

## Weather Forecasting



## Weather People and Service

The National Weather Service (NWS).

- Part of National Oceanic and Atmospheric Administration (NOAA).
- Reports the weather of the U.S. and possessions.
- Issues warnings.
- Supports aviation, marine, agriculture, forestry.
- Maintains nations basic weather network.
- Operates two storm-warning services.

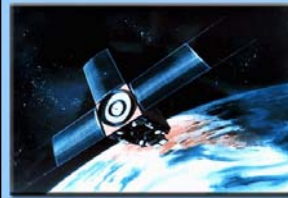


## Weather People and Service

- The Air Force Weather Agency.
  - Works in conjunction with the NWS.
  - The armed services have their own weather services.
  - Serves as DoD's primary weather production facility.
    - 1000 agency members at 20 locations.
    - Executes a worldwide weather support mission.



## Weather Data Collection



**Defense  
Satellite  
Program**

**WC-130  
"Hurricane  
Hunters"**



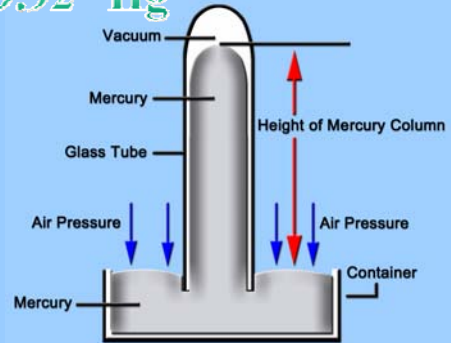
## Near-Surface Measuring Instruments

- **Barometer**

- Invented in 1643 to measure atmospheric pressure.
- Force is transmitted in all directions through any fluid, easily measured by observing the height in a column of liquid.

## Standard Day: Barometer

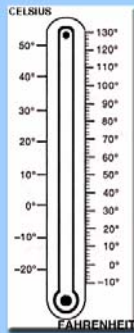
29.92" Hg



## Near-Surface Measuring Instruments

- **Thermometer**

- Used to measure temperature.
- Most common type is the mercury thermometer.
- If temperature increases, the mercury expands.



## Near-Surface Measuring Instruments

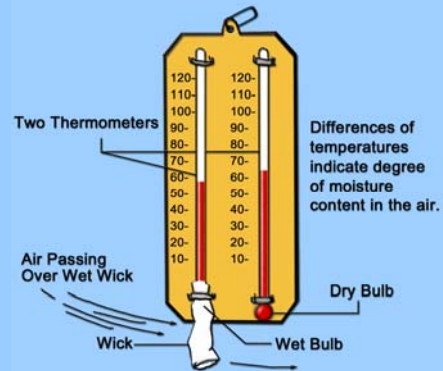
- **Hygrometer**

- Instrument to measure the amount of moisture in the air.
- Uses the change in length of an organic object.
- The fiber tends to lengthen in damp air.

## Near-Surface Measuring Instruments

- **Psychrometer**
  - Used to measure relative humidity.
  - Two similar thermometers are mounted side by side.
    - Dry bulb
    - Wet bulb

## Psychrometer



## Worldwide Sensing and Surveillance

- Pilot Balloons
  - Pilot balloon observations (PIBALS) help determine cloud height.
  - Elapsed time is multiplied by standard rate to compute height.

### Balloon Story – T-38



### Radiosonde (show real example)

- Instrument for measurement and transmission of pressure, temperature and relative humidity.
- Carried into the atmosphere by balloons or rocket mounted.
- Ceiling of 100,000 feet.

## Worldwide Sensing and Surveillance

- **Dropsonde**
  - A radiosonde that is dropped by parachute from aircraft.
  - Primarily used over water or areas where ground stations aren't maintained.
- **Rawinsonde**
  - Upper air observation that evaluates wind, temperature, relative humidity, and pressure aloft.
  - Carries a corner reflector so it can be tracked by radar.

## Worldwide Sensing and Surveillance

- **Storm Detection Radar**
  - Gathers data showing rain, hail, thunderstorms, tornadoes and hurricanes.
  - Doppler radar detects the intensity and direction of storms

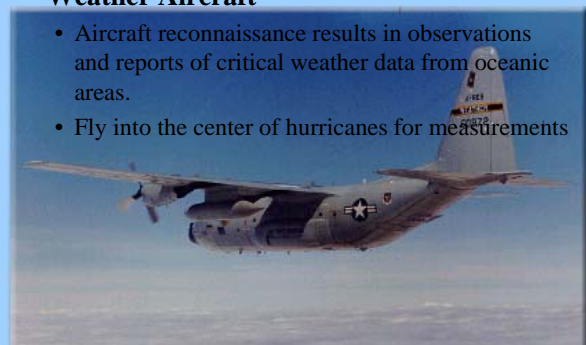


## Radar

- (Radio Detecting And Ranging)
- Radar systems gather information by bouncing radio waves off objects.
- Forecasters use a special radar called Doppler. . [LINK FOR DOPPLER EFFECT TWO](#)
  - A high-powered antenna rotates and sends out pulses or radio waves.
  - A computer combines the radar information with a map to show where the rain is falling.

## Worldwide Sensing and Surveillance

- **Weather Aircraft**
  - Aircraft reconnaissance results in observations and reports of critical weather data from oceanic areas.
  - Fly into the center of hurricanes for measurements



## Worldwide Sensing and Surveillance

- **Solar Observation Network**

- Monitors the events occurring on the Sun.
- Monitors solar radiation through space and the radiations effects on the Earth.



## Weather Satellites

- Enable weathermen to view nearly entire planet.
- Carry advanced photographic measurement equipment.
- Can measure the temperature of the surface.
- Using these satellites cloud cover over a larger part of the Earth could be photographed 24 hours a day.



## Weather Satellites

- **Geostationary Satellites**

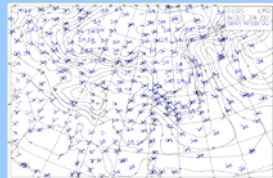
- A satellite that circles the Earth above the equator at the speed as the Earth's rotation.
- The Geostationary Operational Environment Satellites (GOES) program provides timely global and weather information.



## Weather Satellites

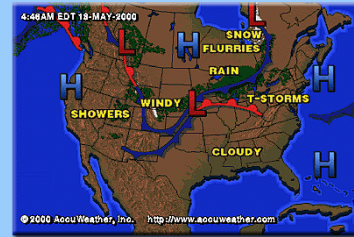
- **Other weather collection sources.**
  - Weather data is also collected from reports from aircraft and ships.
  - The **Automatic Surface Observing System (ASOS)** is a joint effort of the NWS, FAA and DoD.
    - ASOS has the largest and most modern complement of weather sensors and has significant expanded information available to forecaster and the aviation community.
    - ASOS works non-stop, updating observations every minute, 24 hours a day, every day of the year.

## Communicating Weather Data



## Weather Maps

- Give a synoptic view of the weather showing simultaneous conditions over a large area.



## Computers

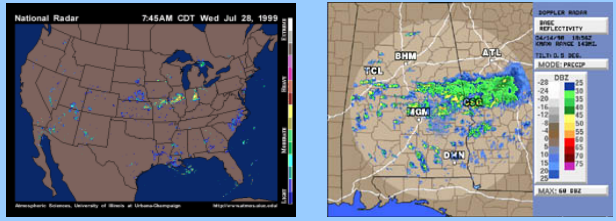
- Located at main forecasting centers.
- Use models and statistical data to predict weather.

## Sources of Weather Information

- **Flight Service Station (FSS).**
- Pilot's Automatic Telephone Weather Answering Service (PATWAS).
- **Automatic Terminal Information Service (ATIS).**
- Transcribed Weather Broadcast (TWEB).
- En Route Flight Advisory Service (EFAS).

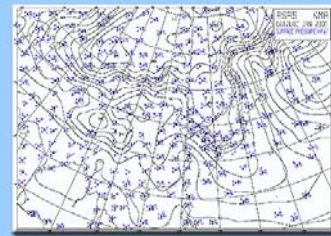
## Radar Summary Charts

- Shows only precipitation.
- Used mainly in pointing to areas of likely dangerous weather.



## Surface Analysis Chart

- Depicts pressure patterns, fronts, surface winds, temperature and dew points, restrictions to visibility, and other vital preflight planning.



## Forecasting as a Service

- Providing a Specific Service.
  - Forecasters must be prepared to give specific answers to specific questions.
  - Forecasting is not an exact science.
  - Aviators continually check weather conditions against predictions.

## Forecasting as a Service

- What the Forecaster Can Do.
- Records show that the forecaster can predict the following weather information at least 75 percent of the time.
  - The passage of a fast-moving cold front within 2 hours of its arrival up to 10 hours in advance.
  - The passage of a warm front or a slow-moving cold front within 5 hours of its passage up to 12 hours in advance with 75 percent accuracy.
  - The rapid lowering of visibility in pre-warm front conditions within 4 hours of the time it occurs.

## Forecasting as a Service

- The beginnings of a thunderstorm within 1 or 2 hours of its arrival with the aid of radar.
- The time that rain or snow will start falling within 5 hours of its actual arrival time.
- The rapid deepening of a low-pressure center and its associated bad weather.

### Category Definition—Likely Effects

|               |  |
|---------------|--|
| <b>ONE:</b>   | <b>Winds 74-95 mph:</b> No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal road flooding and minor pier damage.  |
| <b>TWO:</b>   | <b>Winds 96-110 mph:</b> Some roofing material, door, and window damage to buildings. Considerable damage to vegetation, mobile homes, and piers. Small craft in unprotected anchorages break moorings.  |
| <b>THREE:</b> | <b>Winds 111-130 mph:</b> Some structural damage to small residences and utility buildings with a minor amount of curtainwall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures with larger structures damaged by floating debris. Terrain may be flooded well inland.             |
| <b>FOUR:</b>  | <b>Winds 131-155 mph:</b> More extensive curtainwall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Major damage to lower floors of structures near the shore. Terrain may be flooded well inland.  |
| <b>FIVE:</b>  | <b>Winds greater than 155 mph:</b> Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Major damage to lower floors of all structures located near the shoreline. Massive evacuation of residential areas may be required. |

\*In operational use, the scale corresponds to the 1-minute average sustained wind speed as opposed to gusts which could be 20 percent higher or more.

### The Six-Year List of Names for Atlantic Storms

| 2005     | 2006     | 2007      | 2008      | 2009      |
|----------|----------|-----------|-----------|-----------|
| Arlene   | Alberto  | Andrea    | Arthur    | Ana       |
| Bret     | Beryl    | Barry     | Bertha    | Bill      |
| Cindy    | Chris    | Chantal   | Cristobal | Claudette |
| Dennis   | Debby    | Dean      | Dolly     | Danny     |
| Emily    | Ernesto  | Erin      | Edouard   | Erika     |
| Franklin | Florence | Felix     | Fay       | Fred      |
| Gert     | Gordon   | Gabrielle | Gustav    | Grace     |
| Harvey   | Helene   | Humberto  | Hanna     | Henri     |
| Irene    | Isaac    | Ingrid    | Ike       | Ida       |
| Jose     | Joyce    | Jerry     | Josephine | Joaquin   |
| Katrina  | Kirk     | Karen     | Kyle      | Kate      |
| Lee      | Leslie   | Lorenzo   | Laura     | Larry     |
| Maria    | Michael  | Melissa   | Marco     | Mindy     |
| Nate     | Nadine   | Noel      | Nana      | Nicholas  |
| Ophelia  | Oscar    | Olga      | Omar      | Odette    |
| Philippe | Patty    | Pablo     | Paloma    | Peter     |
| Rita     | Rafael   | Rebekah   | Rene      | Rose      |
| Stan     | Sandy    | Sebastien | Sally     | Sam       |
| Tammy    | Tony     | Tanya     | Teddy     | Teresa    |
| Vince    | Valerie  | Van       | Vicky     | Victor    |
| Wilma    | William  | Wendy     | Wilfred   | Wanda     |