery meteorological data. These communications nets link the artillery meteorological sections with the fire support coordination element (FSCE) artillery cannon-and-rocket battalions, nuclear-capable batteries, and with AWS through tactical operation centers at division and corps (fig 9).

c. Operations/intelligence communications channels over which operational and intelligence traffic is handled from a headquarters to its subordinate units. Weather information provided over these channels can be either in the form of special weather reports such as severe weather warnings or the weather portion of an operations order.

d. Other army communications facilities used infrequently and on an unscheduled basis. These facilities provide support to those groups acquiring limited meteorological observation data for their own use, such as engineers who collect data on precipitation and soil moisture data required for predictions of trafficability, river stages, and floods.

5–5. Nonspecialized Weather Communications Nets

Weather reports carried over the nets indicated in paragraph 5–4*b*, *c*, and *d* do not generate any special net requirements for dissemination of meteorological data other than the allocation of net time.

5–6. Specialized Weather Communication Nets

a. A detailed description of the army communications support for the AWS weather support force as outlined in paragraph 5–4*a* is as follows:

(1) Communication support for the WSF consists of two types of sole-user nets: facsimile and teletypewriter from the WETM/FATOC to the WETM/CTOC, and the WETM/DTOC; teletypewriter links between the WETM/FATOC and FOC at Army, and between the WETM/CTOC and FOC at corps; and teletypewriter links connecting WETM/AFLD to their parent TOC at army, corps and division. Refer to figure 3–5 for net diagrams.

(*a*) *Weather facsimile net army-corps-division.*

1. Purpose. Rapid dissemination of area weather analysis and prognostic charges from which operational forecasts are derived.

2. Range. Net operates through TOC at command echelons, that is, from army to each corps and from corps to each division.

3. Alternate means. Access is provided through common-user voice and sole-user weather teletypewriter system.

4. Security requirements. Normally a reproduced weather chart need not require a security classification. Since the army-corps-division weather facsimile net operates over circuits provided by the field army area communications system (AACOMS), these circuits are link encrypted. If specific weather charts (to be reproduced) are classified, they must be afforded the appropriate protection at both ends of the link (from office of origin to secure facsimile set and from receiving facsimile set to office of receipt).

5. Responsiveness. Facsimile charts are transmitted on a scheduled basis and require sole-user, full-period circuitry with instantaneous transmission-to-receipt responsiveness.

6. Special net requirements. The WETM/CTOC will have the capability to relay facsimile charts transmitted from WETM/FATOC to all WETM/DTOC within the corps.

(*b*) *Weather teletypewriter net army-corps-division.*

1. Purpose. Rapid acquisition of observation from all WETM/AFLD; rapid method of requesting weather support assistance from higher echelon weather facilities; and rapid dissemination of general forecasts, mission control forecasts, weather warnings, and climatological information.

2. Range. Net operates through TOC at command echelons, that is, from army to each corps and from corps to each division; net also operates between TOC and WETM/AFLD at army, corps and division level and between TOC and FOC at army and corps level.

3. Alternate means. Access will be provided through common-user voice system.

4. Security requirements. In an area of tactical operations, weather information is not normally considered as classified when transmitted via teletypewriter, voice, telephone, or couriered printed form. The degree of security classification is determined by the originating authority or office. Field army tactical teletypewriter equipment is habitually operated in conjunction with on-line cryptographic equipment.

5. Responsiveness. The extreme perishability of weather data and the requirements of the army in the field for round-the-clock observation and forecasting necessitate sole-user, full-period circuitry with instantaneous transmission-to-receipt responsiveness. Alternate command

posts will have this same weather communications responsiveness.

(*c*) *Special net requirements.* The WETM/CTOC will have the capability to simultaneously relay WETM/FATOC teletypewriter transmissions to the corps WETM/AFLD, to the corps FOC, to the WETM/DTOC, and to the division WETM/AFLD. Teletypewriter net control procedures are required to meet the stated teletypewriter conference capability requirements necessary to permit the transmission from one net terminal to all other net stations.

b. An analysis of communication terminal equipment at the various WSF weather units follows:

(1) Weather teams at major airfields:

(*a*) Send-receive teletypewriter (drop on sole-user, full period army-corps-division weather teletypewriter net).

(*b*) Common-user telephone with connections to airfield operations, to division command and staff, and to the WETM/DTOC).

(2) Weather team at division:

(*a*) Send-receive teletypewriter (sole-user, full period army-corps-division weather teletypewriter net).

(*b*) Receive-only facsimile (sole-user, full period army-corps-division weather facsimile net). Send-receive voice capability on this net during periods when facsimile charts are not being transmitted.

(*c*) Common-user telephone with connections to division command and staff, to division WETM/AFLD, and to WETM/CTOC.

(3) Weather team at corps TOC:

(*a*) Send-receive teletypewriter (drop on sole-user, full period army-corps-division weather teletypewriter net).

(*b*) Receive only facsimile (sole-user full period army-corps-division weather facsimile net). Also has send-receive voice capability on this net during periods when facsimile charts are not being transmitted.

(*c*) Common-user telephone connecting to corps command and staff, to WETM/FATOC, to WETM/DTOC, to corps and division WETM/AFLD, and to corps FOC.

(4) Weather team at field army tactical operations center:

(*a*) Send-receive teletypewriter (drop on sole-user, full period army-corps-division weather teletypewriter net).

(*b*) Send-receive facsimile (drop on sole-user, full period army-corps-division weather facsimile net). Also has send-receive voice capability on this net during periods when facsimile charts are not being transmitted.

(*c*) Common-user telephone with connections to army command and staff, to army WETM/AFLD, to army FOC, and to WETM/CTOC.

(5) Army and corps FOC:

(*a*) Receive only teletypewriter (drop on sole-user, full period army-corps-division weather teletypewriter net).

(*b*) Common-user telephone with connections to army and corps TOC respectively.

5–7. Specialized Weather Communication Below Division Level

a. The nets listed in paragraph 5–4, and depicted in figure 3–5, provide a dense surface and upper-air weather observational coverage over the army area. It can be expected that, even with this dense coverage, a need for special mission control forecasts will require the acquisition of weather observations obtained in forward division area or beyond the forward edge of the battle area (FEBA). This need normally will be fulfilled by WETM/OBS or WETM/UW deployed by the WETM/FATOC. Intelligence, aviation, or other organic army personnel in forward areas may be given the task of providing some weather observational data. The occasional surface weather observation (acquired outside the indicated weather nets) will be transmitted to the WETM/DTOC over any available communications channels; and from the WETM/DTOC to the WETM/FATOC, over the weather teletypewriter nets.

b. When special weather forecast data is required below division level, the unit intelligence section transmits these special requests for weather support through division G2 to the WETM/DTOC. The return communication channel from the WETM/DTOC to the requesting unit is also through the division G2.

c. Weather radar observations normally will be transmitted over existing weather teletypewriter nets. The number of weather radars in a field army will vary with the tactical situation and climatic region; consequently, the need for radar observations will vary. Air force supplied weather radars will be positioned by and under the direct supervision of the WETM/FATOC and will transmit radar weather observations over available army communications nets.

5–8. USAF Communications

a. In addition to the weather communications services described above, the WECEN must be supported with communications channels:

(1) Between the theater weather central and the WECEN for the exchange of digital weather messages.

(2) From the theater weather central to the WECEN for transmitting graphic/pictorial weather messages.

(3) Between the WECEN and weather reconnaissance aircraft for the exchange of weather messages or other operational messages related to the acquisition of weather information.

(4) From weather satellites to the WECEN and/or WETM/FATOC when specifically stated by these units.

b. The volume, speed, and degree of sophistication of communications service will be determined by the responsible communications agency upon analysis of weather requirements submitted by the WECEN and theater weather central.

5–9. Artillery Met Sections—WETM Link (fig 3–5)

For the exchange of meteorological data with AWS, the following provisions must be made:

a. Division artillery met sections will provide division artillery FDC with rawinsonde data in AWS form. This data will be transmitted by the division FDC to the division FSC in division TOC. The division FSCE will deliver these messages to the WETM/DTOC.

b. FATAB met sections will provide the corps artillery FDC with rawinsonde data in AWS form. This data will be transmitted by the corps artillery FDC to the corps FSCE, field artillery, artillery groups and nondivisional artillery units not under FA group control. The corps FSCE will deliver these messages to the WETM/CTOC.

5–10. Transmission of Weather Information to Aircraft

a. To aircraft in contact with airfield facilities, the tower or radar approach team broadcasts requested weather information over the appropriate channel. WETM requests for inflight weather reports are handled in a similar manner. Local security regulations will govern the use of this service.

b. To aircraft in contact with the FOC, routine weather may be broadcast over the air traffic regulation channel on a time schedule laid down by the army aviation officer. Normally, scheduled radio broadcasts of weather sequences will not be necessary because of the reduced distances and time involved for most flights within the army area. WETM requests for inflight weather reports will receive prompt attention.

c. Applicable weather warnings and other emergency weather information will be broadcast over all available facilities.

APPENDIX A

REFERENCES

1. Field Manuals (FM)

1–60	Army Air Traffic Operations.
3–8	Chemical Reference Handbook.
3–10	Employment of Chemical and Biological Agents. (NW 36–2/AFM 355–4/FMFM 11–3).
3–50	Chemical Smoke Generator Units and Smoke Operations.
5–1	Engineer Troop Organizations and Operations.
5–15	Field Fortifications.
5–20	Camouflage.
5–30	Engineer Intelligence.
6–15	Artillery Meteorology.
6–16	Tables for Artillery Meteorology.
21–76	Survival.
21–77A	(S) Joint Worldwide Evasion and Escape Manual (U).
30–5	Combat Intelligence.
30–10	Terrain Intelligence.
31–70	Basic Cold Weather Manual.
55–8	Transportation Intelligence.
61–100	The Division.
100–5	Operations of Army Forces in the Field.
100–10	Combat Service Support.
101–5	Staff Officer's Field Manual: Staff Organization and Procedure.

2. Technical Manuals (TM)

1–300	Meteorology for Army Aviation.
750–5–3	Meteorological Equipment Data Sheets.

3. Army Regulations (AR)

115–10	Meteorological Support for the U. S. Army (AFR 105–3).
115–12	U. S. Army Requirements for Air Weather Service.
310–25	Dictionary of United States Army Terms.
310–50	Authorized Abbreviations and Brevity Codes.

4. DA Pamphlets (DA Pam)

108–1	Index of Army Motion Pictures and Related Audio-Visual Aids.
310–1	Index of Administration Publications (Regulations, Circulars, Pamphlets, Posters, Joint Chiefs of Staff Publications, and General Orders).

APPENDIX B

TYPICAL EXTENDED PERIOD WEATHER FORECAST

EXTENDED PERIOD FORECAST CLYDESVILLE AND VICINITY VALID 01/0600Z TO 04/0600Z: 1 AUG: CEILING AND SKY CONDITION: 5000 FEET OVERCAST GRADUALLY LOWERING TO 1000 FEET OVERCAST BY SUNSET. VISIBILITY 5 MILES IN HAZE OCCASIONALLY LOWERING TO 2 MILES IN RAIN. WINDS NORTHEAST 3 TO 5 KNOTS. MIN TEMP RANGE 50 TO 60 DEG F, MAX 65 TO 75 DEG F. 2 AUG: CEILING AND SKY CONDITION: 500 TO 1000 FEET OVERCAST BECOMING 2000 FEET SCATTERED BY SUNSET. VISIBILITY 1 TO 2 MILES IN LIGHT RAIN AND FOG BECOMING 7 MILES BY NOON. WINDS NORTHEAST 5 TO 10 KNOTS BECOMING SOUTHWEST 10 TO 15 KNOTS BY MIDAFTERNOON. WARMER. MIN TEMP 55 TO 65 DEG F, MAX 70 TO 80 DEG F. 3 AUG: SKY CONDITION CLEAR, VISIBILITY 10 TO 15 MILES, WIND SOUTHWEST 15 KNOTS. LITTLE CHANGE MIN TEMP, MAX RANGE 75 TO 85 DEG F. LIGHT DATA: 1 AUG: BMNT 01/1151Z, EENT 02/0240Z. MOON: PHASE FULL, RISE 02/0230Z SET 02/1350Z. 2 AUG: BMNT 02/1152Z, EENT 03/0239Z. MOON: PHASE FULL, RISE 03/0320Z, SET 03/1440Z. 3 AUG: BMNT 03/1153Z, EENT 04/0238Z. MOON: PHASE FULL, RISE 04/0410Z, SET 04/1530Z. PLANNING WINDS FOR RADIOLOGICAL FALLOUT, HEIGHTS IN FEET, SPEED IN KNOTS. 0–12000 FEET SOUTH 10–20 KNOTS, 12000–24000 SOUTH TO SOUTHWEST 15 TO 30, 24000–36000 SOUTHWEST 20 TO 40, 36000–48000 SOUTHWEST 35 TO 55, 48000–60000 SOUTHWEST TO WEST 50 TO 70. 2 AUG: 0–12000 SOUTHWEST 15 TO 40.
12000–24000 SOUTHWEST 25 TO 55, 24000–36000 SOUTHWEST 40 TO 75, 36000–48000 SOUTHWEST TO WEST 30 TO 40, 48000–60000 SOUTHWEST TO WEST 25 TO 35. 3 AUG: 0–12000 WEST TO NORTHWEST 20 TO 30, 12000–24000 WEST TO SOUTHWEST 35 TO 50, 24000–36000 WEST TO SOUTHWEST 50 TO 80, 36000–48000 WEST 25 TO 35, 48000–60000 WEST 20 TO 30.

APPENDIX C

EXAMPLE OF CLIMATIC SUMMARY

CLIMATIC SUMMARY FOR THE MONTH OF JULY—3d CORPS AREA

1. GENERAL CIRCULATION

Generally air flows from the west and northwest. Occasionally warm, dry continental air from Russia causes a relatively intense, dry heat with temperature 90° or more.

2. TEMPERATURES

Afternoon temperatures generally are in the 70's and morning temperatures are in the 50's. There are occasional periods of hot, dry spells that last more than a week with temperatures in the 90's.

The highest temperature ever recorded was 101 ° F.

3. THUNDERSTORMS

Occur frequently. They usually develop during the day and reach maximum intensity in the late afternoon and evening.

4. SURFACE WINDS

Average windspeed is 5 MPH. The most predominant direction is northeast, with a mean speed of 8 MPH. Calms are frequent, occuring 25.2 percent of the time, and usually in the early morning. Calms or near calms often last the whole day.

5. CLOUDINESS

Mornings frequently are clear. Clouds develop by noon and cloud cover reaches a maximum in the late afternoon, decreasing to nil just before sunset.

6. VISIBILITY

Normal visibilities are 7 to 13 miles and occasionally further. Occasionally haze may reduce visibility to about 3 miles.

7. PRECIPITATION

Thunderstorms are the usual cause of precipitation. Occasionally a southwesterly wind will cause continued drizzle and low, overcast skies for one to three days. This is the only time low visibilities occur. Occasional haze may reduce visibility to about 3 miles.

	*June	Jul	Aug	Annual	Years recorded
Mean precipitation (inches)	2.56	2.48	2.36	26.97	40
Mean number of days with thunderstorm	4	4	3	18	11
Temperature (°F.)					
Absolute max	95	101	97		40
Absolute min	50	43	43		40
Mean daily max	71	74	73		40
Mean daily min	51	55	53		40
Mean number of days with fog	2	2	4	57	11

Percentage frequency of surface winds by direction and average windspeeds in knots for the month of July

	*S	SSW	SW	WSW	W	WNW	NW	NNW
Percentage frequency of direction	2.1	2.0	8.6	1.0	0.7	0.3	0.4	0.0
Average speed by direction	5.6	9.4	8.8	7.6	6.8	8.3	3.2	0.0
	N	NNE	NE	ENE	E	ESE	SE	SSE
Percentage frequency of direction	1.2	2.1	19.5	10.5	12.2	2.7	9.6	1.0
Average speed by direction	5.0	6.3	8.4	10.0	7.1	6.6	6.0	4.0

APPENDIX D

EXAMPLE OF AN ANALYSIS OF THE AREA OF OPERATIONS

(CLASSIFICATION)

(See FM 30–5 for Details)

Issuing section and headquarters
Place
Date and time

ANALYSIS OF AREA OF OPERATIONS NO. _____

Reference: Maps, charts or other appropriate documents

1. PURPOSE AND LIMITING CONSIDERATIONS

a. Purpose. Include delineation of the area being studied.

b. Limiting considerations. Include a statement of the mission of the command and other considerations which limit the application of the study, such as a time limitation, the commander's plan of action, and enemy capabilities.

2. GENERAL DESCRIPTION OF THE AREA

This paragraph is a listing of facts, pertinent to the purpose and limiting considerations of the study, for use as a basis for the succeeding paragraphs.

a. Climatic or weather conditions. List or refer to other documents containing, for the period under study, meteorological conditions, to include precipitation, fog, cloud conditions, temperature, relative humidity, surface winds, effective winds (or winds aloft), atmospheric pressure, light data to include moon phases, moonrise and moonset, beginning and end of nautical and civil twilights, and other geodetic data as appropriate. When appropriate, include magnetic phenomena.

b. Terrain. Make maximum use of specially colored maps or overlaps to illustrate each of the characteristics below and the effect of predicted weather conditions upon them. Under each characteristic include those facts which will assist in subsequent determination of the effects of the characteristic on the use of nuclear weapons, chemical and biological agents, important devices and equipment used in implementing courses of action. (Do not include in this paragraph the interpretation of these effects on possible friendly or enemy courses of action.)

(1) Relief and drainage system. Configuration of the ground, including slopes for personnel and vehicles and critical relief for equipment dependent on line-of-site. Configuration and condition of streams, including depth, slope, and condition of banks and bottom, and location of crossing sites.

(2) Vegetation. Wooded areas, including location of trees, diameter of trunks, density, crown cover, undergrowth. Types of natural and cultivated vegetation of nonwooded areas.

(3) Surface materials. Type and distribution of soils and subsoils in the area and soil trafficability. Soil content as affects induced radiation.

(4) Manmade features. Manmade changes in the topography, including roads, railroads, bridges, tunnels, mines, towns, industrial areas, and fortifications. Include type of construction.

c. Additional characteristics.

3. MILITARY ASPECTS OF THE AREA

a. Tactical aspects.

(1) Observation and fire.

(2) Concealment and cover.

(3) Obstacles. Indicate graphically or describe all natural and artificial obstacles and the influence of relief, weather, vegetation, surface materials, and manmade features. Include effects, as appropriate, of and on nuclear fires, chemical and biological agents and effects on trafficability and accessibility. If of significant influence, the effect of each obstacle on possible friendly and enemy courses is indicated. Obstacles and trafficability influence site locations for administrative support units.

(4) Key terrain features. Based on the analysis of observation and fire, concealment and cover, obstacles, and the mission, select the key terrain features. Consider any locality or area the seizure, retention, or control of which affords a marked advantage to either force. Briefly discuss in turn the influence of each key terrain feature listed. Discussion is oriented towards subsequent development of friendly and enemy courses of action. Revise, as required by the commander's decision and current situation. This discussion may be omitted when the enemy has no capability to seize or control terrain features which will materially affect the accomplishment of the mission.

(5) Avenues of approach.

b. Administrative support aspects.

(1) Personnel management:

(2) Logistics:

(3) Civil Affairs:

4. EFFECTS OF CHARACTERISTICS OF THE AREA

a. Effect on enemy courses of action.

b. Effect on our courses of action.

APPENDIX E

SAMPLE ENGINEER INTELLIGENCE SUMMARY

(CLASSIFICATION)

Copy No. 1
319th Engr Bn
APO 416 U.S. Army
021200 Feb 1951
Message Reference
Number 7

Annex B (Engineer Intelligence) to OpnO 7

References: Map, KOREA, 1: 250,000, SEOUL Sheet (NJ 52–9)

1. Purpose

This study covers the possible crossing sites on the HAN RIVER within the division boundaries. The area considered extends along the HAN RIVER from the 40th to the 55th vertical grid line.

2. General Description of Area.

a. Weather. The weather during the month of February is generally cold and clear. Temperatures are always below freezing at night, but may rise above freezing in the daytime. Precipitation is rare, and cloud cover is rarely over 25 percent. Sufficient moonlight for good visibility can be expected from 15 February to 23 February. (See inclosed sun and moon table.)

b. General Terrain. The terrain limits the choice of crossing sites. Between the 44th and 48th vertical grid line and from the 52d vertical grid line to the division right boundary, mountains border the river and render it inaccessible to anything but foot troops. Elsewhere, wide river valleys open onto the HAN VALLEY from the south. These valleys are low and flat and generally covered with rice paddies. At this season, they are sufficiently frozen to support tracked vehicles. Three usable roads approach the HAN RIVER from the south. A two-lane, all-weather road runs along the north bank of the river and a one-lane, dry-weather road runs up the PUKHAN VALLEY. (See overlay for road network.)

APPENDIX F

TYPICAL FORMAT FOR AN INTELLIGENCE SUMMARY

(See FM 30–5 for details)

NOTE: Omit items not applicable unless otherwise indicated.

1. ISSUING UNIT. (Always Included)
2. TIME AND DATE OF ISSUE. (Always Included)
3. SUMMARY OF ENEMY ACTIVITY FOR PERIOD.
   a. Ground activity.
   b. Trace of forward elements.
   c. Potential targets for nuclear weapons.
   d. Air activity.
   e. Nuclear activity.
   f. Other (new tactics, counterintelligence, etc.).
4. PERSONNEL AND EQUIPMENT LOSSES.
   a. Personnel (KIA, WIA).
   b. Prisoners of war.
   c. Equipment destroyed or captured.
5. NEW OBSTACLES AND BARRIERS.
6. ADMINISTRATIVE ACTIVITIES.
7. NEW IDENTIFICATIONS.
   a. Units.
   b. Personalities.
8. ENEMY MOVEMENTS.
9. ESTIMATED NUMBER AND TYPES OF VEHICLES.
10. WEATHER AND TERRAIN CONDITIONS.
11. BRIEF DISCUSSION OF CAPABILITIES AND VULNERABILITIES (ALWAYS INCLUDED).
12. CONCLUSIONS (ALWAYS INCLUDED).

APPENDIX G

INTELLIGENCE ESTIMATE, CORPS

(CLASSIFICATION)
(See FM 101–5 for details)

G2 Section, 1st Corps
OLIVIO (0256), KURTANIA
101200 August 1960

INTELLIGENCE ESTIMATE NO. 88

Reference: Maps, KURTANIA, 1:250,000, BONNOTI-LESLETA Sheets T–3. . .

1. MISSION
   a. Defend the area, SEIRATA (4801) . . . . . all points inclusive. Prepare to continue the attack towards . . . on army order.
2. THE AREA OF OPERATIONS
   a. Weather.

(1) Existing situation. During the period 10 to 20 August, weather will be clear except for scattered occasional showers. Visibility . . . . Winds aloft for yields of tactical interest are usually about 15 knots from the west. Atmospheric pressure will average about 980 millibars. Temperature will range from about 57° to 90° F. New moon: 10 Aug.

	Light Data					
	BMNT	BMCT	EECT	EENT	MOONRISE	MOONSET
10 Aug	0402	0443	2007	2051	New Moon	2223
*	*	*	*	*	*	*
20 Aug	0420	0458	1948	2028	1815	0210

(2) Effect on enemy courses of action. Weather, except during showers, gives Aggressor excellent observation in the defense or attack. An attack during the period will have good cross-country trafficability. Cross-country trafficability, and observation will be only slightly restricted by moderate showers. Winds do not favor Aggressor use of smoke, toxic chemicals, or fallout. Weather favors Aggressor use of nuclear weapons and his air and airmobile operations.

(3) Effect on our course of action. The weather favors the defense. Fair weather favors exploitation of our armor, artillery, and air power, and use of nuclear weapons. Surface winds aloft favor our use of smoke, toxic chemicals, and fallout.

   b. Terrain.

(1) Existing situation.

(a) Observation and fire. There are few good observation points, except along***. Smoke from forest fires caused by nuclear weapons is likely to***. Fields of fire throughout the area for flat trajectory weapons range from excellent to poor, being limited by***.

(b) Concealment and cover. Good concealment is afforded by the wooded areas. Some concealment and cover are available in***. The numerous deep ravines and folds in the . . . .

APPENDIX H

INTELLIGENCE ESTIMATE, CONTENT AND FORMAT

(CLASSIFICATION)

(See FM 30-5 for details)

Issuing section and headquarters [1]
Place
Date and Time

INTELLIGENCE ESTIMATE NO.——[2]

Reference: Maps of charts or other documents.

1. MISSION: State the assigned or assumed mission.

2. THE AREAS OF OPERATIONS.

This paragraph discusses the influence of the area of operations used in arriving at conclusions. This paragraph is based on the facts and conclusions of the analysis of the area of operations if one has been prepared. Effects on our courses of action may be omitted if adequately covered in a current analysis of the area of operations.

a. Weather.

(1) Existing situation. Includes light data and either a weather forecast or climatic information as appropriate. Use appendixes for detailed information.

(2) Effect on enemy courses of action. Discuss the effects of weather on each enemy broad course of action. Each discussion concludes with a summary statement as to whether the course of action is favored or not by the weather. Among the courses of action include use of nuclear weapons, chemical and biological agents, special methods, techniques, equipment, procedures, or forces. For example, use of airborne, airmobile forces, surveillance devices, communications, electronic warfare, tactical cover and deception, significant effect on personnel management, logistical support, and civil affairs operations.

(3) Effect on our courses of action. Discuss each major course of action to accomplish the mission in the same manner as for enemy courses of action above.

b. Terrain.

(1) Existing situation. Use graphic representations where possible. Use annexes for detailed material. Include as much information as necessary for an understanding of observation and fire, concealment and cover, obstacles, key terrain features, avenues of approach and include effects of and on each, as appropriate, of nuclear fires, biological and chemical agents, etc.

(2) Effect on enemy courses of action. Discuss in the same manner as for the effects of weather in paragraph 2*a*(2) in this ap-

[1] If distributed outside the headquarters, the first line of the heading is official designation of the issuing command and the ending modified accordingly.

[2] Numbered successively in each calendar year.

pendix. For defense courses of action, give the best defense area and the best enemy avenues of approach leading to the best defense area. For attack courses of action, give the best friendly avenues of approach to the objective area.

(3) Effect on our courses of action. Discuss in the same manner as for effects of terrain on enemy courses of action.

c. Other characteristics. The following additional characteristics are considered, as pertinent, in separate subparagraphs: sociology, politics, economics, psychology, and other factors. Other factors may include such items as science, material, transportation, manpower, and hydrography. They are analyzed under the same headings as weather and terrain.

3. ENEMY SITUATION.

4. ENEMY CAPABILITIES.

5. CONCLUSIONS.

APPENDIX I

OUTLINE FOR TERRAIN STUDIES

(See FM 30–10 for details)

1. PURPOSE AND LIMITING CONSIDERATIONS.

State the purpose and limiting considerations under which the study is being prepared. This statement should include the scope of the study in area, time, and subject matter, and any information on the tactical situation mission, or method of operations that is pertinent to the study.

2. GENERAL DESCRIPTION OF THE TERRAIN

a. *Synopsis.* State briefly the impact of the terrain on military operations.

b. *Climatic Conditions.* Describe expected meteorological conditions for the period, based on climatic data. Present climatic data graphically whenever possible. The requirements of the study will determine the exact information presented and the manner of presentation.

(1) Temperature. Climatic data—give frequency of occurrence of temperatures during period.

(2) Precipitation. Climatic data—state frequency of occurrence of precipitation by type and amount.

(3) Winds. Climatic data—give frequency of occurrence of winds of certain velocities and direction. Use wind rose.

(4) Visibility. Present graphically data on times of sunrise, sunset, twilight, moonrise, and moonset. Describe effect of fogs, mist, haze, and other influences on visibility. State expected visibility by distance when applicable.

(5) Cloudiness. Describe when applicable and separate from precipitation and visibility. Climatic data—give data of frequency of occurrence and time of occurrence of various cloud conditions.

(6) Humidity. Describe only when significant. Describe effect when combined with other weather elements, such as oppressive heat or wind chill.

(7) Electrical disturbances. Describe only when significant.

c. *Topography.* Describe pertinent characteristics.

d. *Coastal Hydrography.* Describe when applicable.

3. MILITARY ASPECTS OF TERRAIN

a. *Tactical aspects of terrain.*

b. *Engineering aspects of the terrain.*

GLOSSARY

Section I. ABBREVIATIONS

AFCS—Air Force Communication Service.
AWS—Air weather service.
CTOC—Corps tactical operations center.
DTOC—Division tactical operations center.
FATAB—Field artillery target acquisition battalion.
FATOC—Field army tactical operation center.
FDC—Fire direction center.
FEBA—Forward edge of the battle area.
FOC—Flight operations center.
FSCE—Fire support coordination element.
INTSUM—Intelligence summary.
IR—Infrared.
MCF—Mission control forecast.
MET—Meteorology.
MSL—Mean sea level.
NIS—National intelligence survey.
PIREPS—Pilot (aviator) weather reports.
RS—Receiving state.
TOC—Tactical operations center.
WETM—Air weather service team.
WSF—Weather support force.

Section II. DEFINITION OF UNUSUAL TERMS

Active Front—A front which produces appreciable cloudiness and precipitation.
Advection—The process of transport of an atmospheric property solely by the mass motion of the atmosphere, normally in the horizontal direction.
Air Mass—An extensive body of air within which the conditions of temperature and moisture in a horizontal plane are relatively uniform.
Ambient Temperature—The temperature of the immediate surrounding medium, such as gas or liquid.
Anemometer—The general name for instruments designed to measure the speed or force of the wind.
Aneroid—Literally, *not wet*, containing no liquid; applied to a kind of barometer which contains no liquid, and aneroid barometer.
Anvil Cloud—The popular name of a heavy cumulus or cumulonimbus cloud having an anvil-like formation of cirrus clouds in its upper portions. If a thunderstorm is seen from the side, the anvil form of the cloud mass is usually noticeable.
Arctic Front—The zone of discontinuity between the extremely cold air of the Arctic regions and the cool polar air of the North Temperate Zone.
Back—To change or shift in a counterclockwise direction (to the left of the moving mass); applied to the wind when it so changes; for example, from the north to northwest. Opposite to *veer*, which signifies a clockwise change. In scientific practices, this definition applies to both hemispheres.
Ballistic Meteorology—The study dealing with the effects of atmospheric phenomena on the motion of a projectile.
Barometer—An instrument for measuring atmospheric pressure.
Blizzard—A strong intensely cold wind laden with snow.
BMCT—Beginning morning civil twilight. The instant the center of the sun is 12 degrees below the horizon.
Buildup—A cloud with considerable vertical development.
Buys-Ballot's Law—A law formulated by a Dutch meteorologist in 1857 stating—if you stand with your back to the wind, pressure is lower on your left than on your right in the northern hemisphere, and the reverse in the southern hemisphere.
Ceiling—The height ascribed to the lowest layer of clouds or obscuring phenomena reported as broken, overcast, or obscured and not classified as thin or partial.
Celestial Dome—That portion of the sky which is visible in all directions of the horizon from the point of observation.
Celsius Temperature Scale—Same as centigrade

temperature scale, by recent convention. The Ninth General Conference on Weights and Measures (1948) replaced the designation "degree centigrade" by "degree Celsius".

Centigrade Temperature Scale—A temperature scale with the ice point at 0 degrees and the boiling point of water at 100 degrees.

Chinook—See Foehn.

Cirrus—A principal cloud type composed of detached cirriform elements (mostly ice crystals fairly widely dispersed) in the form of white, delicate filaments, of white (or mostly white) patches, or of narrow bands.

Civil Twilight—The interval of time between the instant the upper edge of the sun's disk appears on the horizon and the center of the sun is 6 degrees below the horizon. Civil twilight affords sufficient light to carry on normal day activities.

Climatological Information—That information which deals with average weather conditions and variations from normal, for a particular place or area, during a specified period of the year.

Cloud Amount—The portion of the sky, usually expressed in eighths, covered by a particular cloud type.

Cloud Bank—A mass of clouds, sometimes of considerable vertical extent, stretching across the sky on the horizon but not extending overhead.

Cloudburst—A sudden and extremely heavy downpour of rain; associated with thunderstorms and strong convective activity.

Condensation—In meteorology, the physical process by which water vapor is changed to liquid water.

Condensation Nuclei—A minute particle, either liquid or solid, upon which condensation of water vapor begins in the atmosphere.

Conduction—The transfer of energy within a conductor by means of internal molecular activity, and without any net external motion.

Convection—Although frequently used in physics to denote a complete atmospheric current, in meteorology convection refers to localized vertical air motions. The horizontal air movement that completes an air current is called *Advection.*

Coriolis Force—An apparent force which causes horizontally moving particles to be deflected to the right in the northern hemisphere and to the left in the southern hemisphere.

Cumuliform—"Cumulus-like," general term for all clouds which have vertical development in the form of rising mounds, domes, or towers (contrasting to stratiform).

Cyclone—An area of low pressure that has counterclockwise closed circulation about it in the northern hemisphere, and a clockwise circulation in the southern hemisphere.

Deepening—The decreasing of pressure in the center of a low pressure system.

Density—The amount of mass per unit volume of any substance (pound per cubic foot, gram per cubic centimeter, kilogram per cubic meter, etc.). Heating causes a substance to expand, thereby reducing the number of molecules that can be contained by a fixed volume and decreasing density. Cooling increases the density of a substance. The density of a gaseous medium is particularly sensitive to changes in temperature (and pressure). The weight of an equal volume of a substance varies directly with its density.

Depression—A cyclonic (low pressure) area, with winds less than hurricane force.

Dewpoint—The temperature to which the air must be cooled, at constant pressure and constant water vapor content, in order for saturation to occur.

Discomfort Index (DI)—The temperature-humidity index, specified by the U.S. Weather Bureau, used to report the relative discomfort due to heat.

Discontinuity—The term applied in a special sense by meteorologists to a zone within which there is a comparatively rapid and abrupt transition of the meteorological elements from one value to another.

Diurnal—Variation of actions which tend to recur in a cycle through every 24 hours.

EECT—End evening civil twilight. The instant the center of the sun is 6 degrees below the horizon.

EENT—End evening nautical twilight. The instant the center of the sun is 12 degrees below the horizon.

Effective Temperature—In ballistic meteorology, the temperature used in computing corrections for sound ranging, the sonic temperature.

Equinox—The moment, occurring twice each year, when the sun, in its apparent annual motion among the fixed stars crosses the celestial equator; so called because then the night is equal to the day, each being 12 hours long over the whole earth. The autumnal equinox occurs on or about September 22, when the sun is traveling southward; the vernal equinox on or about March 21, when the sun is moving northward.

Evaporation—The physical process by which liquid water is changed to water vapor.

Fallout—The descent to the ground of dust and

other debris raised to, or produced at, great heights in the atmosphere by a violent explosion.

Filling—The increasing of pressure in the center of a low pressure system; the opposite of *Deepening*.

Foehn—A warm, dry wind on the lee side of a mountain range, the warmth and dryness of the air being due to adiabatic compression upon descending the mountain slopes. The foehn is characteristic of nearly all mountain areas and has a variety of local names; for example, Chinook in the Rocky Mountains.

Frontogenesis—The process which creates or recreates a front in areas where air mass discontinuities are intensifying.

Frontolysis—The process by which a front weakens or dissipates as the density of air masses change or the wind field changes.

Fronts—In general, a transition zone between air masses of different densities.

Gradient—1. The rate of increase or decrease in magnitude with distance, such as a pressure or temperature gradient. When a horizontal pressure gradient exists, the direct force exerted by the area of higher pressure is called the pressure gradient force.

2. When used to describe a wind (gradient wind), gradient refers to winds above the influence of terrestrial friction—normally above 2,000 feet—where only pressure gradient force is affecting the speed of the wind.

Greenhouse Effect—This term is derived from the effect of the glass roof on a greenhouse which transmits high-frequency, short-wave solar radiation, but blocks the passage of terrestrial radiation from within the glass enclosure. The greenhouse effect caused by clouds and impurities in the atmosphere is most noticeable at night when they reduce the nocturnal cooling of the earth.

Heat of Fusion—The heat released by a fluid when it changes from liquid to solid.

Hydrometeors—Weather phenomena which arise from modifications in the conditions of the water vapor in the atmosphere. These phenomena may occur in the form of precipitation (rain, drizzle, snow, hail), as particles more or less suspended in the atmosphere (fog, mist), as particles raised by the wind (drifting or flowing snow, spray) or as deposits (dew, hoarfrost, rime, glaze).

Intertropical Front—The boundary between the trade wind systems of the northern and southern hemispheres. In some areas it appears as a broad zone of transition commonly known as the doldrums; in other places, as a fairly sharp shift in winds.

Inversion—A layer of atmosphere where the temperature increases rather than decreases with height.

Isobar—A line of constant pressure.

Isobaric—Of equal or constant pressure.

Isotherm—A line of constant temperature.

Isothermal—Of equal or constant temperature.

Jet Stream—Arbitrarily defined as narrow bands of high-velocity winds, above 50 knots, that are usually embedded in the prevailing wind circulation—in the case of the polar-front jet stream, the prevailing westerlies. The axis of the high velocity must generally have a length of approximately 300 nautical miles to be considered as a jet stream.

Katabatic Wind—Any wind blowing down an incline.

Kelvin Scale (°*K.*)—An absolute temperature scale with an ice point of 273.16° and a boiling point of 373.16° K. This is a modification of the centigrade temperature scale to eliminate negative, below zero, readings. Absolute zero is 0° K, the equivalent of −273.16° C.

Lapse Rate—The rate of decrease of an atmospheric variable with height, the variable being temperature unless otherwise specified; for example, 2 degrees C per 1,000 feet in the standard atmosphere.

Lithometers—Weather phenomena consisting of particles most of which are solid and nonaqueous. The particles may be more or less suspended in the air (haze, dust haze, smoke) or may be lifted from the ground by the wind (drifting and blowing dust or sand, dust storm or sandstorm, dust whirl or sand whirl).

Low Level Winds—Winds in the friction layer of the atmosphere.

Macrometeorology—The study of the largest-scale aspects of the atmosphere such as the general circulation and weather types.

Mean Sea Level—The average height of the sea surface, based upon hourly observation of tide height on the open coast or in adjacent waters which have free access to the sea.

Meteorology—The science of the earth's atmosphere.

Met Section—Refers to artillery meteorological sections.

Micrometeorology—The study of variations in meteorological conditions in the lower layers of the atmosphere and over very small areas, such

as hillsides, forests, river basins, or individual cities.

Millibar (mb)—A unit of pressure, convenient for measuring atmospheric pressure, which is equal to a force of 1000 dynes per square centimeter.

Mobile Weather Radar Team—The weather team located as directed by the WECEN to provide weather radar observations.

Mobile Weather Satellite Readout Team—When this team is deployed in the army, it will provide a weather satellite readout capability to the weather center.

Monsoon—Seasonal wind systems which reverse their prevailing direction and usually cause significant weather changes.

Nautical Twilight—The interval of time between the instant the center of the sun's disk is 6 degrees below the horizon and the instant the center of the sun is 12 degrees below the horizon. Nautical twilight provides enough illumination to carry on most types of ground movement without difficulty and approaches conditions expected under full light of day.

Occlusion—A line along which a cold front has overtaken a warm front.

Orographic Lifting—The lifting of an air current caused by its passage up and over mountains.

Pilot Balloon—A small balloon whose ascent is followed by a theodolite in order to obtain data for the computation of the speed and direction of winds in the upper air. Such observations are called *pibals*.

Polar Easterlies—The dominant wind system which exists in polar regions.

Precipitation—A form of water, either liquid or solid, that falls from the atmosphere and reaches the ground.

Pressure Gradient Force—The force due to pressure differences within a fluid mass.

Prevailing Westerlies—The dominant wind system of the atmosphere which occurs in middle latitudes of both hemispheres.

Prognostic Chart—A chart showing, principally, the expected pressure pattern of a given synoptic chart at a specified future time.

Psychrometer (Sling)—An instrument consisting of a wet and a dry-bulb thermometer used for determining the water vapor content of the atmosphere.

Radiation—The process by which electromagnetic energy is propagated through free space.

Radioactive Fallout—The fall to the earth of radioactive debris resulting from an atomic or nuclear explosion. Radioactive fallout.

Radiosonde—A balloon-borne instrument for simultaneous measurement and transmission of meteorological data.

Rawin—A method of winds aloft observation; that is, the determination of windspeed and direction in the atmosphere above the station. Stands for *Ra*dio *Wind* when the measurement is made by tracking a balloon-borne transmitter by radio-direction finding equipment; and for *Ra*dar *Wind* when a balloon-borne radar target is tracked by radar.

Rawinsonde—A method of upper air observation consisting of the evaluation of winds, temperature, pressure, and relative humidity aloft by means of a balloon-borne radiosonde tracked by a radio-direction finder.

Relative Humidity—The ratio of the actual vapor pressure of the air to the saturation vapor pressure, usually expressed in percent.

Saturated Adiabatic Lapse Rate—A rate of temperature decrease with height, equal to the rate at which an ascending body of saturated air will cool during adiabatic expansion. It varies inversely with the air temperature. The average value generally used is 1.5 degrees C per 1,000 feet.

Sea Level Pressure—Station pressure reduced by a formula to what it presumably would be at sea-level.

Secondary Circulation—In this wind classification category, many authorities include only migratory anticyclones and cyclones. Such wind patterns as land and sea breezes, mountain and valley breezes, eddies, and foehn winds are then classified as local winds.

Secondary Cyclone—A small area of low pressure on the border of a large (primary) area. The secondary low may develop into a vigorous cyclone while the primary center disappears.

Significant Level—A level in the atmosphere usually selected as the result of a change in the rate of change of temperature or humidity with height. The location of the points of evaluation of the radiosonde record.

Sky Cover—The portion of the sky, usually expressed in eights, covered by all clouds and obscurations.

Sonic Temperature—The temperature used in computing corrections for sound ranging, the effective temperature.

Sound Ranging (Sound Locating)—The method of locating the source of a sound, such as that of a gun report or a shell burst, by calculations based on the intervals between the reception of the sound at various previously oriented microphone stations.

Sounding Balloon—A free, unmanned balloon with instruments attached for sounding the upper air.

Source Region—An extensive portion of the earth's surface where overlying air masses acquire characteristics, properties of temperature and moisture.

Spread (Slang For Temperature-Dewpoint Spread)—The difference between the temperature of the air and the dewpoint of the air, expressed in degrees. Although there is a definite relationship between spread and relative humidity, a spread of 5° F. between 90° F. and 85° F. indicates a significantly different relative humidity from the same spread between 65° F. and 60° F.

Squall Line—A line of thunderstorms, generally associated with fast moving cold fronts. The line usually forms parallel to the front and 50 to 300 miles ahead of it. This band of thunderstorms is very similar to a cold front line of thunderstorms but are often more violent.

Station Elevation—The vertical distance above mean sea level that is adopted as the reference datum level for all current measurements of atmospheric pressure at the station.

Station Pressure—Surface pressure measured at the observing station. The atmospheric pressure computed for the level of the station elevation.

Stratiform—Description of clouds of extensive horizontal development, as contrasted to the vertically developed cumuliform types.

Stratopause—The top of the stratosphere.

Stratosphere—The layer of atmosphere, next above the tropopause, between the troposphere and mesosphere.

Subsidence Inversion—An inversion layer which usually forms near a center of high pressure where the entire column of air is descending (subsiding) toward the surface. As this air layer descends, it is compressed and warmed adiabatically. The resulting increase in temperature with height through the layer is a subsidence inversion. Haze layers often develop below these inversion layers.

Supercooled—The reduction of temperature of any liquid below the melting point of that substance's solid phase; that is, cooled beyond its normal freezing point.

Surface Wind—The windspeed and direction as measured at the surface observing station (measured approximately 12 feet above the surface) with an anemometer.

Synoptic Weather—Refers to the use of meteorological data obtained simultaneously over an extensive area for the purpose of presenting a comprehensive picture of the state of the atmosphere.

SWO (Unit)—Staff weather office to army and air force units down to and including squadron and army division level. Identify the unit as closely as possible; that is, SWO 82 ABN DIV, SWO ( ) ABN DIV, or SWO ( ) DIV.

Topography—Generally, the disposition and shape of the major natural and manmade physical features on the earth's surface.

Trade Winds—The wind system, occupying most of the tropics, which blows from the subtropical highs toward the equatorial trough.

Trajectory (ballistic)—The path of a projectile in the earth's atmosphere.

Tropopause—The top of the troposphere.

Troposphere—The lower layer of the atmosphere from the earth's surface to the tropopause (10 to 20 km) in which the average condition is typified by a decrease of temperature with increasing altitude.

True North—The direction from any point on the earth's surface toward the geographic North Pole.

Turbulence—Irregular eddy-like motion of the atmosphere, which defies analytical representation, such as when air flows over uneven surfaces of the earth.

Virtual Temperature—In a system of moist air, the temperature of dry air having the same density and pressure as the moist air. The virtual temperature is always greater than the actual temperature.

Weather Forecast—A prediction of weather conditions at a point, along a route, or within an area, for a specific period of time.

Weather Information—Information concerning the state of the atmosphere, mainly with respect to its effects upon the military. Data and information concerned with forecasts, summaries, and climatology.

Weather Intelligence—An analysis of the effect of weather on the plans and operations of both the friendly and enemy forces.

Weather Support Force (WSF)—The AWS organization providing joint weather support to the army and air force in the field. The WSF may contain the following components: WECEN, WETM/FATOC, WETM/CTOC, WETM/DTOC, WETM/AFLD, WETM/OBS WETM/RAWIN, Mobile Weather Satellite Readout Team, and WETM/UW

WECEN—The weather center at army

group/numbered air force or joint task force headquarters. This is the center of the WSF system. Normally, it is the only independent forecast-producing agency within the WSF. This center prepares and issues forecasts on a scheduled basis to best meet the general needs of WSF elements and provides special forecasts as required in support of specific operations. This center must be an integral part of the command headquarters positioned with to have necessary unit integrity, provide direct support, and have access to command communications.

Weighting Factors—The factors used in weighing the effects of metro conditions in each artillery zone.

Wet-Bulb Depression—The difference in degrees between the dry-bulb temperature and the wet-bulb temperature.

WETM/AFLD—Airfield weather support team. This team provides surface observing and briefing support at key army airfields and at airfields where direct briefing support is required.

WETM/CTOC—The weather team at a corps TOC. This team depends on planning and mission control forecasts from the WECEN and uses these forecasts to brief TOC and subordinate elements. They maintain a continuous meteorological watch on the TOC area of responsibility including enemy territory and provide trend forecasts as required by the TOC and FOC for operations in progress. They may assume FOC weather support responsibilities.

WETM/DTOC—The weather team at a division TOC. This WETM performs functions similar to those of the CTOC, but on the smaller division scale.

WETM/FATOC—The weather team located at army headquarters. This tactical weather facility provides weather service to the army in the field, including its components and support organizations.

WETM/OBS—Surface observing team. This team is used at airfields where full WETM/AFLD is not required and at other locations as required by WECEN. These teams must be manned by personnel trained to survive under field conditions and to operate with army forces. They acquire surface and low level weather observations.

WETM/RAWIN—Rawinsonde observing team. This team is capable of providing upper air (rawinsonde) and surface observations for sustained periods under mobile field conditions. They are used when there is a scarcity of upper air data in the planned area of operations, usually as a follow-on of initial support.

WETM/UW—The unconventional warfare detachment weather support team. This team normally is attached to a Special Forces Group and will provide direct support to UW operations. Personnel will normally be airborne and UW qualified.

Wind Chill—That part of the total cooling rate of a body caused by air motion (wind).

Wind Shear—The rate of change of wind velocity (speed and/or direction) with distance. Eddies and gusts form in areas of wind shear, thus producing turbulent flying conditions. Wind shear may occur in either the vertical or horizontal plane.

Wind Velocity—The speed of the wind associated with its direction (as a vector).

INDEX

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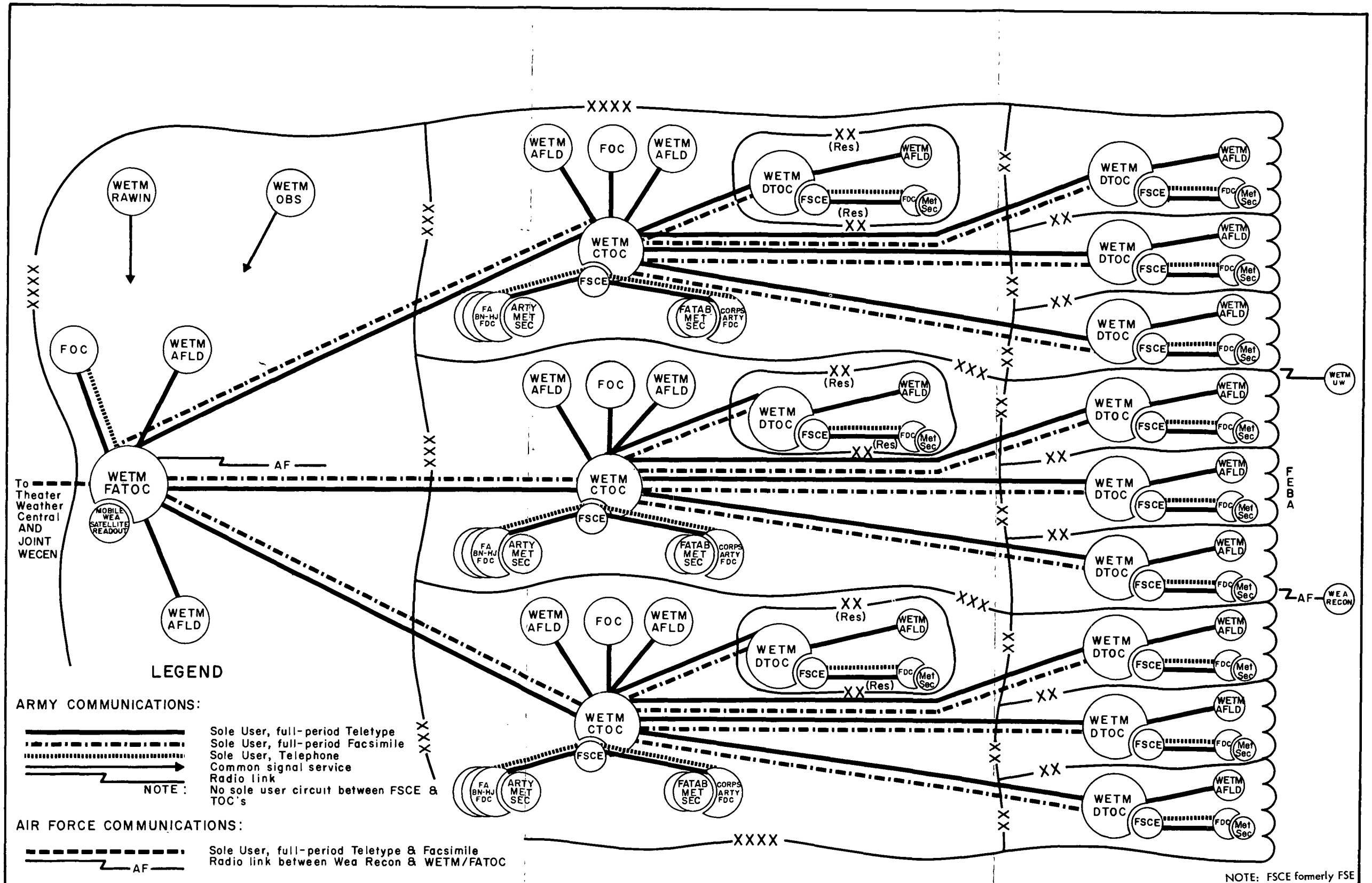


Figure 3–5. Typical weather support communications.

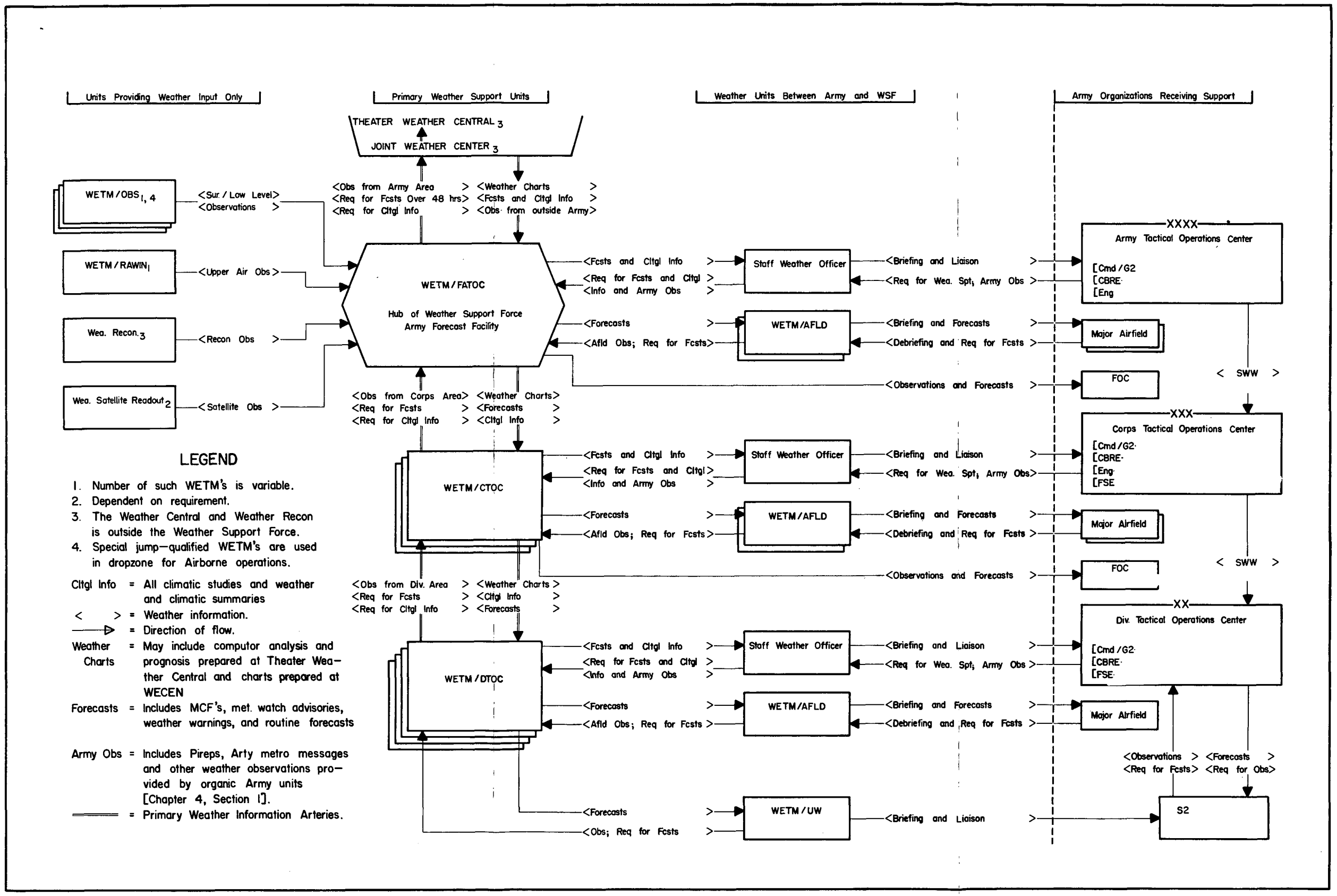
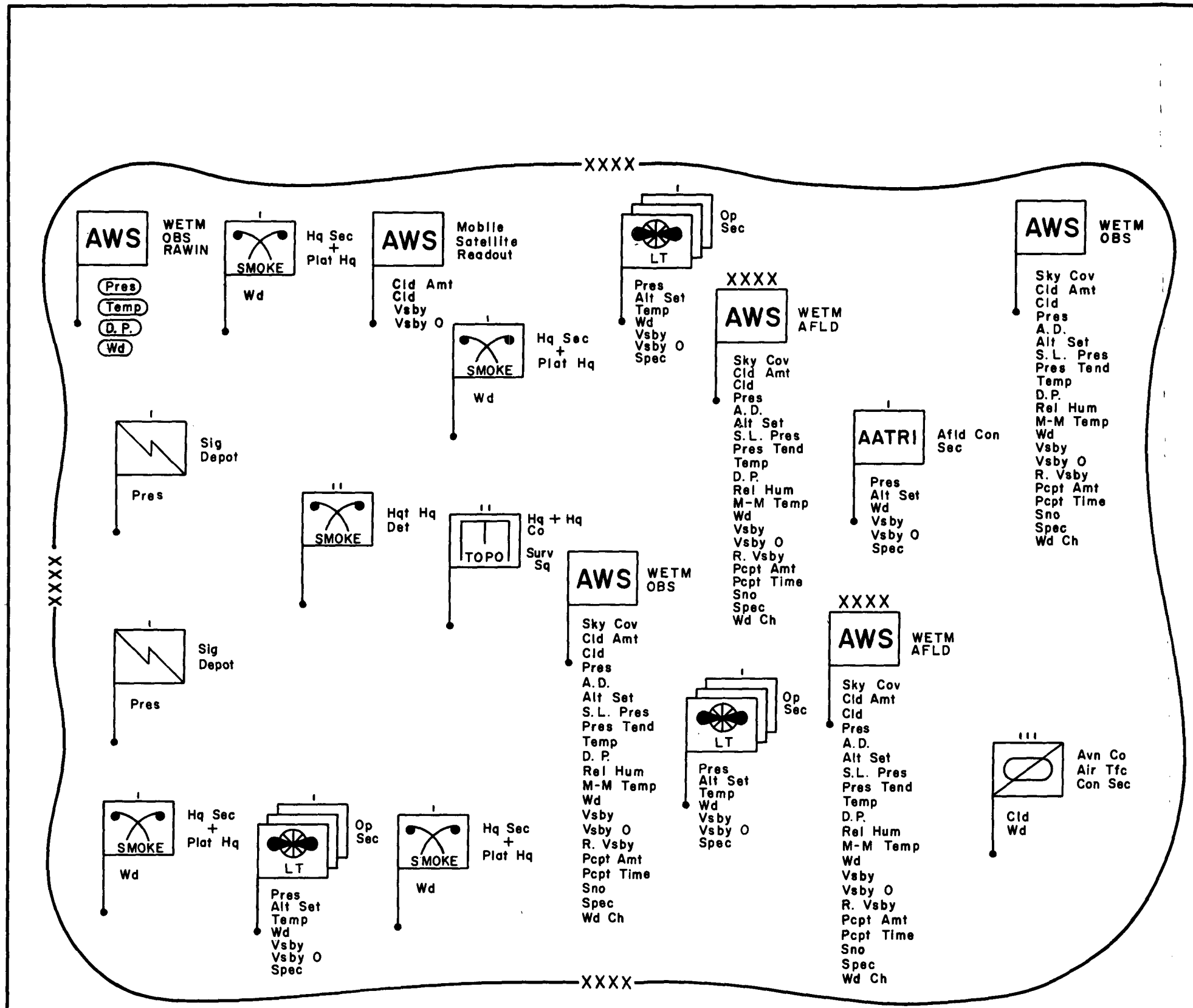


Figure 4–2. Flow of basic information in a type weather support force supporting the army.



LEGEND

SURFACE

Sky Cov	Sky Cover
Cld Amt	Cloud Amount
Cld	Cloud Height
Pres	Surface Pressure
A.D.	Air Density
Alt Set	Altimeter Setting
S.L. Pres	Sea Level Pressure
Pres Tend	Pressure Tendency
Temp	Temperature
D.P.	Dew Point
Rel Hum	Relative Humidity
M-M Temp	Max-Min Temperature
Wd	Wind Direction-Speed
Vsby	Visibility
Vsby O	Obstruction to Visibility
R. Vsby	Runway Visibility
Pcpt Amt	Precipitation Amount
Pcpt Time	Time beg-end Precipitation
Sno	Sno Depth
Spec	Special Phenomena
Wd Ch	Wind Chill

ALOFT

Pres	Pressure Height
Temp	Temperature
D.P.	Dew Point
Wd	Winds

FM 31-3-6

Figure 3-1. Organic army weather observing capabilities.

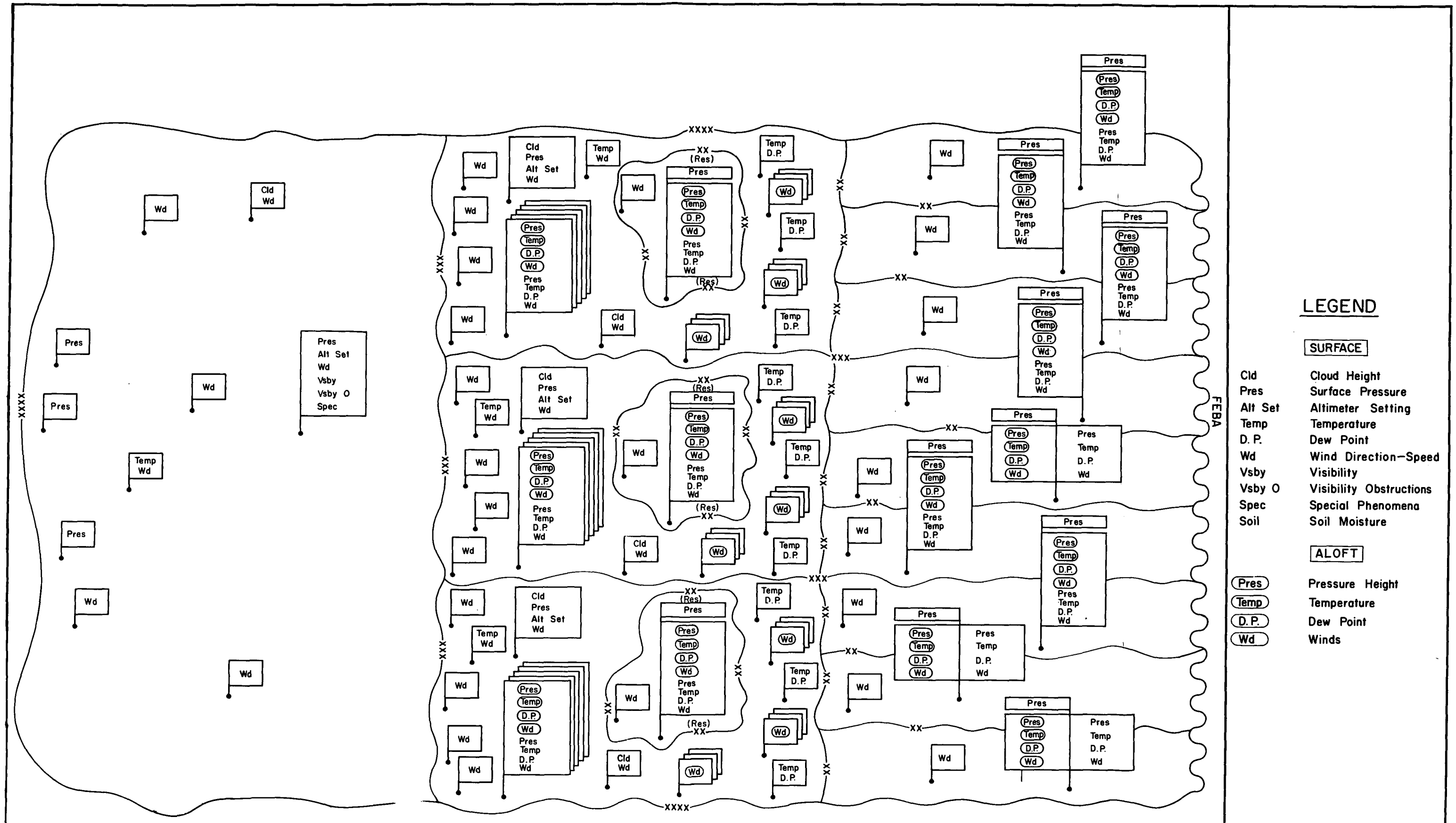
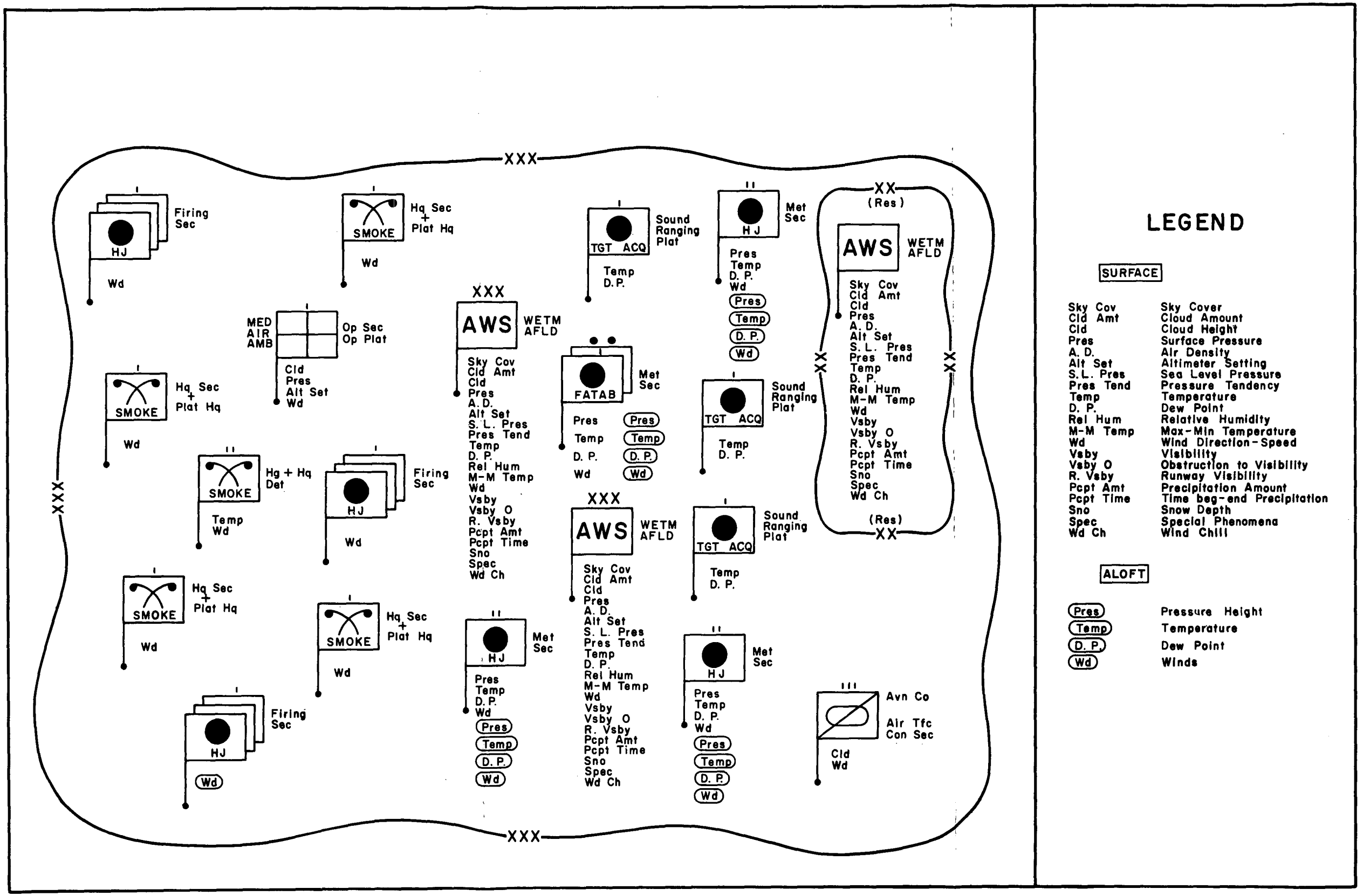


Figure 3–2. Army area weather observing capabilities.



LEGEND

SURFACE

Sky Cov	Sky Cover
Cld Amt	Cloud Amount
Cld	Cloud Height
Pres	Surface Pressure
A. D.	Air Density
Alt Set	Altimeter Setting
S. L. Pres	Sea Level Pressure
Pres Tend	Pressure Tendency
Temp	Temperature
D. P.	Dew Point
Rel Hum	Relative Humidity
M-M Temp	Max-Min Temperature
Wd	Wind Direction-Speed
Vsby	Visibility
Vsby O	Obstruction to Visibility
R. Vsby	Runway Visibility
Pcpt Amt	Precipitation Amount
Pcpt Time	Time beg-end Precipitation
Sno	Snow Depth
Spec	Special Phenomena
Wd Ch	Wind Chill

ALOFT

Pres	Pressure Height
Temp	Temperature
D. P.	Dew Point
Wd	Winds

FM 31-3-7

Figure 3–3. Corps area weather observing capabilities.

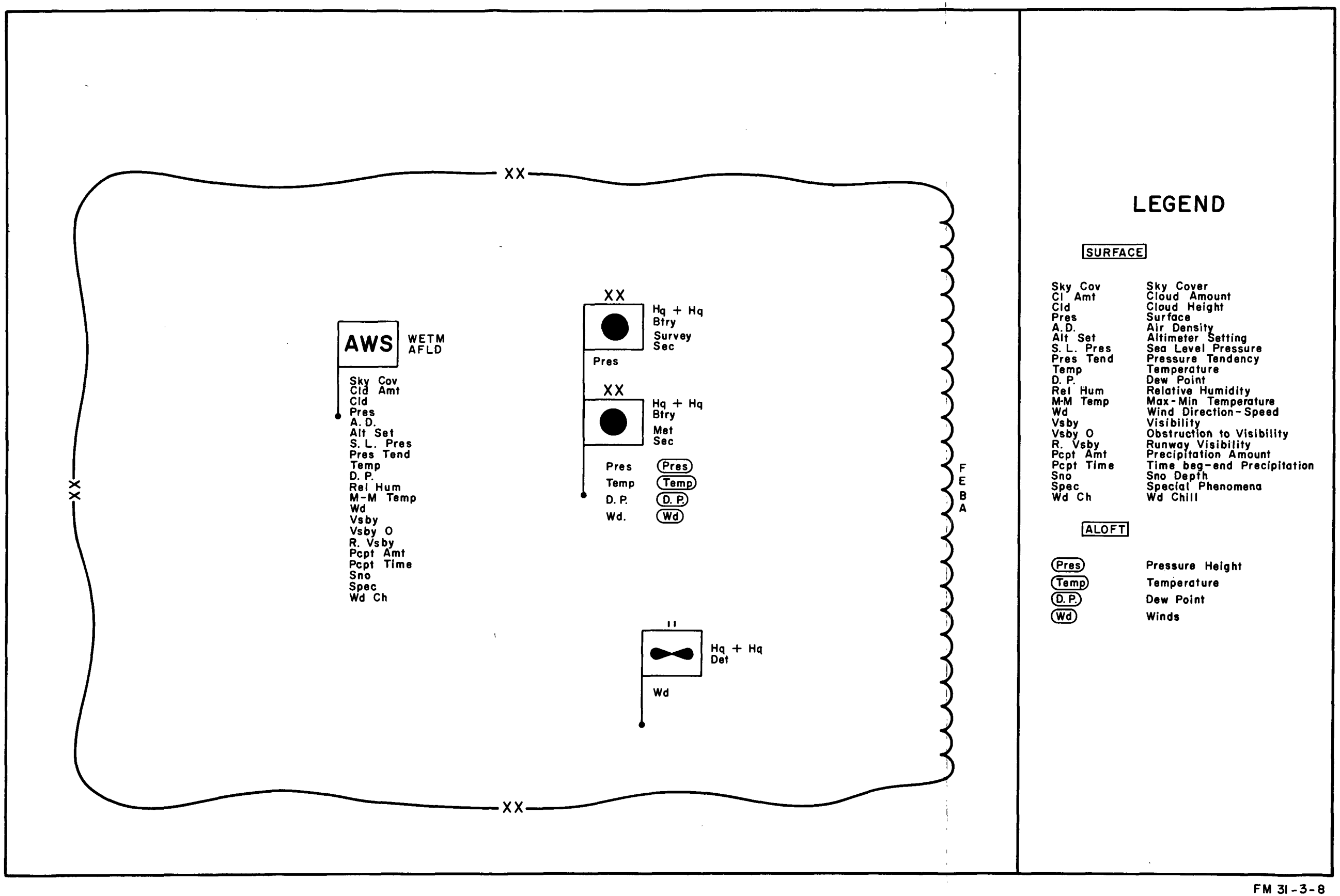


Figure 3–4. Division area weather observing capabilities.

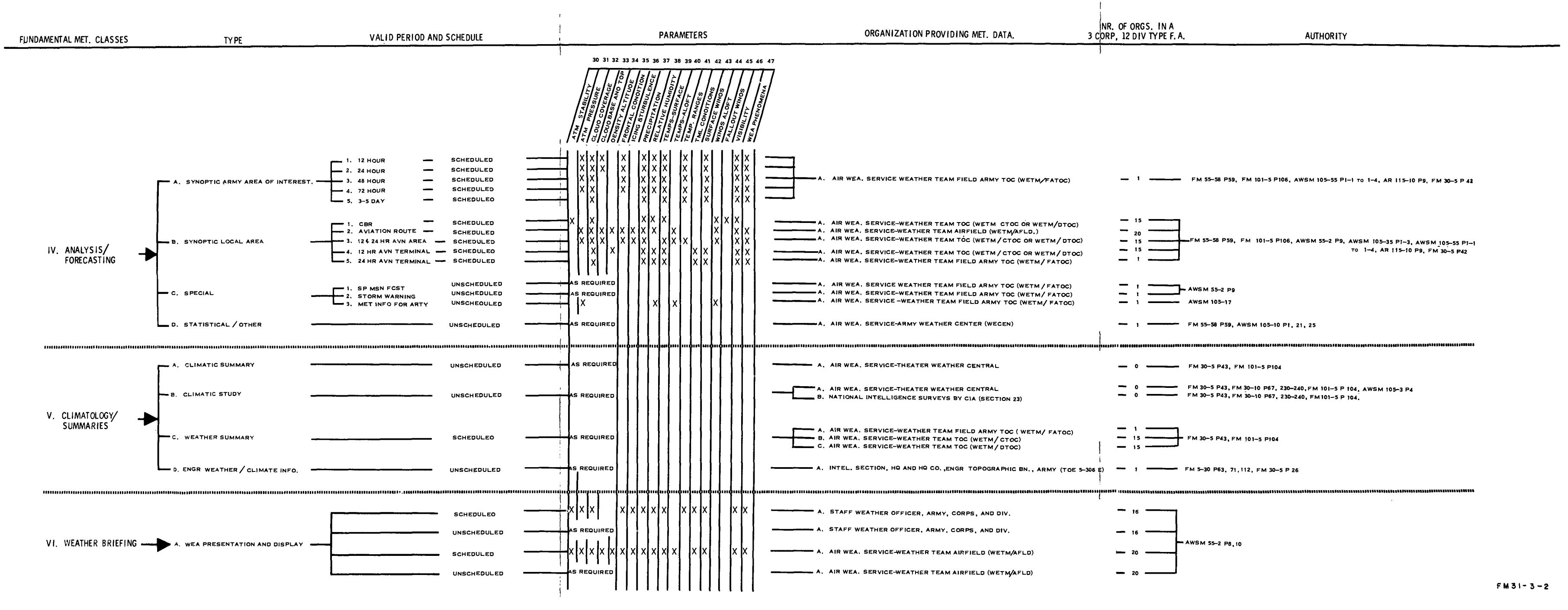


Figure 2–2. Current field army sources of meteorological information—forecasts/climatology.

CHART A - OBSERVATIONS

FUNDAMENTAL MET. CLASSES	HOW OBTAINED	SCHEDULE *	PARAMETERS (SURFACE 1–22; ALOFT 23–29)	ORGANIZATIONS MEASURING PARAMETERS	NR. OF ORGS. IN A 3 CORPS 12 DIV TYPE F. A.	AUTHORITY: TOE'S	AUTHORITY: MANUALS, ETC.
I. SURFACE/LOW LEVEL OBSERVATIONS	A. BY SURFACE REPORTING ELEMENTS	1. SCHEDULED	X X X X X X X X X X X X X X X X X X X X X X	A. AIR WEA. SERVICE OBSERVING WEATHER TEAMS (WETM ARMY AFLD, WETM OBS., WETM UW)	20	52-ID(DRAFT), 7-4E, 17-4E, 37-4E	AWSM 55-2 P9
			X X X X X X X X X X X X X X X X X X X X X X	A. METRO SECTION, HQ AND HQ BATTERY ARMD, INF, MECH AND ABN DIVARTY	27	6-201E, 6-302E	FM1-60 P48, FM6-120 P66 TO 70, FM 6-15
				B. METRO SECTION, HQ AND HQ BATTERY, FATAB		6-576E	
				C. METRO SECTION, FA MSL BN, HJ RKT (SP)		6-526E	
			X X X X X X X X X X X X X X X X X X X X X X	D. SOUND RANGING PLATOON, FIELD ARTILLERY TARGET-ACQUISITION BATTERY, FATAB	9	6-577D	FM6-120 P 18, 19, 21, 22 FM 6-122 P8-9, 14-15, 108-114 FM 6-15 ALL, FM 6-16 ALL.
				E. SPECIAL FORCES GROUP (AIRBORNE)	—	1-307E, 31-106E, 31-107E	NONE
				F. HQ AND HQ DET AVN BN, ARMD, INF, MECH AND ABN DIV (CON TOWER OP)	12	1-56E, 1-76E,	NONE
				G. HQ SECTION AND PLATOON HQ, CHEM. SMOKE GEN. CO.	16	3-287E	FM 3-6 P14
			X X X X X X X X X X X X X X X X X X X X X X	H. AIRFIELD CONTROL SECTION, ARMY AIR TRAFFIC REG. AND IDENT. CO. (CON TOWER OP)	1	1-207E	NONE
			X X X X X X X X X X X X X X X X X X X X X X	I. HQ DET, HQ AND HQ DET., CHEM. SMOKE GEN. BN.	4	3-266E	NONE
			X X X X X X X X X X X X X X X X X X X X X X	J. SURVEY SQD, HQ AND HQ CO., ENG TOPOGRAPHIC BN, ARMY	1	5-306E	NO CURRENT MET. FUNCTION.
				K. SURVEY SECTION, HQ AND HQ BATTERY, ARMED, INF, MECH AND ABN DIVARTY	12	6-201E, 6-302E	
				L. SIGNAL DEPOT CO, ARMY SIGNAL SUPPLY AND MAINT BN	2	11-158D	
				M. TRANSPORTATION COMPANY (LIGHT BOAT)	(1)	55-127D	
			X X X X X X X X X X X X X X X X X X X X X X	N. OPERATIONS SECTION, OPERATIONS PLATOON, MEDICAL AIR AMBULANCE CO.	3	8-137E	NONE
			X X X X X X X X X X X X X X X X X X X X X X	O. AIR TFC CON SEC, AVN CO, ARMD CAV REGT	4	1-67D	NONE
				P. AVN CO AND CAV TRP, COMD AND CON BN, ABN DIV	(1 PR. ABN. DIV)	1-57D, 17-77D	NONE
			X X X X X X X X X X X X X X X X X X X X X X	Q. OPERATIONS SECTION, TRANSPORTATION LIGHT HELICOPTER CO.	9	55-57D	NONE
			X X X X X X X X X X X X X X X X X X X X X X	R. ENGINEER FLOOD PREDICTION SERVICE	1	NONE	TB 5-550-1 P2, 5, TB 5-550-3 P3-6
			X X X X X X X X X X X X X X X X X X X X X X	S. INF PFDR DET, ABN	3	7-168D	FM 57-38, P3, 15, 25
	B. BY LOW LEVEL REPORTING ELEMENTS	1. UNSCHEDULED	X X X X X X X X X X X X X X X X X X X X X X	A. FIRING SEC, FIELD ARTY MSL BTRY, HJ RKT BN (SP)	38	6-527E	FM 6-56P 77
II. UPPER AIR OBSERVATIONS	A. RAWIN	1. SCHEDULED	X X X X X	A. MET SECTION, ARTY. (SEE 1, A, 2, A THRU C ABOVE)	27	SEE ABOVE	FM 6-15
				B. AIR WEA. SERVICE, RAWIN WEATHER TEAMS (WETM OBS RAWIN)	0-3	NOT APPLICABLE	AWSM 55-2 P9, 33, 37, AWSM 105-17
	B. PILOT BALLOONS (PIBAL)	1. UNSCHEDULED	X	A. MET SECTION, ARTY. (SEE 1, A, 2, A THRU C ABOVE)	27	SEE ABOVE	FM 6-15
				B. AIR WEA. SERVICE DROPZONE AND UNCONVENTIONAL WARFARE WEATHER TEAMS (WETM UW)	0-3	NOT APPLICABLE	FM 57-30 P24, AWSM 55-2 P33
				C. SOUND RANGING PLATOON, FIELD ARTY. TARGET ACQUISITION BATTERY, FATAB	9	6-577D	FM 6-120 P 18, 19, 20, 21, 22 FM 6-15 ALL, FM 6-16 ALL
	C. ESTIMATED (CLIMATE TABLES)	1. UNSCHEDULED	X X X	A. MET SECTION, ARTY. (SEE 1, A, 2, A THRU C ABOVE)	27	SEE ABOVE	FM6-15
III. INDIRECT OR RECONNAISSANCE OBSERVATIONS	A. AERIAL RECONNAISSANCE	1. SCHEDULED	X X X X X X X X X X X X X X X X X X X X X X	A. AIR WEA SERVICE RECON. SQDN.	1	NOT APPLICABLE	FM 30-20 P13, 19, FM 57-10 P15, AWSM 105-1 P1, AWSM 105-10 P3, 105-31 P1
		2. UNSCHEDULED	X X X X X X X X X X X X X X X X X X X X X X	A. AIR WEA. SERVICE RECON. SQDN.	1	NOT APPLICABLE	SAME AS ABOVE
				B. TACTICAL AIR COMMAND RECON. ACFT	1	NOT APPLICABLE	FM 30-20 P13, 19, FM 57-10 P15, AWSM 105-1 P1
	B. AERIAL PHOTOGRAPHY (DRONE)	1. UNSCHEDULED	X X X X	A. DRONE SEC, AERIAL SURV PLAT, AVN CO, ARMD CAV REGT	4	1-67D	FM 6-121 P29
				B. DRONE PLATOON, HQ AND HQ BATTERY, FATAB	3	6-576E	
				C. AVIATION GENERAL SUPPORT CO., AVIATION BN, ARMD, INF AND MECH DIV	12	1-78E	
	C. PILOT REPORTS (PIREPS)	1. UNSCHEDULED	X X X X X X X X X X X X X X X X X X X X X X	A. ARMY AIRCRAFT	NOT APPLIC	NOT APPLICABLE	FM 1-60 P50, AWSM 105-10 P15
				B. AIR FORCE AIRCRAFT			AWSM 105-10 P15
				C. NAVAL, MARINE CORPS ACFT			NONE
				D. OTHER AIRCRAFT (CIVILIAN, FOREIGN ETC.)			NONE
	D. GROUND BASED RADAR	1. UNSCHEDULED	X X X X X X X X X X X X X X X X X X X X X X	A. ARMY TACTICAL FORCES GROUND BASED RADAR	NOT APPLIC	NOT APPLICABLE	ANY AVAILABLE FOR TAKING WEATHER OBS.
	E. WEATHER SATELLITES	1. SCHEDULED	X X X X X X X X X X X X X X X X X X X X X X	A. AIR WEA. SERVICE, WEA. CENTRAL	0-1	NOT APPLICABLE	NONE
	F. SFERICS	1. SCHEDULED	X X X X X X X X X X X X X X X X X X X X X X	A. INDIGENOUS WEATHER SERVICES, WHEN ARMY IS AN AREA WITH FIXED BASE SFERICS COVERAGE	NOT APPLIC	NOT APPLICABLE	FM 55-38 P 38, 39, AWSM 105-38 P 7.
	G. OTHER	1. UNSCHEDULED	X X X X X X X X X X X X X X X X X X X X X X	A. NON WEATHER U.W., FRONT LINE TROOPS, INTERROGATION OF PRISONER OF WAR, ETC.	NOT APPLIC	NOT APPLICABLE	FM 30-5 P41

NOTES. SCHEDULED – MET INFORMATION NORMALLY ACQUIRED AT REGULAR, PREDETERMINED INTERVALS (HOURLY, THREE-HOURLY, ETC.) FOR AS LONG AS THE FIELD ARMY IS IN A TACTICAL CONFIGURATION.

UNSCHEDULED – MET INFORMATION NORMALLY ACQUIRED ONLY WHEN A SPECIFIC ACTIVITY WITHIN THE FIELD ARMY REQUESTS THIS DATA.

( ) AVAILABLE ONLY WHEN THE UNIT INDICATED IS EMPLOYED

FM31-3-1

Figure 2–1. Current field army sources of meteorological information—observations.