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CONFERENCE GREETINGS

ADDRESS REPLY TO
HEADQUARTERS OF THE ARMY AIR FORCES
WAR DEPARTMENT
WASHINGTON, D. C.

WAR DEPARTMENT
HEADQUARTERS OF THE ARMY AIR FORCES
WASHINGTON

18 September 1943

MEMORANDUM FOR: Air Weather Officer.

SUBJECT: Conference of Regional Control Officers of all Weather Regions.

1. I regret that it will be impossible to attend the conference of Weather Regional Control Officers which is to be held in Asheville beginning 20 September 1943.

2. I wish, therefore, that you would present to the conference an expression of my appreciation for the contribution already made by the A.A.F. Weather Service to the war effort. Also, it would be well to point out that, with the addition of large numbers of newly trained weather officers, the A.A.F. Weather Service will be faced with the heavy responsibility of seeing that they are used in the most efficient manner possible, to the end that the Weather Service as a whole may be further improved. A large share of this responsibility will fall on the shoulders of the Regional Control Officers.

3. Every effort must be made to improve weather techniques and to insure that all weather officers take advantage of opportunities to improve their personnel proficiency. Individual efforts must be carefully coordinated and controlled in order that an adequate weather service may be made available to Air Force and other War Department agencies in every theater of operations.

4. I feel sure that a continuation of past enthusiastic efforts by weather personnel will insure that all weather requirements are met and that the goal of making the A.A.F. Weather Service the best in the world will be very definitely achieved.

H. A. CRAIG
Brigadier General, U. S. A.
Assistant Chief of Air Staff
Operations, Commitments and
Requirements.

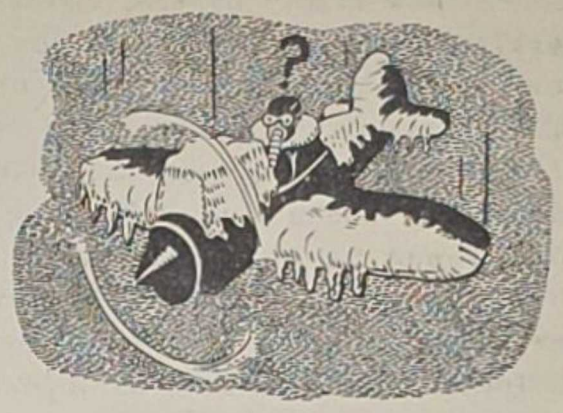
CONTENTS

THE COVER this month represents the Weathercock in a fighting mood. He has deserted his accustomed resting place atop the steeple of peace to do a job on the rats who came to disturb it. To the men overseas, this is no exaggeration.

The Weather Service Bulletin is printed monthly by the AAF Weather Wing, Asheville, N. C., under the authority of 1st Indorsement, Headquarters AAF Management Control, Washington, D. C., dated 9 July 1942, to basic letter, file 461, AAF Weather Wing, dated 25 June 1943, subject: "Weather Service House Organ" and is published for the use and benefit of the personnel of the Army Air Forces Weather Service.

ICING ON AIRCRAFT: II

by DAVID L. ARENBERG



With the exception of frost, all icing takes place in clouds or below them in regions of falling rain. The only absolute safe way to avoid icing is to stay away from clouds. Military necessity, however, often dictates a different course.

Not all clouds cause icing. In fact, only about 30 percent of all clouds at subfreezing temperatures will form ice, and a much smaller percentage will produce it in amounts sufficient to be dangerous. When ice does form, its onset can be extremely rapid. Records are well established of 2 or 3 inches of ice forming in as many minutes.

Characteristics of Cloud Types

The pilot should be able to distinguish between clouds of ice particles and clouds of water. Ice particle clouds are cirrus, cirrostratus, and cirrocumulus. All others should be thought of as containing liquid water in some degree determined by their type and history.

Clouds important to icing are produced in free air principally by adiabatic cooling which is due to lifting in the following ways:

(1) Convection produced by heating at the earth's surface.

(2) Upslope motion along a front

(3) Convergence over a wide area

(4) Turbulence

(5) Orographic lifting

(6) Surface lifting

(7) Potential instability because of overrunning

Two important groups of clouds are recognized. Clouds that are formed mainly by vertical development, usually with sharp contours, in unstable air, and often separated by open spaces, such as *cumulus, cumulonimbus, altocumulus, and stratocumulus* are of primary importance. Turbulence and thermal instability are significant characteristics of these formations. Layer clouds such as *altostratus* and *stratus* formed in stable air, are in general less important as regards icing unless a long flight is planned. *Nimbostratus* may have exceptionally severe icing or no icing at all, depending on the stage of precipitation, since changes from water to ice particles may occur between its base and top.

Clouds in Stable and Unstable Air

The severity of icing in the group of clouds in unstable air is due to the increased water-content possible in convective clouds. In these, air enters the cloud from beneath, condensation starts at a common level; the higher portions have been lifted through greater distances and cooled by greater amounts. Consequently, the liquid water content increases with height, and icing severity increases with increasing height and decreasing temperatures rather than glaze is offset by the increase in the amount of water deposited. When the temperature of the air at the cloud base is high, a large quantity of moisture will be available for condensation, and the quantity of liquid water carried to icing levels will be large.

In stratiform clouds the amount of lifting and cooling is nearly the same for all portions of the cloud layer. The

cloud extends itself upward, downward, or laterally through the air as the latter rises. Consequently there are not many local variations in liquid water content. The liquid water content decreases with temperature, and diminished icing hazard can be found by going to a high level.

One gram of liquid water per cubic meter corresponds to a rate of deposit of 0.20 inches per minute on an object going 200 mph, but most planes will not collect even 50 percent of this liquid water unless the drops are large. Significant changes in the icing rate experienced in a cloud will be produced by change in lifting of less than 1,000 feet. Billows and waves of this size are found in free, stable air, so local variations of icing rates observed in mountain regions are understandable. Reports of 4 inches being deposited in one minute on a plane flying at 12,000 feet and -20°C through a cumuliform projection has been received recently.

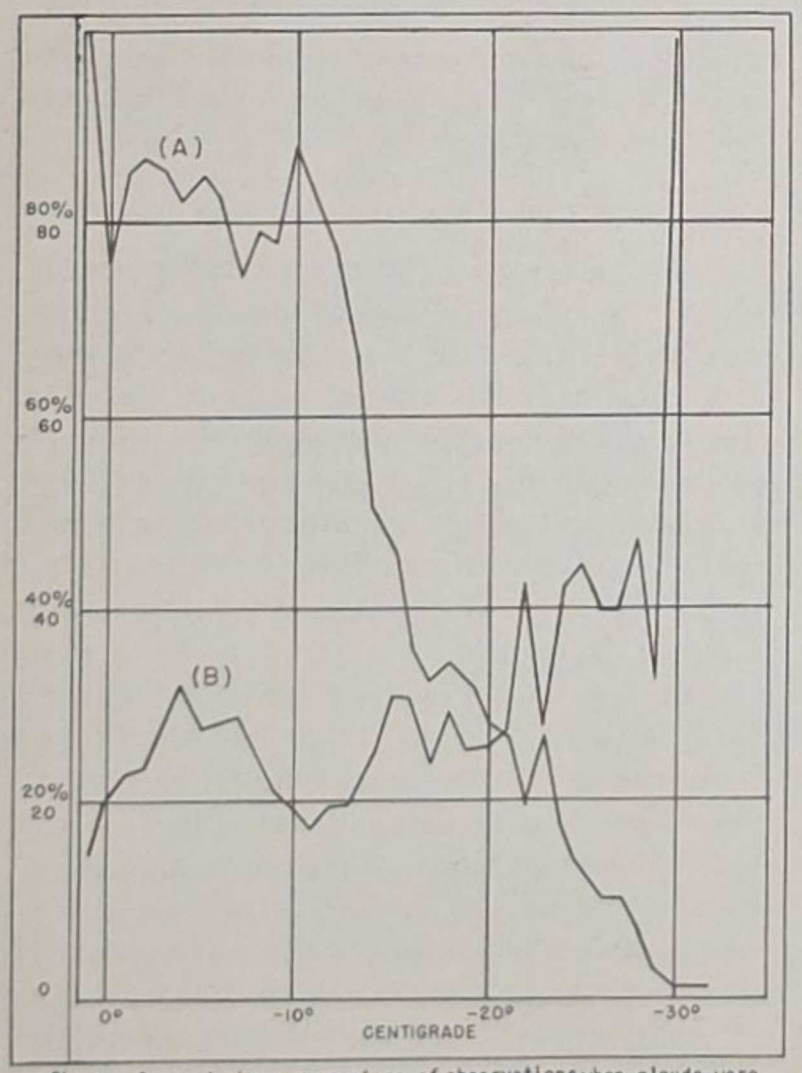


Fig 1. Curve A shows percentage of observations when clouds were encountered at each temperature. Curve B shows the percentage of these clouds which caused glaze.

Figure 1 gives the relative frequency of occurrence of glaze and no icing in clouds above 6,500 feet at various temperatures. It is based on U. S. Weather Bureau APOB data where flights were attempted daily to 14,000 feet. The probability of an airplane encountering clouds decreases directly with temperature. The over-all probability of encountering icing in any form likewise decreases. However, at these higher altitudes the likelihood that icing when encountered will be glaze *increases* at low temperatures. This is in contrast to the situation for clouds below 2,000 feet where most cases of glaze occur above -8°C and may indicate that high-altitude icing is principally due to convective clouds.

The data do not compare rates of icing, which would probably be greater on an average at the higher temperatures. Observations of the frequency of riming at mountain stations show no decrease in percentages of water clouds as compared to ice clouds at temperatures well below freezing.

Effect of Precipitation

Clouds are dynamic units which are either actively growing or decaying but are seldom static. The severity of icing within them will depend on the liquid water content, and this content will begin to vary as soon as the cloud has formed.

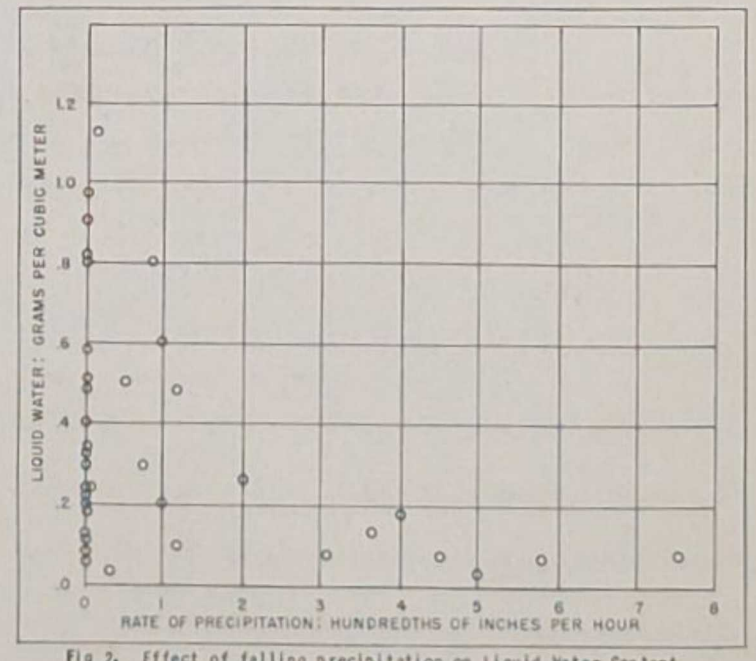


Fig 2. Effect of falling precipitation on Liquid Water Content. Comparison of cloud measurements on Mt. Washington with simultaneous precipitation reports from Pinkham Notch, March-April, 1939: Nov.-Dec., 1940: and March-April, 1941.

In older clouds, crystalization and precipitation can reduce the liquid water content more rapidly than it is formed by lifting. The cause of crystalization has not been established, but the onset of precipitation is as follows:

Only light rain or drizzle can form in clouds at a temperature above 0 °C by simple collision between the drops, except that in the tropics where the freezing level is high a shower may fall from a very tall cloud before its top reaches low temperatures. The rate of fall of droplets, except in these tropical clouds, is so slow as to be almost ineffective. Heavy rain does not occur until the top of the cloud cools to between -10°C and -20°C. Ice crystals then form in the top of the water cloud. Because of the difference in vapor pressure between ice and water at subfreezing temperatures, sublimation will take place and the ice crystals will grow at the expense of the water droplets. In a short time the crystals will grow to a size where their rate of fall is enough to cause further growth due to collision with water drops as well as to sublimation. This continues until the particle falls out of the cloud or melts into rain.

At a temperature of -12°C the maximum difference in vapor pressure between ice and water occurs, and precipitation withdraws water from the cloud most rapidly at that temperature. Figure 1 shows that the frequency of icing clouds has a minimum at 12°C.

Comparison of rainfall with liquid cloud water, as in figure 2, establishes the empirical rule that severe icing within the lower layer of clouds cannot occur near a ground station that reports more than 0.03 inches per hour of precipitation. This condition is especially important in considering the icing risk over warm fronts.

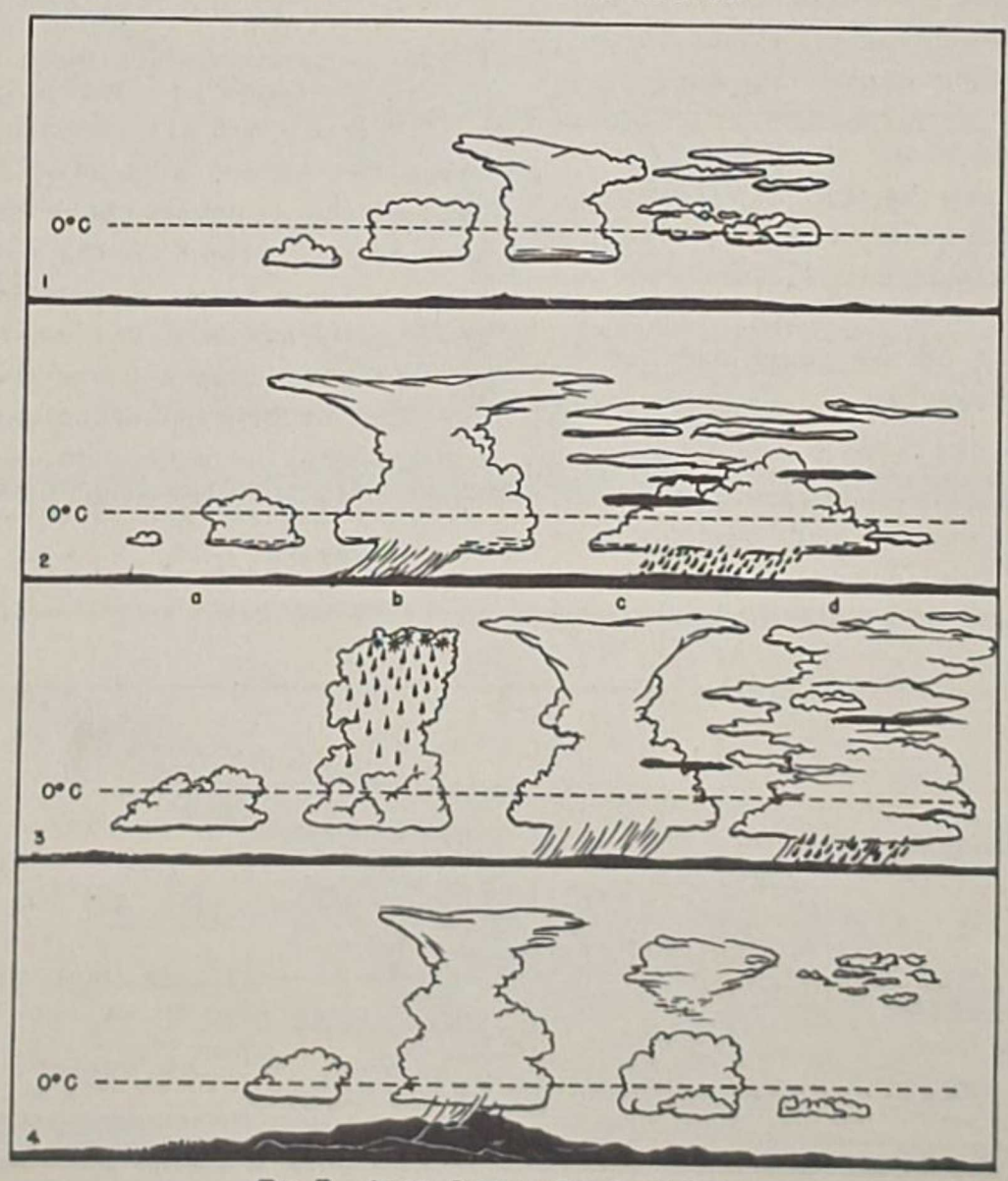


FIG. 3 LIFE CYCLE OF CLOUDS

Life Cycles of Clouds

Because of the importance of precipitation and the ease with which it is observed, it is valuable to divide clouds into groups on the following basis:

(a) Clouds of small development with no icing or precipitation.

(b) Clouds of large vertical development with heavy icing but no precipitation (rapid growth, growing cold)

(c) Clouds of large development with icing and precipitation (rapid growth, older cloud).

(d) Clouds of large development with no icing but with precipitation (slow growth).

Every cloud starts as a cloud of small development. Factors affecting the rapidity of its growth and dissolution will determine its subsequent forms and the order in which it will pass through them. The sequence of icing conditions will follow the sequence of cloud form. The commonest and most important sequences of cloud forms are as follows:

1. A small cloud forms, but the forces producing it are so slight that development does not proceed, and the cloud disappears without producing icing or precipitation. This sequence is that of the small cumulus clouds of fair weather.

2. A small cloud forms and grows slowly, the rising motion of the air being gradual and, perhaps, widespread. Precipitation occurs, but the gradual transformation of liquid water to ice and the depletion of the cloud by precipitation prevents the development of an icing condition. This sequence is characteristic of warm front conditions where air is lifted comparatively slowly over a large area.

3. A small cloud forms and grows rapidly under the influence of strong lifting forces. A period of intense icing precedes the onset of heavy precipitation. This sequence is typical of squalls and thunderstorms. Precipitation subsequently depletes the cloud of liquid water and it becomes a cloud of phase D.

4. A small cloud forms and grows rapidly to large size under the influence of strong lifting forces causing intense icing, but the forces causing the lifting do not persist and the cloud dies away again before heavy precipitation falls.

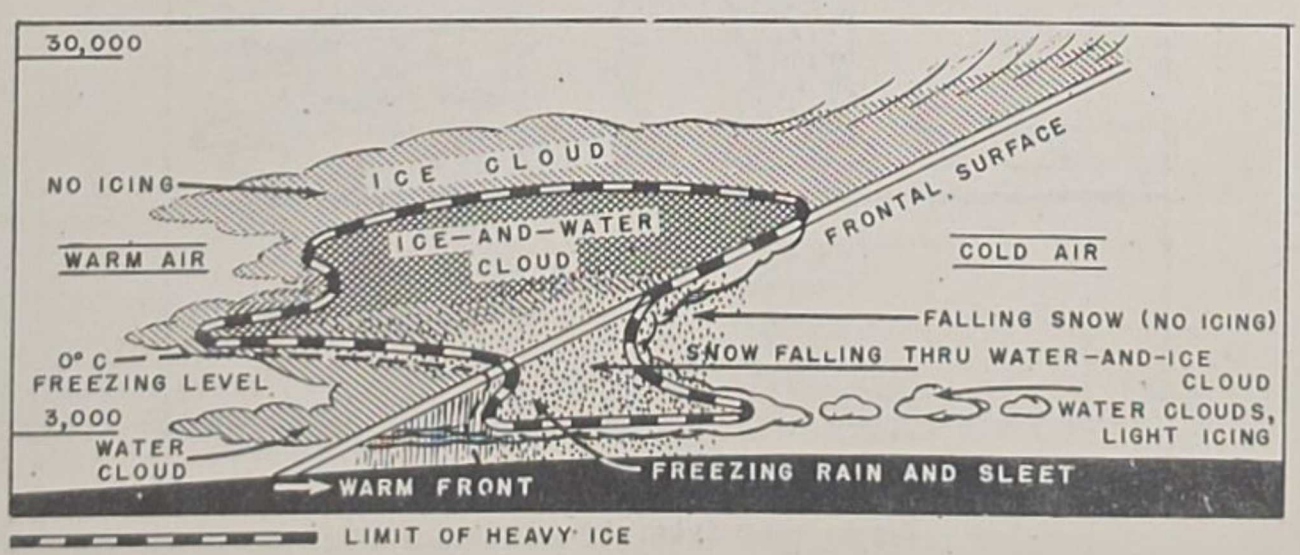
Observations in clouds have confirmed these sequences. The most intense icing always precedes precipitation.

Because definite substances appear to be needed to act as nuclei for crystallization and because these substances are lost to the cloud in the process of precipitation, icing may be exceptionally severe in certain air masses or at the tops of cloud decks where the air has been purified by precipitation and thick clouds subsequently have been formed.

Icing in Cloud Systems

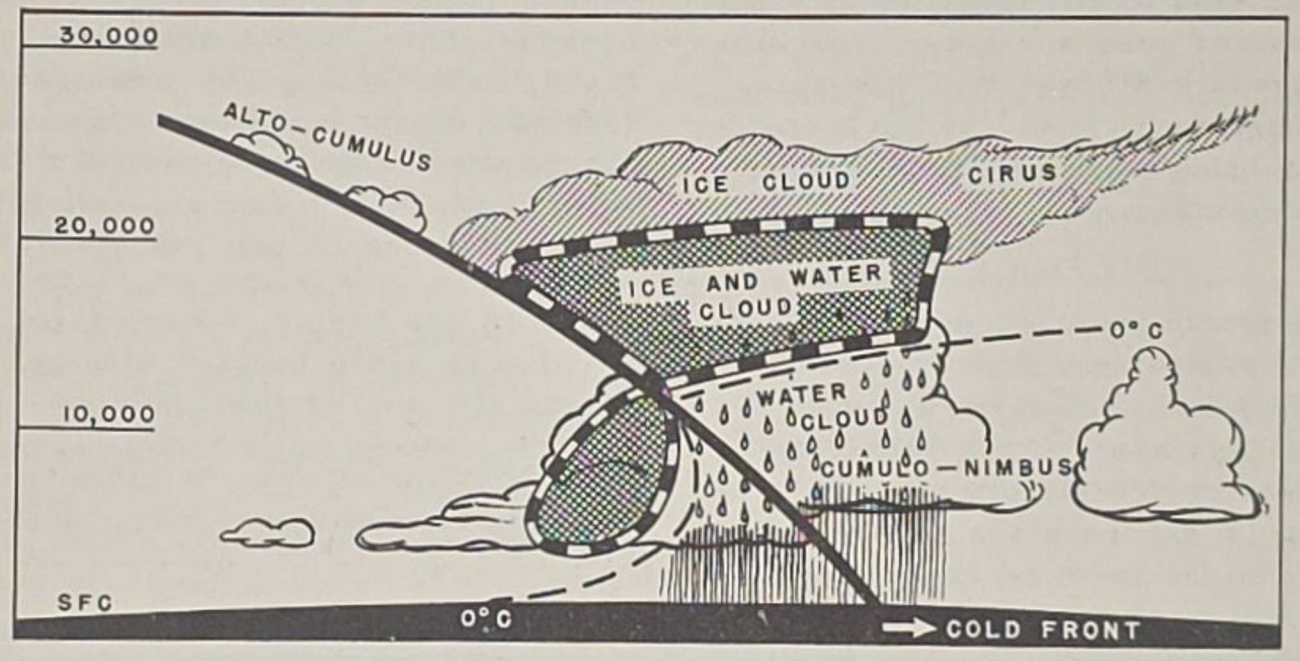
In Air Masses.

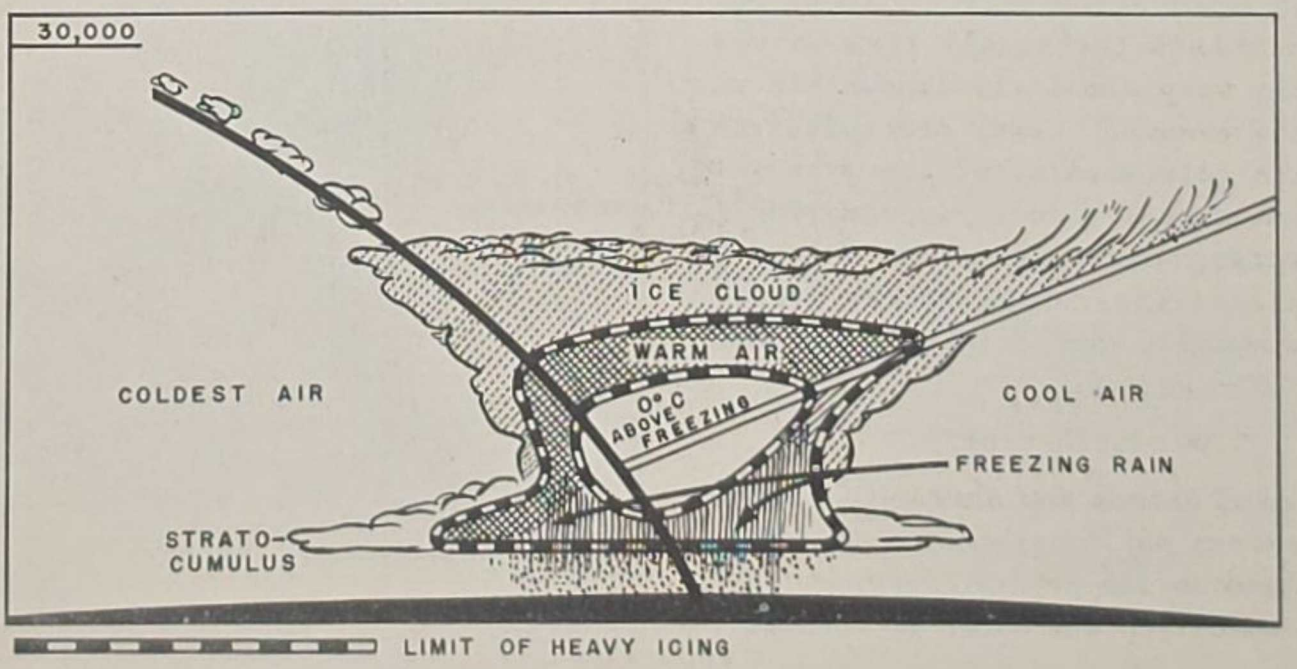
Convective clouds, principally cumu-



lus, stratocumulus, and cumulonimbus, are the only air mass clouds which produce icing to any formidable degree. Stratus, altostratus, or altocumulus, when formed or air invasion other than a front, seldom cause icing. In air masses, convective clouds produced by heating at the earth's surface may extend to very great heights and have the severest icing of any cloud type. It makes no difference whether the development of thunderstorms is started by sunshine in moist tropical air or by transformation of continental polar air to maritime polar air over the North Atlantic. Clouds above freezing levels will have a high icing frequency in these air masses. Regions of ice accretion within air masses can usually be easily avoided by proper choice of flight path.

A mature air mass thunderstorm contains clouds in many stages of development. In the forward portion of the storm, clouds of stage A will be found. These will grow rapidly to stage B in the dark, heavy cloud towers of the storm front. The shower portion of the storm represents the C stage of development, which is followed by a return to stage A and eventual dissipation. The fact that a shower is falling indicates that heavy icing will not occur in that particular part of the thunderstorm where precipitation has been going on for a little while, but it warns that there are clouds in the developing portion of the storm which are approaching the precipitating stage and will cause heavy icing.





Along Fronts

Along fronts about 85 percent of the observed icing occurs in frontal zones.

Warm Fronts

Warm fronts are normally characterized by relatively slow-up-glide of the air mass. The clouds on it therefore tend to follow sequence 2; but growth may be at moderate speed with some resultant ice accretion. Warm front clouds are usually stratiform in nature and rime predominates over glaze, but occasionally the lifting and condensation will release potential instability and thunderstorms will occur ahead of the front with glaze accretion in the upper portions of the convective clouds. In the stratiform clouds only rime is produced, but the cumuliform clouds will lead to the formation of glaze or mixtures of rime and glaze. As warm front systems are often very extensive, necessitating long flight through clouds, even small icing rates may be dangerous if the ice accumulates over a period of time.

Cold Fronts

Cold fronts produce the most intense icing. In active cold fronts, sequence 3 will be followed. Cumuliform clouds are most often associated with cold fronts, and thunderstorms will form well ahead of the front if the warm air is moist and unstable. Glaze is to be expected at all times. The cloud systems are relatively narrow and fast-moving. The time required to fly through them is shorter than for a warm front, but transit is not to be recommended unless the squall line is exceptionally long and it is impossible to fly over or around. Heavy precipitation occurs with cold fronts but the area involved is too narrow to be considered of use in avoiding the icing zones. The most dangerous area lies ahead of the front. Subsidence usually occurs in the rear with dissipation of clouds.

Occluded Fronts

Occluded Fronts and Poorly Developed Frontal Systems may consist of clouds that do not extend to the crystallization level. This condition can occur if vertical ascent of the air is checked. Because precipitation ceases, little attention might be paid to the icing hazard. Should deepening begin again severe icing conditions may take place suddenly because the slow development will have led to the formation of large drops and to the absence of sublimation nuclei. Figure 7 represents in idealized form the icing zones about a well developed cyclone.

Turbulence

Turbulence induced either by surface friction or by differences in wind velocity between two layers of stable air will lead to the development of a stratiform or stratocumuliform cloud in which liquid water content will be greatest at the top. Frictional influences normally extend to between 1,500 and 2,00 feet above the ground. Usually the thickness of the cloud is limited by the formation of an inversion in the air above. When cold air passes over large open bodies of warmer water, both water vapor and heat will add their influence to that friction. Extensive icing conditions exist from this cause in the lee of the Great Lakes and off the Atlantic Coast. Although these clouds are thinner than cumuliform clouds with the same water distribution, the fact that this type of cloud forms an extensive unbroken layer makes it particularly dan-

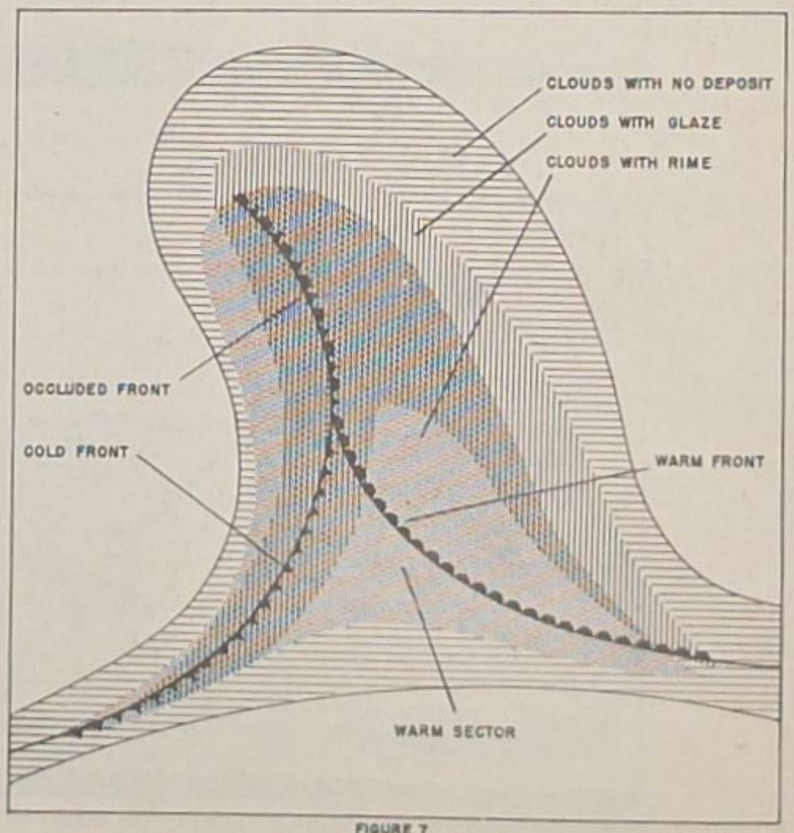


FIGURE 7

gerous for extended flight within the cloud. Flight above the layer is preferred because it will protect the flyer from surface observation while enemy planes can be avoided if necessary by diving into the cloud for brief intervals.

The development of turbulence at higher levels can lead to the formation of clouds and icing when two currents of air are found such that potentially colder air is brought in aloft. A deep trough extending north and south with southerly winds at the surface and northerly winds above will cause this situation. Observations of the upper air both with pilot balloons and radiosondes are very helpful in predicting this situation.

Orographic Lifting

Orographic lifting can produce severe icing over mountain ranges. The lifting occurs in the same manner as above a frontal surface, add cumuliform clouds will form on the windward side of the ridges. Dissipation of the cloud will occur on the leeward side. Instability if present in the air will be released by the condensation process, and the resulting clouds can extend to great heights. When open water is present to windward, the combination of the surface heating and moistening with the orographic lifting will intensify icing conditions. Such a situation exists over the Allegheny Mountains when continental polar air crosses the Great Lakes and the Mountain ranges. Another locality where the weather is similarly affected by topography is the northern part of the Rocky Mountains region, which has frequent invasions of maritime polar air from the North Pacific Ocean.

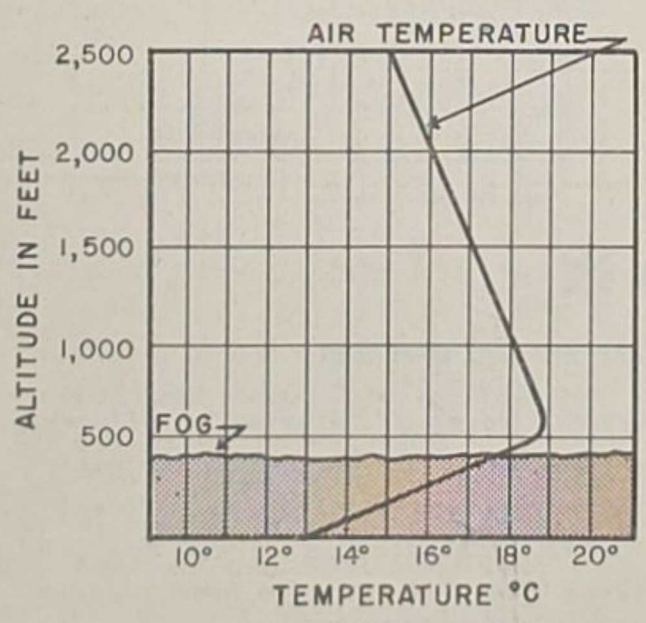
Icing Frequencies of Air Masses

Air masses vary considerably in the frequency with which they cause icing. It was first thought that this variation was due to their thermodynamic properties of moisture and temperature alone, but it has now been determined that stability is also a very important factor. Moist air having a steep lapse rate, approaching the wet adiabatic, was found to have the highest frequency of icing reports. The following table gives the frequency of icing clouds within air masses during U. S. Weather Bureau APOB flights over a period of four years.

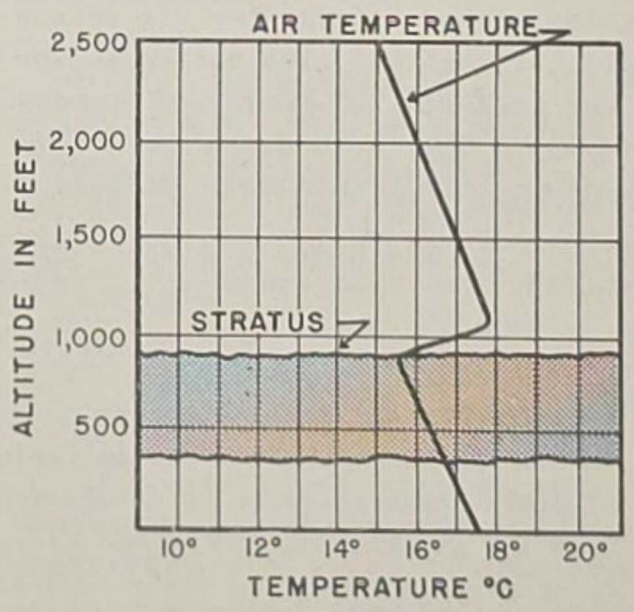
TABLE I.

Frequency of Icing within Air Masses

TYPE OF AIR MASS BERGERON CLASSIFICATION	*TOTAL NO. OF CASES ENCOUNTERING CLOUDS*	*NO DEPOSIT*	*FROST*	*RIME*	*GLAZE*
cP	68	50	-	11	7
cPk	41	28	2	2	9
mP	49	28	-	1	20
mPw	48	20	1	9	18
mE	43	34	-	4	5
mEw	0	-	-	-	-
mT	4	2	-	2	-
mP	7	1	-	-	6
Doubtful	28	22	-	1	5



(A) WIND 7 MPH



(B) WIND 20MPH

6. The instability curves or signs (thunderstorms turbulence, towering cumulus). The symbol for instability, turbulence, thunderstorm, is red and very similar to the usual symbol for lightening, only drawn horizontally, this indicating bumps as well as electrical phenomena.

7. The fog curves or signs. The symbol for fog is yellow, as usual.

Probable displacement of dangerous zones is indicated with black arrows showing the displacement after 6 hours. An example is the map for July 27, 1943, 0730E. This example was selected because it showed the severe hurricane which struck the Houston area. In this typical summer map there are no fogs or very low ceilings. The main features of the new pilot weather map may nevertheless be demonstrated in this example.

Almost the entire country is shown covered with tropical maritime air (mT). A relatively short cold front line runs from Eastern Kansas through Michigan to Canada, with a slight wave in northwestern Illinois. The air mass behind the cold front is modified polar maritime (mPK).

The weather is fine in the northern half of the tropical air mass, and in the polar air starting a few hundred miles northwest of the front line. There are two zones of bad weather:

The first one is a zone of frontal weather with two areas of precipitation, one in Michigan and the other in Kansas and Nebraska.

The second zone is one of air mass weather of a type which often occurs during the warm season. The hurricane is clearly visible.

The map indicates:

1. How to select flight itineraries avoiding low ceiling and turbulent areas.

2. That even along the cold front line bad weather does not prevail everywhere. In Missouri the cold front is entirely harmless; whereas in Nebraska, where no real front line exists, there are relatively low ceilings and precipitations.

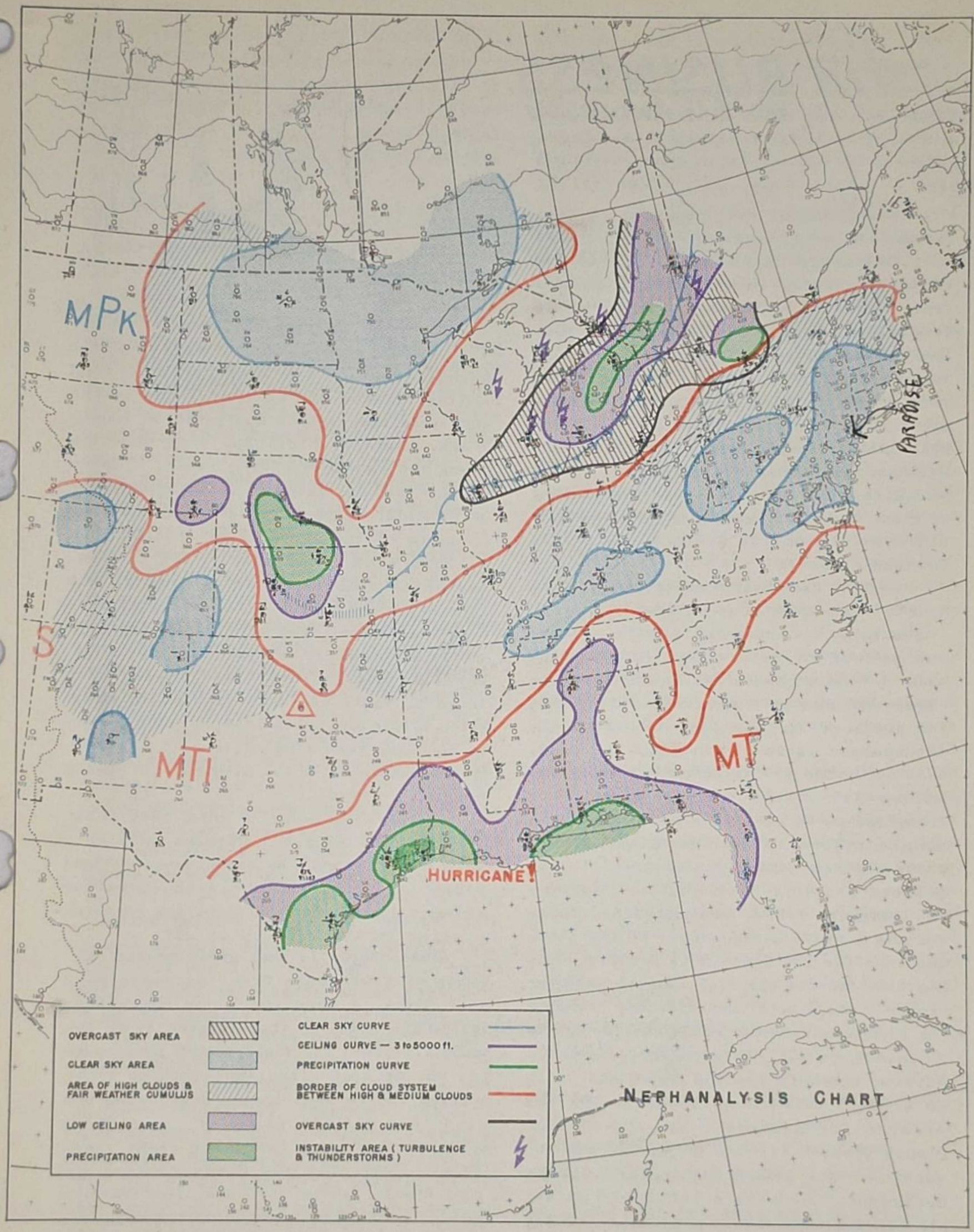
3. That the air mass weather is much worse and much more extensive than frontal weather. It culminates in a severe hurricane with very high thunderclouds.

4. That inside of the tropical air mass the weather is very heterogeneous, including every possible variety from clear sky areas to heavy thunderstorms and even a hurricane.

Remarks and suggestions regarding the subject of special maps for pilots will be welcome from weather officers and pilots.

RECONNAISSANCE SQUADRONS RECEIVE SPECIAL TRAINING IN NEPHANALYSIS

Because of the important part played in weather reconnaissance by visual observation of clouds and correct interpretation of them, observers and forecasters assigned to weather reconnaissance outfits receive special training in this comparatively novel branch of meteorology. In the course of operational training at a field in the mid-west, the personnel of the First Weather Reconnaissance Squadron, Test, received a period of intensive training in nephanalysis under the direction of Dr. P. Schereschewsky which, it is reported, is being well utilized in their present operations over the northeast route. Other weather reconnaissance squadrons will receive similar training as part of their specialized preparation for duty, and a handbook on the subject is being prepared at the Training Aids Division in New York.



NEPHANALYSIS CHART

AIR BUSINESS

by P.F.C. E. G. ANDERSON

This morning at 0300K (1700Z) the Fifteenth Weather Squadron spun ML 24's from Queensland's Brisbane to New Guinea's famed Buna, Merauke and Wau - from historic Milne Bay, to Manbullo in far northwestern Australia. 0300K: spun ML 24's, read pressures to the nearest thousandth of an inch, read wind direction and speed. While pilots slept, eyes of the Fifteenth Weather Squadron saw at a glance entire cloud systems, encompassed indications of giant highs and lows; glanced at today's sky over the entire South West Pacific Theatre of War.

0300K, and, of course, with each hour's obs - each hour on the quarter of - charting the changes in this ponderous sea of important air - until the observer has become conscious of his air-element almost as a substance, imagining the pools of it, can just about see the transparent isobars. isobaric surfaces, thrills inside to the schools of grey and silver air-fish moving overhead - or trembles, as he does this morning, over a single figure in the decoding of this 9300K radioed report (teletyped into the Garbutt Station) from Station 214.

Garbutt Field. Two thousand forecasts a month. Headquarters of the 15th. Terminus for the South West Pacific. The Big Time for the observer as well as forecaster - where more than ever one realizes the airplanes are suspended from the single decoded figure... Here is the forecaster waiting silently for the 0300K map, with we wonder how much patience... Planes cleared for Sidney, Darwin, Moresby. Planes cleared for the No-Man s-Blue out yonder. The 0300K map, forecaster's decisions, the planes and their crews, all hanging on a series of little decoded figures - like this direction of middle clouds at Station 214.

Here the observer can stop, if he has time, to notice that the walls of the Garbutt Station are transparent beyond the brilliance of their daylight-lamps; that they open into a honeycomb of lonely 3 A.M. Weather Stations, each with its 0300K map on the plotting table. - Maybe 214 Max Hoke hesitates in decoding direction of middle Garbutt clouds - or catches a vision of the net work of obs-communications that under six layers of code transmits this six-hourly synoptic map to every big-time airfield, every wilderness-spaced fuel stop of the sky caravans. And it's the *layers* of code that make this war time meteorology like jumping with weights, isn't it, Max? Makes you think twice within the split fraction of a second in decoding that single figure that holds up the plane, while the Lieutenant or Master Sergeant waits...

Perhaps he doesn't mean that look of just-call-me-Sir. Perhaps he's only suffering from what he calls those Doldrum Blues (the over-and-above-the-Duration Blues), the compound difficulties of forecasting in the Tropics at all.

Almost worse is that great mechanical Voice of Conscience from the radio room next door. I mean the *human* voice from *inside* the plane up there coming in in the sunset, or when the field-lights have to be put on, or that plane invisible up there buzzing in the soup that's swallowing the wind-sock and the glass of the airport tower. That voice literally right there in the room with you comes seeking out your heart, asking for that Alaco which - well, some observers have considered suicide - you *hope* you've taken in to the radio desk five minutes ago when the

visibility on the ground socked in to an eighth of a mile again... The assistant mechanic in the crew whose wife is on the swing-shift at Lockheed, whose mother writes "Dear Son", who only wants to get in for those three V-letters waiting in the mail call...

Almost as thick as the soup? - But Max knows what I mean in one little intake of breath when we hesitate on the code figure for cloud-direction or visibility.

It's just this split second for war nerves, Mr. Doldrum Blues - but. of course, the mere suspicion of the air masses warring in your mind is enough to drive any observer's attention even farther afield.. Well, we *have* gone on from the hesitant code figure, even on to the completion of Fenton, Cloncurry - and 105. So, Mr. Forecaster. trusting in God again, we're racing on. It's a job, keepin' abreast of the weather, isn't it? - when traditonally nothing-is-more-variable-than...0300K, all the reports in, now going on the map. 0400K and the whole picture will have changed again. The map can only hope to keep up to the recent past. Here it comes, there it goes. The very best we can do is none too good. - Wonder if Gordy remembered to put Woodstock's report on the teletype message... in this eternal flux, this science like following a drop of water from the sky to to the sea, through eddies in small streams to currents in rivers...

Wonder how the pibal went at 214, 0200K this morning. Were the curlews in their weird chorus Was a barking Bush Hen putting in her two-"pence" worth somewhere off down by the river? Did John Ray run into another black-snake half way up the ladder as he came down from the theodolite? Did the gang have steaks in at Ma Smith's tonight? What a solitary cafe, what a town!

Here at Garbutt - a metropolis in comparison. Sidewalks! Pavement! Traffic! One from the bush or " orth" stares at the third and fourth stories on some of the buildings, has to be careful of the American-in-Australia habit of feeling safe on the wrong side of the street. But *milk* here, *eggs* here, *fresh vegetables*, even *ice cream* in crowded Milk Bars. *People* in and out - it's a carnival air, one big amusement park - until the sidewalks are rolled in at nine, and the empty trucks and busses wait in the empty dimmed-out main street for the three movies to let out.

At any rate, we reflect above the pounding of the teletype, here the animals are in cages in the Zoo instead of just anywhere around your tent. Then of course, there's the three and four a week Red Cross dances, and everyday Snackateria where Lois Elliman, Red Cross Worker, band singer from U.S., really believes in "Something for the Boys" when she leads two and three hour vocal jam-sessions for rotating roups of hepcats at the Piano. Some satellite making with the spoons, another Chattanooga-train-whistling from his laryngitis.

Or in your free time you can play tourist a bit more than you could at 214 where the boat came in on Wednesday and on Thursday the "train" ran. You can wander around in this land of chemist's shops and lunch called tea and dinner called tea and dessert called sweets. Where one gives anything a go and where a plain guy becomes a bloke or joker, even cobber or mate.

You might get to know a Sheila or Good Sort and step into one of those street-corner phone booths nailed on to a telephone pole to call her. A wood and glass and folding door contraption which boxes your head and body down as far as your hips leaving your legs and feet just standing there on the sidewalk - a booth you more or less "put on" like a flight jacket. Then be entertained *under* her house (also off the ground) up on stilts with this fern garden below.. There is a hammock swung between the pier-pilings.

Or you can write home your V-letter in the park under a BanyanTree Whose branch-borne roots almost reach the ground, sway around you in the Trade Winds - all the time wishing you were looking at a similar scene *painted* on that brick and plaster wall backing against the shoe store on Hollywood Boulevard where for fifty-cents (instead of so many shillings

and D's) you could have a nice little controlled dream of the far-away to a "Gold of the Seven Seas Cocktail" and a Tahitian orchestra.

Complaining? - Free mail, free outdoor (Fox-Garbutt) movies at the post. All this world travel and cut rate Chesterfields. Command Performances! And you can always just go back to bed at the barracks, sleep while Cope's little black puppy, Duke, gets everybody's socks out of his shoes into a helter skelter stack in the middle of the room. The other shift is forever rattling mess kits out to the truck. Just pretend it's a flock of peaceful cowbells and roll over.

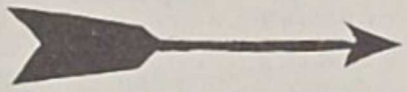
- But suddenly you smell celery soup. Are they cooking again over in the radio room across the hall? Well, we in the Weather Station had sandwiches, each the size of a small prefabricated house, and boiled lollies. And while you've been working head-down on the map, the 4A.? rush has come and gone. Pilots had flocked - in their sheepskins - into the Forecaster's office - dark brown leather jackets, sheepskin collars, gold and silver bars and stars shining in our blue daylight-lights, long before the east gets blue. And the forecaster, for latest indications that his earliest deduwere right, has been looking over your shoulder for Horn Island coverage and Moresby on the upper wind map.

Now the planes *with* these men roar out - right over your head it seems three inches over your head as you lean over the plotting table. Each shaking the building right after the other as you put in the low cloud five symbol for 285, DDF on 254.

Men and symbols carry on like these motors too fast and thunderous for the ground. Weather forever now drawing its own pictures captured now on charts, in figures, on picturesmaps. The atmosphere, in its unhampered Vastness, Air unwatched forever - now from the four corners of the earth giving away its age old secrets with every 0300K in Siberia, Africa, Iceland, Queensland, becoming just that much less unpredictable.

War Effort

And out of "War Effort" gradually emerges our unconditional peace with that Ole Debil Sky - our all-encompassing Air Way to show to men's hearts the logic of a Unit World. Age of Flight (from a slit trench) up into new horizons in the heart and mind. Age of Flight to the weird cries of the 214 curlews 0200K ballon run to the Forecaster's Doldrum frowns - while the pilots are still getting that quick sip of coffee with the all-night mechanics at the Red Cross booth (Lois' morning to serve). Age of Flight as an observer at Garbutt tenses up for a moment under his six layers of code.



We need pictures. Pictures tell stories, and we want to tell the story of the weather service. Here are a few hints on how to put the most story into your pictures.

Don't overlook the obvious. What is everyday potatoes to you may be hot stuff somewhere else.

Write a complete caption for the picture. Where it was taken and when, names and home towns of everyone in the picture what they are doing and why and any other information that rounds out the story told by the picture.

Don't overclassify. Remember that the existence and location of a weather station is seldom confidential after broadcasts have begun. Current weather ceases to be confidential after a week.

Send along the negatives if you can. If you can't then be sure you send the best print that can be made from the negative. It should be bright and snappy, but detail must not be lost in the highlights.

R.C.O. *Conference Notes*

The first conference of Regional Control Officers to achieve world-wide representation of the Army Air Forces Weather Service was held in Asheville, September 20-24, 1943. Patterned after the earlier conferences held in March and June of this year, questions brought up for discussion by the Regional Control Officers were talked over with the chiefs of the headquarters sections concerned and their staffs; while the remaining time was devoted to questions which the weather wing directed at the Regional Control Officers.

The September conference was able to present a wider and more complete picture of the weather service than any previous meeting. Combat theaters were represented for the first time, and the high point of the entire conference was the description and discussion by representatives from the active theaters of weather operations as they are now carried out under combat conditions.

Naturally, most of what was said in the course of the conference cannot be discussed under the classification of this Bulletin; it must suffice to say that the results of the conference are already being felt in the increasing efficiency and smoothness of operation of the Weather Services throughout the World. A few notes of general interest to Weather Officers, however, are presented herewith.

WEATHER OPERATION IN THE SOUTH PACIFIC

After the invasion of the Netherlands East Indies by the Japanese, several weather personnel of the U. S. Army turned up in Australia. These personnel were absorbed in stations where American and Australian air units were operating, and jointly operated weather stations were set up. It was not until the 15th Weather Squadron arrived in that theater that it was possible to abandon the joint stations and set up American-manned weather stations. This was done as rapidly as possible, and soon all American bases and major ferry transfer points had AAF weather stations.

The manner of organization and operation of the weather stations in the 15th region is best exemplified by the set-up at Port Moresby, the major air operational base in New Guinea. A weather central is centrally located in the Port Moresby area, connected by direct teletype with the AACS station, whence it receives weather messages intercepted and deciphered there. The weather central directly serves the headquarters of the air force commander by making 4-day forecasts on the basis of which strike missions are planned. These forecasts are discussed by conference telephone among the weather central and various headquarters, including fighter, bomber, and ferry headquarters. If there is disagreement, the weather central forecast is accepted as final.

Later forecasts are prepared for specific strike missions, and, when the times comes, operational forecasts are forwarded to the group staff weather officers concerned who brief the crews accordingly.

For the fighter command, forecasts of weather over enemy territory are made. These forecasts are used in estimating what enemy capabilities the air activities of the enemy for the day will be, and upon this estimate the operation of fighter sweeps and patrols is based.

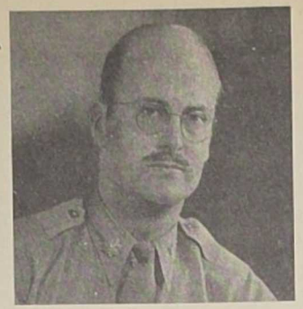
Smaller stations are located at dispersal fields in the Port Moresby area and are connected with the weather central by a teletype loop.

The pattern of the Port Moresby weather set-up is followed on a smaller scale at other bases. When the Japs were thrown out of Buna, for instance, two weather observers and an AACS radioman were sent in

REGIONAL CONTROL OFFICERS CONFERENCE

ASHEVILLE N.C. Sept. 20-24, 1943

1ST WEATHER REGION
COL. ROBERT L. EASTON



2ND WEATHER REGION
MAJ. ARTHUR S. FRANCIS JR.

3RD WEATHER REGION
COL. SIDNEY OFSTHUN

4TH WEATHER REGION
MAJ. FLOYD H. MAGAR

6TH WEATHER REGION
MAJ. KARL T. RAUK

7TH WEATHER REGION
LT. COL. RICHARD ARNOLD JR.

8TH WEATHER REGION
COL. ARTHUR F. MEREWETHER

9TH WEATHER REGION
COL. CARL W. CARLMARK

10TH WEATHER REGION
MAJ. WILLIAM E. MARLING

11TH WEATHER REGION
COL. HAROLD L. SMITH

12TH WEATHER REGION
LT. COL. JOS. A. MILLER JR.

15TH WEATHER REGION
COL. JAMES H. TWADDELL

16TH WEATHER REGION
COL. DAVID H. KENNEDY

18TH WEATHER REGION
COL. EDWARD G. SIMENSON

19TH WEATHER REGION
MAJ. HENRY A. MOONEY

20TH WEATHER REGION
MAJ. EUGENE T. EARLY

22ND WEATHER REGION
LT. COL. JAMES B. BAKER

25TH WEATHER REGION
CAPT. JAMES R. REYNOLDS

WEATHER RECONNAISSANCE SQUADRON
LT. COL. CLARK L. HOSMER

CHIEF, WEATHER DIVISION
COL. HUNTLEY H. BASSETT

STAFF WEATHER OFFICER, A.T.C.
COL. PAUL JOHNSTON

UNIV. METEOROLOGICAL COMMITTEE
DR. CARL G. ROSSBY

to make and report weather observations. This front-line station was gradually expanded and will continue to expand in the future as the operational demands upon it increase.

Besides briefing crews before their missions, the group weather officers interrogate pilots on landing to get post-flight weather reports which are immediately forwarded over command teletype lines to the weather central. The group weather officer in this theater is in a key poisition in his group and a strong correlation has been observed between the capability of the group weather officer and the operational efficiency of his group.

STAFF WEATHER OFFICERS' COURSE

At the Army Air Forces Tactical Center at Orlando, Florida, selected weather officers receive additional training to fit them for work in the staffs of groups and larger organizations, to which they are later assigned as staff weather officers. The courses of study include the functions of other branches of the Army which tie in with the Air Forces, but concentrate on the special duties of staff weather officers and such subjects as the tactical use of clouds, weather communications, briefing procedures, and conditions encountered in the theaters.

WEATHER OPERATIONS IN THE ALASKAN THEATER

Weather operations in Alaska are carried on jointly by the Air Forces, the Navy, and the Weather Bureau. A strategically located weather central operates, to a limited degree, in the same way that the original weather central in Washington functioned, making and transmitting analyses and forecasts for the entire area. Weather forecasting stations located at bases receive these forecasts on an advisory basis but are not required to make their own forecasts conform. Forecasts are also furnished to the Ground Forces and Supply Forces.

One major weather station is operated jointly by the Air Forces and the Navy, "command" of the station changing with the changing shifts according as the ranking officer on duty is Air Forces or Navy. This arrangement has worked out very well.

Upper air data and single station analysis procedures are being used with some success in the Alaskan theater, but many difficult forecasting problems remain to be solved. It is felt that climatological reports are of great value in this theater.

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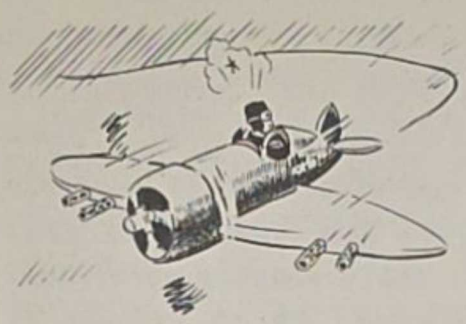
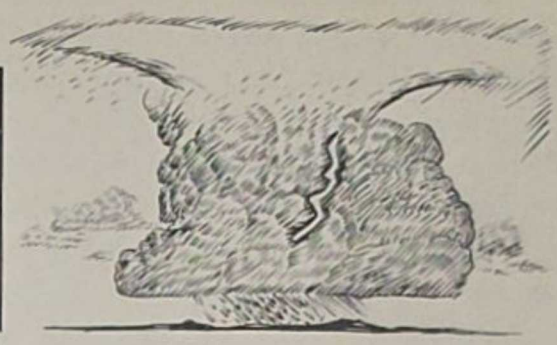
PROFESSORS TO HELP OUT

Our schools and colleges have contributed heavily to the training of Weather Officers. This wealth of scientific knowledge is to be made directly available in the theaters of operation for the solution of scientific problems as they arise in the field under a program now under way. Certain especially qualified civilian meteorological experts from participating colleges will visit foreign theaters where their particular knowledge or experience may prove helpful. Already requests have been made from several theaters for the temporary assignment of these special consultants to help get at particular weather problems, and plans are being made to get the program under way as soon as possible.



How it WORKS

by Col. A.Q. Mustoe



Having been in the European Theater of Operations for the past year as Air Force Weather Officer of the Eighth Air Force, I have been requested to give you a short talk on how the Air Force Weather Service works in the field and how it is used by an operating Air Force. What I have to say will not add to your technical knowledge but will, I hope, make a little clearer to you what is expected of you when you have completed your course here and have been transferred to various theaters or to stations here in the United States.

Today the A. C. weather service operates nearly all over the world except in enemy countries. We hope to be there before much longer.

In Great Britain a Weather Squadron is assigned to the Eight Air Force to furnish the required weather service. The only Air Forces unit in the United Kingdom, other than the Eighth Air Force, is the Air Transport Command, and this Weather Squadron also furnishes this unit weather service. The question has been asked numerous times why don't we use the RAF weather service and why do we need our own? Isn't that duplication of service? The answer is no, it is not duplication, but rather augmentation. American units in general operate from their own airdromes which are 100% American. Where American units do operate from RAF airdromes, if there is an RAF weather station, it is normally the practice not to establish duplicate American weather stations nor to assign American weather personnel other than possibly a weather liaison offcier. An exception to this is at ATC stations which I will discuss later.

It has been found from experience that for Aviation, centralized forecasting in the true sense of the word is not practical and is only a last resort expediency where shortage of equipment and trained personnel exists. In apparent contradiction to this statement, however, I will say that for combined operations or Air Force operations involving units from different airdromes which must operate together as one force or in support of each other, limited centralized forecasting is almost essential.

In general, however, it may be taken as an Air Force doctrine, that from a safety standpoint, every airdrome from which flying is conducted should have its own local independent forecasting station. No satisfactory method has yet been discovered of conveying to pilots a complete picture of the weather other than by a personal conference between the forecaster and the pilot, in front of completed weather maps and charts and with all of the other information available in a weather station. As long as the weather is perfect, and is certain to remain so for the duration of a flight, centralized forecasting would be as satisfactory as local forecasting. However, it is in bad, uncertain, or changeable weather that the forecaster really earns his money; and pure centralized forecasting cannot give the pilot the complete picture of the weather that he needs.

Hence, in the ETO our policy is to establish a weather forecasting station at every group airdrome and at the headquarters of each tactical wing and higher tactical headquarters.

The Eighth Air Force consists principally of the Air Force Hq, Bomber Command, Fighter Command, Air Support Command, and the wings and groups, plus the various service units including air depots. An air force can serve in two roles, offensive or defensive, or a combination of the two. The RAF and the Eighth Air Force based in England are today definitely on the offensive. The primary role of the Eighth Air Force is thus bombing of enemy objectives. The principal mission of the weather Service is therefore to forecast weather for the Bomber Command and the various bomb groups.

To provide weather service for the Eighth Air Force we have established a large independent weather forecasting station at the A. F. Hq., Bomber Command , Hq, Fighter Command and at each tactical wing. Each of these stations operates 24 hours daily and draws a minimum of 10 weather maps a day plus the auxiliary upper air charts. Practically all forecasting is done by a weather officer. Enlisted forecasters draw a certain number of weather maps and prepare limited forecasts, prepare or supervise the preparation of the various auxiliary charts, work on special studies, and supervise the work and training of the enlisted observers. They act as assistant forecasters and fill a vital role, but the primary burden of all operational forecasting falls on the weather officers. Each group airdrome weather station has a smaller staff than wings and higher Hq. and operates as a 24 hour observing station and limited forecasting station.

Now we come back to the central forecasting. It is a well known fact that no two forecasters will prepare identical forecasts even if all of the forecasts are good. For individual operations this is of minor importance. However, where large numbers of airplanes must take off from various airdromes, some widely separated, and must rendezvous at a certain point or points and must operate on a schedule which must fit with that of other units, it is essential that all units receive the same general forecast. This is particularly important in regards to the winds aloft. If each unit receives a slightly different wind aloft forecast and the courses are plotted and the flight times computed accordingly, many rendezvous will be missed, bomb groups may have to operate separately,escorting fighters or fighters may find nothing to escort and many planes may be lost. If, however, all units receive the same wind aloft forecast and plot their courses accordingly, even if the forecast is in error, all units will be effected alike by the error, and rendezvous should be successful. In addition, it decreases confidence for different units to receive different forecasts. Therefore, in the Eighth Air force all forecasting for bombardment missions or combined operations is centralized. For any particular operation the weather station at each wing and higher headquarters, A.F. Bomber Command, Fighter Command and Air Support Command will prepare completely independent forecasts and analyses. At a designated time each of these weather stations will be connected together by a conference scrambler telephone. One officer will preside over the conference; if a bomb operation, normally the Bomber Command weather officer. One officer will be called on to present his forecast and general analysis of the map. This is copied down, Each officer is then called on in turn for his opinion of the forecast or wherein he disagrees. After all officers have discussed the forecast the Bomber Command weather officer presents the final approved forecast if it is a bomber operation, or the Fighter Command weather officer if it is a Fighter operation. Each officer copies this forecast. If this is an operational forecast rather than a planning forecast, each wing weather officer then transmits this forecast direct to each group of his wing involved in the operations.

The group officer mimeographs or dittos the centralized forecast and at the crew briefing, prior to take off, issues a copy on a card to the navigator and/or pilot of each airplane. Prior to the briefing the weather officer studies the forecast in conjunction with local weather maps and charts so as to fully understand it and the reasoning back of

it. At the briefing he presents the forecast word for word. Then he explains or interprets the forecast and enlarges upon it by such details as will assist the pilots and crews in receiving a clear picture of the weather situation and conditions to be expected in route, at the target the route back and the bases upon return. At stations equipped with projectors the groups weather officer will project a weather map onto a screen. At other stations it is the usual procedure in explaining the weather to large numbers of people to draw the map analysis, fronts, isobars, and any special phenomenon on a large piece of plexiglass over a large map so that all can see it from a distance. A cross section is drawn to indicate cloud heights, types, and layers, temperatures and winds at various altitudes.

The group weather officer may have points of disagreement with the central forecast. He is not allowed to change this forecast in any way, but it is all right for him to explain his own ideas. Hence, he is nevertheless an important cog in the machine. Much depends upon his study of the local conditions and his presentation and interpretation of the forecast. The central forecast is simply a straight statement of the expected conditions. The interpretation should explain the reasons for and the possible variations of importance from the straight forecast.

Upon the return of airplanes from operations the group weather officer interviews a sufficient number of the pilots, co-pilots, navigators and/or other members of the crews to acquire a clear picture of the weather encountered in route and over the target. This he transmits to the Wing weather officer who in turn transmits a composite report to the Command weather officer. This is also included in the intelligence report of A-2.

Normally there are three weather telephone conferences daily between the weather officers of Wings and higher headquarters. Since our present combardment operations are being conducted during daylight hours our forecasts are made accordingly. The first conference is in the afternoon and the forecast is general in nature, and covering all areas rather than specific routes or areas. It is purely a planning forecast. Based on this forecast a decision is made by the Commanding General, Bomber Command, whether or not to schedule an operation for the following day. A target may be selected based entirely on the weather or it may be selected for other reasons even though the expected weather is not entirely suitable. The weather may be better at another target but the importance of hitting a particular target outweighs the weather factor. The mission may be cancelled entirely if the forecast is for definitely adverse weather.

The second weather telephone conference is held about midnight and this time the forecast is for a definite target area or areas, the bases and routes. It is still a planning forecast in that the mission may be cancelled or the target changed as a result. Neither this forecast nor the afternoon forecast is transmitted to the groups.

The final operational forecast is decided upon at a third telephone conference about 4:00 A. M. This forecast is transmitted to all units involved and finally to all pilots.

In addition to operational flights there are numerous daily individual or unit miscellaneous flights conducted from each airdrome. The group or station weather officer therefore has numerous route forecasts to prepare to all parts of the U.K. Air depots require fairly complete weather stations.

At the major ATC terminal an independent American forecasting station is operated to forecast for all American Trans-Atlantic flights. The RAF weather station, alongside, forecasts for RAF planes which also use this airdrome. This has proven desirable for two reasons. One is that the amount of air traffic warrants the two stations. The second reason is that American pilots who have just arrived from the United States and

are not familiar with British forecast terminology and methods are more at home with American forecasters and forecasts.

One of the chief requirements of any weather service is communications. The ideal system of weather communications is a teletype network, and we have been very fortunate in having such a network available in the United Kingdom. Unlike certain theaters where the country is less civilized and less thickly settled, we are able to utilize weather teletype almost exclusively. Rather than tying into the British network at numerous points, we have installed a more or less separate weather teletype network with most of our ties going to one point in the British network. The British have a central station which is a collecting and distributing agency for all available weather reports, both radio and teletype. Weather reports are received by radio from various sources and these are transmitted over the teletype Reports are also collected from all stations within the U.K. and these are likewise transmitted over the teletype. Unlike the American teletype network in which a number of stations are connected in series, a great many of our stations are connected to one point by direct line. For example: Two direct teletype circuits run from the British Central to each Wing and higher Headquarters. From each Wing a direct line runs to each of the group stations under the Wing. In a few cases, two or more groups are connected to one circuit.

In an active theater where the war is a war of movement, weather teletype is not always practical. This is particularly true in the advanced areas which are relatively unstable. It is therefore necessary in planning for a war of movement that special radio weather communications facilities with communications personnel be provided a weather squadron. While weather communications may on certain occasions be by wire, every weather station must be prepared to receive and transmit its weather reports by radio. As units move forward and rear airdromes become more or less permanent, it will be practical to install weather teletype networks in such areas.

While on the subject of teletype, I should like to mention the difference between the American and British machines and the methods of preparing weather reports. The British machines have standard keyboard and all reports are transmitted in the numeral code. Since we are connected to and thus form a part of the British weather network, it is necessary to transmit all our reports in the same code. In my opionion, and that of all I have talked to who have used both systems, the weather keyboard or the symbolic method of transmitting current weather reports is far superior to the numeral system, though there is no doubt that the latter should be used for synoptic reports or map signals.

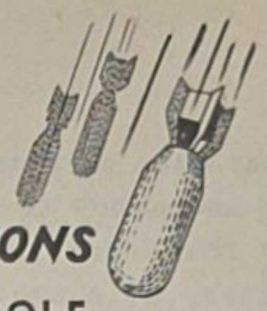
The Atlantic Ocean is a vast area. The ship reports which give a rather excellent picture in peace time are sadly lacking. To overcome this difficulty a number of weather reconnaissance flights are scheduled daily over the Atlantic. In addition, we receive reports from many of the planes which cross the Atlantic. It is surprising what can be done with a small amount of information when one is forced to depend upon it. Continuity on maps becomes of major importance, and great pains must be taken in analyzing them. It is therefore necessary to draw large numbers of maps, one every three hours, of the European area at all major stations. In addition, two or more synoptic maps are drawn daily of the United States, North Atlantic and the European area.

All weather information is considered confidential. However, all information going by teletype is transmitted in the clear. Also, it is permissible to transmit any weather information by scrambler telephone or by ordinary telephones if government lines are used which do not pass through the telephone switchboard of the General Post Office.

In closing, I would like to emphasize to you the importance of weather forecasts military and particularly Air Force operations. Mistakes in forecasting are inevitable. This does not mean that we should accept such a condition with complacency. Every plane cleared without the pilot having a complete and accurate under-

Continued to page 26

WEATHER BRIEFING *FOR*
EUROPEAN THEATRE BOMBING MISSIONS



by Capt. ROBERT T. POOLE

A bomber crew on the offensive over Europe has a great many things to do besides looking at clouds, and a great many things to think about besides the weather. I do not mean to imply that the weather is not important to these men nor to the success of their forays. I do mean that the weather is only one of many important considerations with which they must be familiar. For this reason, the material presented to the air crews at their briefing sessions must be trimmed of absolutely all non-essentials. At the same time, it must contain a maximum of important and useful information.

Weather briefing at the U. S. Army Air Force station at which I have been stationed has been systamitized to insure the most satisfactory results. Careful, and thoroughly systematic preparation precedes each briefing and a definite routine is followed. This routine varies somewhat according to the type of mission, the time of day, and the time allotted between briefing and take-off.

The forecasts as they come down from Wing Headquarters are reproduced; enough copies being made to provide one for each navigator with a few extra. The forecaster on duty may disagree with the forecast made at Wing Headquarters; but this forecast must be used nevertheless, although at the briefing session it may be enlarged upon and possible departures from it discussed. A separate list is made of all data in which only the bombardiers are interested; this includes such items as the mean temperature of the air column, the surface temperature, and the pressure altitude at the target. The lead navigator and the lead bombardier are given all data on winds, pressure altitude, etc., as soon as it arrives. A discussion is held with Flying Control about the wind conditions for take-off to decide which runway to use.

The preparation of the actual weather data to be used at the briefing includes a detailed study of the forecast sent down by the Wing Headquarters to eliminate any small errors which may have crept in. The latest synoptic map is analysed and the cross section made of the weather enroute.

In the briefing room, brief and emphatic presentation is important. We make it short and to the point. It gives a poor impression to read a forecast, so the forecast is memorized and the briefing officer uses only the weather cross section projected on the screen to boost his memory. Only data such as winds and temperatures, which must be correct to the last figure, are read. Items most interesting to the aircrews are the weather conditions at the target, the weather at the base for their return, wind and temperature at the cruising altitude, and special conditions such as condensation trails and icing which might affect their safety.

After the crews as a whole have been briefed and dismissed, the component members attend their own individual briefings. The Weather Officer is called upon again in the briefings for navigators and for bombardiers. It is the navigator more than any other crew member who uses weather forecast data. It is also the navigator who will upon his return give the most detailed information about the actual weather conditions. The lead navigator must be kept supplied with the very latest bits of dope. For this reason, the weather officer keeps track of what ship the lead navigator is in

and where the ship is dispersed, as it may become necessary to chase out to him just before the order is given to taxi. Each navigator, of course, gets a copy of the forecast so that if he becomes separated from the flight he can use it in returning alone.

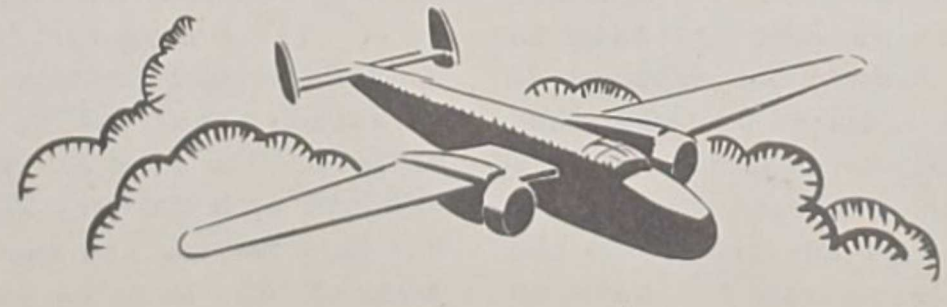
When a bombing plane is over its target, the bombardier is key man. The whole airplane was built, the crew trained, the bombs armed and loaded, all to become a precise instrument in the hands of the bombardier for a few exacting seconds. Every effort must be made to achieve accuracy at that moment, and the weather data given the bombardier is then of prime importance. The wind direction and velocity at altitude and throughout the air column over the target, the temperature at the ground, the mean temperature of the air column, the temperature at the cruising height, and especially the pressure altitude - these are the things the bombardier must know without guessing when the target is grasped by the cross-hairs in the bombsight. Of Course, in the case of pattern bombing, only the planes equipped with bombsights need be provided these specialized forecast.

The job is not always complete after the briefing sessions are over. The commanding officer always seems to have a few last minute questions, especially if there is any delay in take-off. The weather officer stays on the ball in his office. A change in forecast might come in, and must be distributed without delay. The wind might change and necessitate complicated changes in taxing orders for take-off from a different runway.

All in all, there are lots of things to remember, and a slip-up on one of them may prove altogether too costly. The way to make sure is to use a check list and check off every item. Here is one which might be used.

BOMBER BRIEFING CHECK LIST

1. Before The Briefing
   a. Examine the Wing forecast for possible errors
   b. Reproduce forecast - one per navigator and a few extra
   c. Transmit data to lead bombardier, lead navigator
   d. Decide on wind direction for take-off
   e. Prepare and analyse latest synoptic map
   f. Prepare atmospheric cross section of route
2. At The Briefing
   a. Make it short and to the point
   b. Don't read the forecast, except figure data
   c. Cover weather at the target
   d. Cover weather at base upon return
   e. Cover wind and temperature at altitude
   f. Cover special conditions affecting safety
3. Navigator Briefing
   a. Make sure each navigator gets a copy of the forecast
   b. Give exact figures on wind and temperature
4. Bombardier Briefing
   a. Cover temperature at target; ground, mean, and at altitude
   b. Cover winds at target
   c. Cover pressure altitude at target
5. After The Briefing
   a. Stay within reach, at the office
   b. Transmit last-minute changes to lead navigator, lead bombardier.
   c. Keep an eye on the surface wind



Headquarters Notes

ATTENTION HISTORICAL OFFICERS

"Activated a station at Blank." Five words, that's all. But one of the most fascinating stories of the weather service may be behind that activation. Why was it necessary to activate the station? Was there any struggle in having activation orders written and approved? What kind of place is Blank? Is it in the Arctic; or the desert; or in a newly cleared airport in the jungle? Who were the men who went there? One from Mississippi to the Arctic; an Iowa boy in the midst of the jungle; another from the State of Maine observing at an oasis in the desert? What were the men like? Was there any difficulty in getting them in? After the station was in operation did anything unusual happen? It did? Well, what was it? Write it all as a story--it's part of the history of your unit.

There's a whale of a story in the weather service, and it's up to the Historical Officer to write it. The first installment of the history of your unit is due on October 1, 1943.

The report should take the form of a story of the unit, supported by photographs and documents such as correspondence, directives, orders, etc. The following excerpt from Historical Officers Circular No. 2 should be kept in mind when writing the history:

"The unit history must be a complete chronological narrative *** Supporting documents are the backbone not only of the unit histories but also of the staff studies now demanded and must be available for vital use when the Army Air Forces have completed their work in this war."

A thorough reading of the Historical Officers Circulars is recommended before and after the history is written to see that all points have been covered.

Take pains with your writing. Exercise discrimination as to what items and events should be recorded. Send in copies of supporting documents as evidence. Keep in mind that your unit's solutions of a problem may help some other unit to a quicker solution of the same problem. Not only will your history help the Army Air Forces, but from it you will receive a more complete understanding of your unit. The research you will do may be of great aid in saving some project of your unit, by disclosing precedents established in similar cases.

Don't put off the writing until the last week in September. Work on the project every day. Write it now! Write it as a story

WEATHER ON THE ARMY HOUR

The Weather Wing was featured on the Army Hour Broadcast Sunday, 8 August 1943, when Colonel Senter and other personnel of the Weather Wing were heard on the coast to coast hookup of the National Broadcasting System. After a brief introduction, Colonel Senter, Commanding Officer of the Weather Wing, took over the broadcast and told of a few of the instances in which weather had played a decisive part in major battles of this war. He pointed out that the Japanese lost the Bismark Sea battle largely because they failed in their weather predictions. The storm they had been hiding in suddenly swung away, leaving their ships like ducks in a shooting gallery. The recent New Georgia action he stated, was accomplished with a minimum of loss because accurate weather forecasts made possible an approach under

protection of heavy clouds, mist, and rain. "All the warring nations are straining every effort", he said, "to build up their weather service. To arm our fighters with accurate weather information, hundreds of trained weather units maintain a weather service all over the world."

When a scheduled pickup from Alaska failed to materialize, Colonel Senter briefly described the problems which weather posed in the North Pacific. "It is in the waters adjacent to Attu that the weather is born", he said; "Practically every news story from the Aleutians has mentioned the weather. Good flying weather is rare and we face a grave responsibility because of rapidly changing conditions. The weather squadron there is doing its job." Colonel Senter went on to pay tribute to those who are making the weather service what it is. The most important ingredient, he pointed out, is men - trained, highly skilled, courageous men. "The Weather Wing is proud of the record of its officers and enlisted men who are giving our army the finest weather service in the world", was his frank commendation.

A switch to Denver, Colorado, was made to pick up the voice of Captain Innes-Taylor who, together with S/Sgts Arthur C. Hall of Chicago and Charles L. Howes, Jr. of Stamford, Connecticut, told of experiences on the Greenland ice cap.

When the program was turned back to Asheville, Colonel Senter pointed out that weather is the battlefield of the air and that air commanders require accurate knowledge of the atmospheric terrain just as ground commanders depend on contour maps and aerial photographs. In the Sicilian invasion, it was the weather officer, he said, who followed up the "on your mark" and "get set" ordered by the strategic commanders with final "go".

PROTECTING INSTRUMENTS

In moist climates, particularly in equatorial wet-hot regions, special protection is necessary to prevent weather instruments from deteriorating through corrosion and fungus growth. The best method of accomplishing this is by keeping the instruments in a dessicator or dry chamber. Such a dessicator can easily be made by placing a silica gel or calcium chloride in the bottom of a large lard pail or other container having a tight-fitting cover, and placing the instruments in this container on a small wooden platform. Silica gel is preferable to calcium chloride because it can be dried out by heating in an oven and used over again.

Another method is to construct a "dry closet" using light bulbs or a small electric heater unit to keep the closet warm. A theodolite kept on a permanent mount out of doors may be protected by inverting a tight-lidded pail over it, the lid being fastened to the stand beneath the theodolite, and placing a small container of drying chemical inside. A hasp connecting the lid to the pail can be padlocked to prevent tampering with the instrument.

Fungus growth on a theodolite can be removed by removing the affected parts and washing them in a special lens cleaning fluid obtained from the Base Photographic Laboratory. Other corrosion products can be removed with warm soapy water.

Continued from page 22

standing of existing and future weather, is a possible casualty. The proper briefing of each pilot for individual flights is important, but multiply this by a hundred or a thousand fold and consider how much depends upon you when you forecast for large scale military operations. Tremendous efforts of large numbers of persons and enormous quantities of valuable equipment are involved in large operations. Poor weather forecasts aside from endangering lives and equipment may easily cause failure of the mission. Accurate forecasts will save lives and and equipment and to a great extent assure success. As weather officers and forecasters you will fill jobs of great responsibility. Consider your work in this light and take full advantage of the opportunity to prepare yourselves to shoulder this responsibility.

REPORTS FROM THE REGIONS

6th WEATHER SOUADRON

The emblem you see at the top of this column is the new insigne of the 6th Weather Squadron. The slogan, when extracted from the Latin, is "In the knowledge of the winds lies the strength of wings". In Latin it's a motto, but in English we maintain it's just a slogan. The six stars at the top govern the fate of the cloud, the shower, and the peaceful lagoon.

An active seminar has been organized at APO# 825, meeting weekly on Monday afternoons. The papers which have been presented show that the 6th is making an important contribution to our weather knowledge of the tropics.

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15th WEATHER REGION

From the Fifteenth Weather Region comes word that a training program has been undertaken by the 317th Troop Carrier Group aiming at better understanding of common weather problems and their particular effect on flight operations by pilots and their crews.

It appeared that many complaints aimed at the Weather Service had their basis in misunderstanding on the part of the younger pilots of the group. The staff weather officer, in order to correct this situation, is issuing a series of weekly bulletins of practical value and interest. These bulletins are posted in conspicious locations where they will receive attention from pilots and other air crew members.

A sample bulletin contained the time of sunrise, sunset, and moonrise for the succeeding week. This was followed by a very timely and pointed discussion of ceiling, noting the manner in which a misunderstanding of the term "ceiling unlimited" had led to a near accident. A young pilot, upon receiving a weather report of "unlimited ceiling", let down through large scattered clouds and broke out underneath at a dangerously low altitude. The danger was doubly great because of the fact that the clouds capped several mountain peaks in the vicinity.

18th WEATHER REGION

The 18th Weather Region in England reports that a new manual has recently been compiled describing the construction and use of upper air contour maps. This manual is now in general use by the American forces throughout the European Theaters of Operations.

The officer responsible for this manual is Captain Kenneth A. Willard, formerly chief instructor in meteorology at Parks Air College near St. Louis.

It appears that Captain Willard has not been neglecting what he learned in school nor what he did in school. Following up his triumphs in inter-collegiate and amateur swimming, he recently starred in the ETO Championship swimming meet held in London. In competition with the 1936 olympic diving champion, Major Marshall Wayne, Captain Willard took first place in the three-meter dive event and placed second on the low board.

Captain Willard's swimming began at Northwestern University where he made the 1933 Big-Ten Championship Team.

NEW TYPE BAROGRAPH

A new type of mercurial barograph has been developed by Sgt. Fred Warren, student forecaster at the Los Angeles Fighter Wing, and the California Institute of Technology. The new barograph is claimed to record every change in the pressure field above the station to a remarkable degree of accuracy. The instrument consists of a mercurial barometer with a fluorescent light and a blocking layer photoelectric cell on opposite sides of the mercury column at its top. The photocell is shielded and inclosed in such a manner that the only light entering it reaches it from the fluorescent light across the top of the mercury column. A rise or fall of the mercury column decreases or increases the amount of light reaching the photocell and hence the electric current generated by it. This current is amplified and measured.

Editor's Note. The barograph described, although still subject to temperature correction, suggests an interesting refinement of the Draper weighing type barograph in which the temperature correction is automatically eliminated.

POISONOUS RESIDUE FROM HYDROGEN GENERATORS

A few weather stations have had rather unfortunate experiences with the improper disposal of the poisonous wastes from the Pan-American type hydrogen generator. In order to make sure that trouble is avoided in the future, all stations should check up to see that disposal methods used are safe.

The compound left over after the generation of hydrogen from ferro-silicon and caustic soda in the Pan-American generators is extremely poisonous to both vegetation and animal life, and may pollute food grown in polluted soil as well as drinking water. It will burn animal and vegetable tissues, skin, clothes, etc.

The best method of disposal is to bury the waste where it will be covered with at least three feet of earth. Where this cannot be done because of frozen soil, the residue should be buried under the snow on top of the ice of a large stream. By its chemical action it will melt its way through the ice and be sluiced downstream before the spring break-up. This should not be done where the stream is very small or where it is used for public water supply, and it must be remembered that the ice in that vicinity will be greatly weakened and should be avoided.

When there is no large stream nearby, an alternative method is to burn out a large stump and dump the residue in the center. Where the weather station is near the sea, the waste can of course be satisfactorily disposed of by dumping it in the water. At any rate, every precaution must be taken to insure that the poison does not get where it can affect human beings or animals nor plants which may be used for food or forage.

ABSTRACT

SOUTH ATLANTIC WEATHER

Transcontinental & Western Air, Inc., Intercontinental Division, Meteorological Department Technical Note No. 2, by Harry Olander and R. K. Dornaus.

Circulation

As shown in Figure 1, the general circulation over South America is controlled largely by the South Pacific high pressure cell, which with the low pressure center off the lower tip of the continent drives in surges of cold polar air. The South Atlantic high brings warm, moist air onto the northern part of the continent in summer. The circulation about these pressure systems is of course opposite to that found in the northern hemisphere.

FIGURE 1

Air Masses

Polar air reaching southern South Americasresembles mPK in North America. This air loses little moisture except over the Andes, until it reaches the mountains of Eastern Brazil where it is lifted, causing rain and long periods of fog. These polar air masses arrive greatly modified over northern and eastern Brazil. During certain periods of the year they stagnate there. Tropical maritime air masses which flow westward and then southward over the Brazilian hump are the controlling factor of most Brazilian weather. Tropical continental air is restricted mostly to the upper Amazon basin and is more moist than the usual cT air.

Fronts

Most cold fronts approach from the southeast, forming cyclonic waves off the east coast of Argentina. By the time the cold air mass has moved north to Brazil, the front usually lies in a nearly east-west line.

As the front crosses the mountains of eastern Brazil it may break in two if weak, with one part pushing up the coast and one inland. A stronger front will cross the mountains and acquire a V-shaped bend. By the time a front reaches the vicinity of Natal, it usually has a very slight slope and slow motion. A change of wind at the surface may be followed by a very gradual change of cloud types and "unsettled" weather for several days, until the air mass deepens sufficiently for significant frontal action to take place. North of Natal, fronts tend to stagnate and may oscillate north and south. If the South Atlantic high then builds up, it will push the front inland and cause rain and clouds which can usually be topped at 9,000 feet. Winds aloft and pilot reports are very valuable in forecasting retrogression of these fronts. Occasionally a front will cross the equator from the North Atlantic high, but little weather accompanies the front. When this happens in conjunction with a thermal low over the

interior of Brazil south-southwest of Natal, strong easterly winds at upper levels are found over eastern Brazil and the ocean to the eastward. On some occasions, a front may break up and leave an isolated area of bad weather.

The portion of cold fronts which pass over the ocean to the east of South America is important for over-ocean flights to Africa. Flight experience shows that turbulence in these fronts is seldom heavy and cloud bases are 1,000 to 2,000 feet high with tops at 8,000 to 9,000 occasionally extending to 12,000. Brief intervals of heavy precipitation occur.

The Intertropical Front

The intertropical front is the surface of discontinuity between the northeast and southeast "trades". It oscillates from Georgetown to Natal, moving sou*hward for five months and northward for seven months. In the Belem-Natal sector, the worst weather occurs from December to May. This front at times cannot be found either from surface reports, upper air reports, or flight records, but can and occasionally does develop into a very active front in a few hours. Development is caused by waves forming along the front and moving onto the land. It may vary rapidly between warm and cold characteristics. Advisabe
tics. Advisable practice is to land when the front is active and await more favorable conditions, since the clouds extend to 30,000 or even 40,000 feet with severe turbulence and heavy rain. Conditions are most severe at night and over land. When flying from South America to Africa, it is often easy to parallel the front for the entire distance without entering it; but a terminal near the front may experience rapid fluctuations of weather from zero zero to clear and back again. Winds in the region of the intertropical front are almost entirely easterly. The anti-trades seldom appear below 12,000 feet.

General Weather

Moderate or intense storms are seldom found in or around eastern Brazil except during the rainy season ad
during the rainy season and during the passage of the intertropical front. Fog seldom forms and when formed it dissipates quickly.

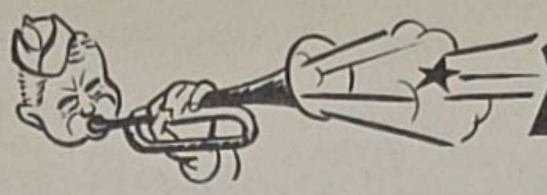
Cumulus and stratocumulus clouds predominate; altostratus and altocumulous also are frequent. Bases of lower clouds are 2,000 to 3,000 feet. Tops of stratocumulus vary widely about an average of 6,500 feet. Cumulous tops average 7,000 feet on the South America to Africa route, although at times they rise to 20,000 feet. Cumulonimbus tops in the Trinidad to Belem sector rise to 35,000 to 60,000 feet and contain severe turbulence.

Visibility is usually unlimited except in rain. Natal is often affected by local dust.

Thunderstorms may close in a destination for 20 to 40 minutes. A pilot finding a storm over his destination should stay well clear of the storm until it has moved on. They move usually west southwestward. An over-water rout southwestward. An over-water route should be chosen for daytime or early night flights, and a land route night flights, and a land route for flights in the early morning.

The question occasionally is asked whether a man on duty with the Army can submit papers for publication outside the Army. The answer is yes. In fact, contributions to knowledge of all sorts are encouraged, and there is usually no objection to any distribution the officer wishes to make. except in the cast of classified matters. However, army regulations do require approval of all papers before they are released for publication.

One of the functions of the Weather Service Bulletin is to provide a means for weather service personnel to get their work published. However, there will doubtless be some papers which should be presented to other professional groups, such as aeronautical engineers or hydrologists, or should receive the attention of civilian as well as army meterologists. In these cases the papers should be published in the most suitable place.



AT THE HIGH SCHOOL LEVEL

Elements of Pre-Flight Aeronautics for High Schools

Science of Pre-Flight Aeronautics for High Schools

The "Air-Age Education Series" of sixteen books is designed to provide high schools with adequate material for preparing students to understand the part played by aeronautics in the world of today and tomorrow. Out of these sixteen volumes, the above two contain substantial sections devoted to meteorology.

The first of these books, "Elements of Pre-Flight Aeronautics for High Schools", contains much the same material on meteorology as is found in practically all of the recent crop of books aimed at air-minded youth, but it is written with a school teacher's eye toward getting across a few painless lessons in physics. Essentially, it is a re-hash of various publications beginning with Byers' "Aeronautical Meteorology" and winding up with the Army's Technical Manual, "Basic Weather for Pilots". It contains little material that is not better presented elsewhere, but is adequate for its job of providing the budding aeronaut with some meteorology and some general science. The only contact which air forces weather personnel might have with this book will not be felt until students given training with it begin to appear in the ranks of pilots. At that time, weather officers may find themselves called upon to amplify some of the sketchy explanations or to correct the few statements which might have given an erroneous explanation.

The section on weather in the volume "Science of Pre-Flight Aeronautics for High Schools", is considerably more pretentious but retains the same characteristics. It was obviously compiled from well known texts by a man not too fundamentally interested nor expert in meteorology. Explanations tend to wander far from what is needed by a pilot, or would-be pilot, and to make him into a rather hap-hazardly trained meteorologist.

STRATEGIC AIDS IN THE SOUTH PACIFIC

Meteorology of the Marshall Islands (Strategic Bulletins of Oceania, Number 2

Meteorology of the Caroline Islands (Strategic Bulletins of Oceania, Number 7

These two bulletins, compiled by the Cross-Cultural Survey of the Institute of Human Relations at Yale University, give sufficient statistical data to establish working values for the means, annual periods, and diurnal periods of the meteorological elements in their respective regions. Variability about the means is not sufficiently presented, however, since nearly all the data is in the form of monthly means. The impression left is that the weather shows very little variability, so that forecasting would be a matter of interpreting diurnal and seasonal changes. The only hints that the situation might be more complicated is to be found in the data on the number of bright, overcast, and rainy days -- with only diurnal variations, why should a given month have 3 bright days and 8 rainy ones?

Forecasters will find more help from some of the comments on wind variability, cloud directions, and types of stroms than from statistical value found in the tables. These comments reveal that the weather is not quite as domesticated as the tables make it out to be and indicate that there is still much to be learned about weather in the tropics.

BOOK LIST ON WEATHER

Weather in Relation to War, A List of Reference (The Library of Congress, Division of Bibliography, Washington, D. C., 1943)

A bibliography is one of the most important tools of the research worker; and, for anyone undertaking research on the various opinions which men have held on the effect of weather on the art of war, the bibliography on the subject prepared by the staff of the Library of Congress would be most useful. The casual reader, however, will find this publication a little disappointing unless he is of a historical turn of mind.

Out of some 250 references, very few are to articles or papers published before World War I. A rather large, group has its origin in the works inspired by the experiences of the first World War, the flow of papers being strong up to the early '20s. References to works published in the late '20s and early '30s are few, but the renascence of meteorology in the middle and late '30s up to the present time, has produced a large number of references not all of them related directly to wartime applications of meteorology: many general references, such as the booklet on Air Mass Analysis by J. Namias and others are included.

There are a great many titles which offer intriguing vistas that might be followed by any man with access to the library and sufficient leisure. For the weather forecaster who plans to remain in this profession after the war, this bibliography will be a handy and interesting guide, although it is but little fitted for a place in the weather station library as far as immediate operations go.

WEATHER RESEARCH IS NEEDED MORE THAN EVER

One result of the short range forecast verification program has been to point up the fact that we still know regrettably little about forecasting the weather. We must also, it is clear, apply every scrap of knowledge which we do have to every forecast in order to make it as nearly perfect as possible.

There is a wealth of weather information available which is not being used. A lot of it we don't know how to use -- yet. The AAF weather research program is getting behind the problem of gathering knowledge, making it useful, and then getting it out to everybody in the field.

Naturally some of that new knowledge is going to originate right in the field from the work of the thousands of weather officers now going out to active duty in foreign theaters. Also, some of those theaters will have problems which may best be solved by a specialist or or some special facility somewhere else. It is matching the brains to the problem, and getting the answer out to where it is needed, that the Research Division is working on.

WEATHERMAN'S SONG

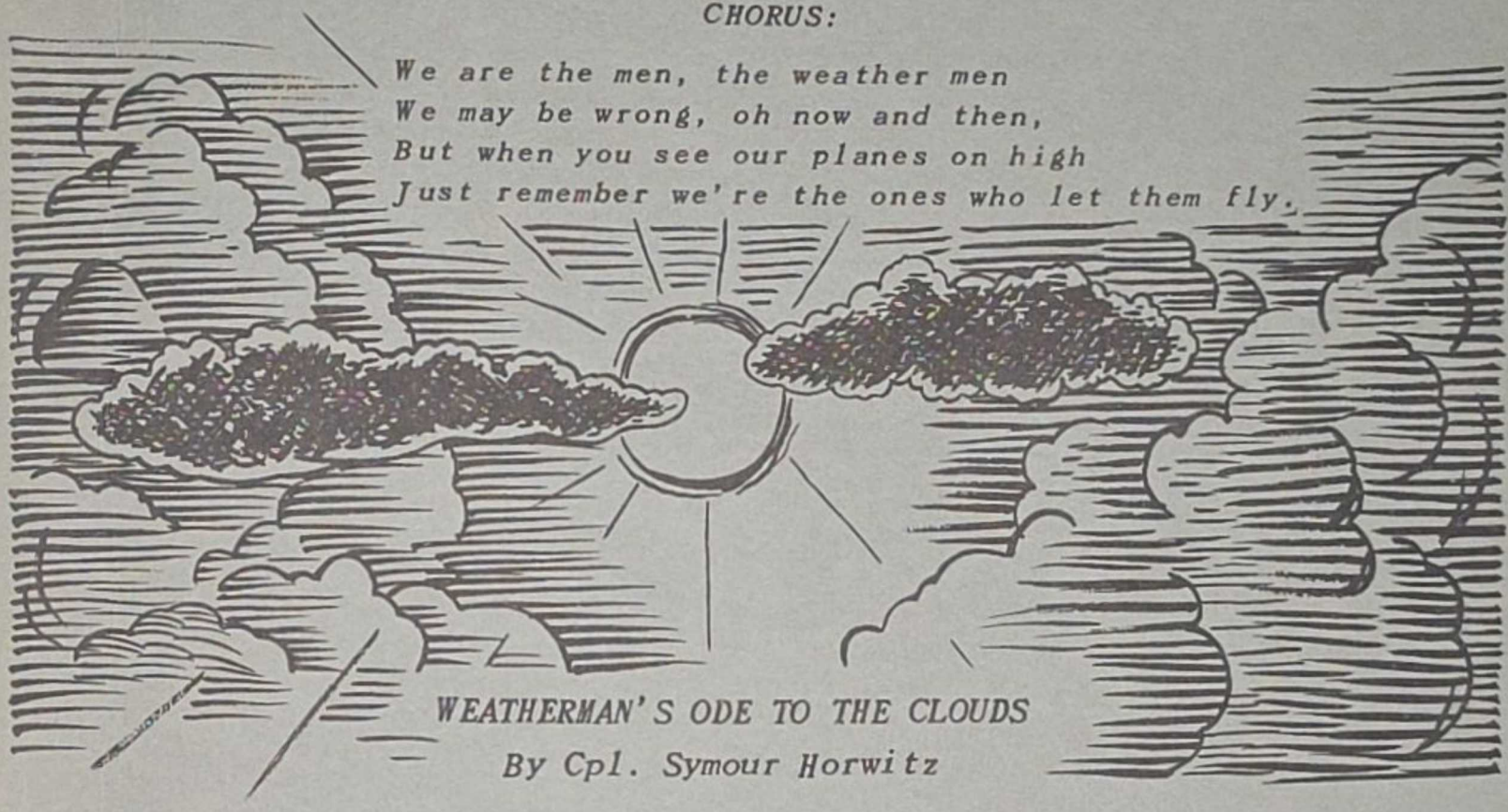
(To the tune of McNamara's Band)

Teletype, synoptic, shot, anemometers
going around
Our pressure lines are intertwined,
our fronts are underground
The winds that blow from high to low
have blown me off the track.
I'll have to throw my books away
and use the almanac.

I'll never forget the day was wet,
the general wanted to fly.
He said, 'My boy, is it O.K. for
me to go on high?'
When I said no, it's going to snow,
you should have seen him frown
Say I'm the only one, who ever
kept the general down.

CHORUS:

We are the men, the weather men
We may be wrong, oh now and then,
But when you see our planes on high
Just remember we're the ones who let them fly.



WEATHERMAN'S ODE TO THE CLOUDS

By Cpl. Symour Horwitz

gaze upon your lovely forms,
Your beauty brings rapturous feelings;
My soul must yield to Weather Forms
That label you coldly - a 'cig.

The red-hued sunset that 'cirrus bears-
To an artist, a poet, it mattered;
But I must shun the exquisite world
And record 'Hi brkn low sctd'.

The sunlight dances on towering clouds,
A glory of Nature at best,
But not so for me, poor weatherman.
To me its 'Twrg cu W'.

The blanket of soft white-tufted cloud,
It awes you most at night.
Inscribed 'Ac at 9 thsd ft'
'Tis no hint of a beauteous sight.

So realize the torment that wracks my soul
When the sky with cloudforms is replete,
and duty compels me to limit my gaze
And determine the cig in ft.

And so it is ever for shift upon shift
A battle 'twixt soul and mind,
While the former raves on in rhetorical drift,
The other to beauty is blind.

NEW YEAR'S GREETING

ARMY AIR FORCES
HEADQUARTERS, WEATHER WING
ASHEVILLE, N. C.

With two years of war behind us, the Army Air Forces Weather Service looks forward to the year 1944 with confidence and determination. May we all join in the hope that this year will bring victory to the United Nations and strive with singleness of purpose that peace may return to the world.

Although this issue of the Bulletin will not reach the field until after the New Year, I wish to take this opportunity to extend best wishes to each member of the Weather Service wherever he may be.

W O Senter

W. O. SENTER
Colonel,
Commanding