

UNDERSTANDING WEATHER

Learning Objectives:

As a result of this session the participant should:

- Become familiar with the types of clouds and fog
- Understand the effects of air masses fronts and pressure have on weather
- Be aware of storms and their effects and impacts
- Be familiar with the various sources of weather information

Resources:

Boating Skills & Seamanship, Eleventh Edition, U.S. Coast guard Auxiliary, Chapter 10
Chapman Piloting Seamanship & Small Boat Handling, 62nd Edition, Hearst Marine
Books, Chapter 14

Material and Equipment:

Equipment Items

Overhead Projector, as required by instructor

Material Items

Provide one copy for each participant:

The Beaufort Wind Scale Handout

General Barometer Rules Handout

Boat Weather Log/Local Weather Observations

Instructor Qualification:

U.S. Coast Guard Auxiliary Trainer presence required for USCGAUX Certificate
Program

U.S. Power Squadron Instructor, Council Venturing Trainer or equivalent

Time Allocation: 1.5 Hours

Session Plan:

Classroom Session

1. Module Introduction.

- a. Introduce yourself and each member of the module staff.
- b. Explain the objectives of this module.

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2. **Weather Introduction.**

- a. Describe briefly the effects of heat from the Sun on air pressure and flow.
- b. Describe briefly the effects of the Coriolis Force on global atmospheric circulation.
- c. Explain briefly dew point and relative humidity.

3. **Clouds.**

- a. Describe briefly how clouds are formed.
- b. Identify using the International System of Cloud Classification the following:
 1. High Clouds (Above about 18,000 to 20,000 feet)
 - (a). Cirrus (Ci)
 - (b). Cirrocumulus (Cc)
 - (c). Cirrostratus (Cs)
 2. Middle Clouds (From about 7,000 up to 20,000 feet)
 - (a). Altostratus (As)
 - (b). Altostratus (As)
 3. Low Clouds (From near ground up to 7,000 feet)
 - (a). Nimbostratus (Ns)
 - (b). Stratocumulus (Sc)
 - (c). Stratus (St)
 4. Vertically Developed Clouds
 - (a). Cumulus (Cu)
 - (b). Cumulonimbus (Cb)
- c. Describe briefly how reading the local cloud signs help forecast the weather.

4. **Fog.**

- a. Describe briefly the following types of fog:
 1. Radiation Fog (ground)
 2. Advection Fog (coastal or warm air over cold water)
 3. Precipitation Fog (frontal)
 4. Steam Fog (cold air over warm water)
 5. Upslope Fog
 6. Ice Fog
- b. Describe briefly the effects the yearly seasons have on fog frequency.

5. **Wind.**

- a. Describe briefly the effects heating land and water has on land and sea breezes.
- b. Distribute the handout “The Beaufort Wind Scale” and briefly cover its contents and the effects wind has on water.

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6. **Air Pressure.**
 - a. Describe briefly how high and low pressure areas are formed.
 - b. Distribute the handout “General Barometer Rules and describe briefly the effects barometric changes have on wind velocity and shifts.
7. **Air Masses and Fronts.**
 - a. Describe briefly the characteristics of high and low pressure air masses and flows.
 - b. Explain briefly “Buys-Ballot’s Law” to determine the location of a low pressure area.
 - c. Describe briefly the definition of a “Front” and the characteristics of the following:
 1. Cold Fronts
 2. Warm Fronts
 3. Stationary Fronts
 4. Occluded Fronts
8. **Storms.**
 - a. Discuss briefly the following three requirements for the development of a thunderstorm:
 1. There must be strong upward air currents
 2. The air forming the storm must be buoyant relative to the area outside the storm
 3. The air must have a very large concentration of water vapor
 - b. Describe briefly the four characteristics of a thunderstorm:
 1. A layer of cirrus clouds shaped like an anvil (anvil top)
 2. The main body of large cumulus clouds of great heights and cauliflower sides
 3. The roll cloud formed by violent air currents along the leading edge of the base of the cumulus cloud
 4. The dark area within the storm (rain, with hail and rain at the edges)
 - c. Describe briefly the characteristics of the following:
 1. Tornadoes (land) and
 2. Waterspouts (marine)
 3. Microbursts
 - d. Describe briefly how extra-tropical cyclones develop between warm and cold air masses.
 - e. Describe briefly how hurricanes (tropical cyclone) are developed with a counterclockwise circulation origin.
9. **Weather Information.**
 - a. Describe briefly the following communication sources of weather information:
 1. Recorded telephone marine weather forecasts.

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2. National Weather Service (NWS) broadcasts
 3. NWS forecast advisories and warnings
 4. Short wave radio and facsimile weather map
- b. Describe briefly the following other sources of weather information:
1. Pennants, Flags, and Lights
 2. NWS Weather Maps (facsimile transmitted)
 3. NWS Marine Weather Services Charts
 4. Television Weather Maps (The Weather Channel)
 5. Local or Network News Programs
- c. Distribute the “Boat Weather Log/Local Weather Observations” Form and discuss keeping personal weather information as a source for weather forecasting.

Note: The Boat Weather Log/Local Weather Observation Form is suitable for use on recreational boats.

Source: Chapman Piloting Seamanship & Small Boat Handling

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THE BEAUFORT WIND SCALE HANDOUT

<u>Beaufort Number</u>	<u>Miles per Hour</u>	<u>Knot</u>	<u>International Description</u>	<u>Effort observed on water</u>
0	Less than 1	Less than 1	Calm	Sea like a mirror.
1	1 – 3	1 – 3	Light air	Ripples with appearance of scales; no foam crests.
2	4 – 7	4 – 6	Light breeze	Small wavelets; crests of glassy appearance; not breaking.
3	8 – 12	7 – 10	Gentle breeze	Large wavelets; crests begin to break, scattered whitecaps.
4	13 – 18	11 – 16	Moderate	Small waves 0.5 – 1.25 meters high, becoming longer; numerous whitecaps.
5	19 – 24	17 – 21	Fresh	Moderate waves of 1.25 – 2.5 meters, taking longer form; many whitecaps; some spray.
6	25 – 31	22 – 27	Strong	Larger waves 2.5 – 4 meters forming; whitecaps everywhere; more spray.
7	32 – 38	28 – 33	Near gale	Sea heaps up, waves 4 – 6 meters; white foam from breaking waves begin to blow in streaks.
8	39 – 46	34 – 40	Gale	Moderately high waves (4 – 6 meters) of greater length; edge of crests begin to break into spindrift; foam is blown in well-marked streaks.
9	47 – 54	41 – 47	Strong Gale	High waves (6 meters); sea begins to roll; dense streaks of foam; spray may reduce visibility.
10	55 – 63	48 – 55	Storm	Very high waves (6 – 9 meters); with overhanging crests; sea takes a white appearance as foam is blown in very dense streaks; rolling is heavy and visibility is reduced.
11	64 – 73	56 – 63	Violent Storm	Exceptionally high (9 – 14 meters); sea covered with white foam patches; visibility still more reduced.
12	74 – 82	64 – 71	Hurricane	Air filled with foam; waves over 14 meters; sea completely white with driving spray; visibility greatly reduced.

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GENERAL BAROMETER RULES HANDOUT

- Usually foul weather is forecast by a falling barometer, and with winds from the east quadrants.
- Clearing and fair weather is usually forecast by winds shifting to west quadrants from a rising barometer.
- When the wind sets in from points between south and southeast and the barometer falls steadily, a storm is approaching from the west or northwest, and its center will pass near or north of the observer within 12 to 24 hours. With the wind veering to northwest by way of south and southwest.
- When the wind sets in from points between east and northeast, and the barometer starts to fall steadily, a storm is approaching from the south or southwest. Its center will pass near or to the south of the observer within 12 to 24 hours, with the wind backing to northwest by way or north.
- The rate and the amount of fall in the barometer will indicate a storm's rapid approach along with its intensity.
- A falling barometer and a rising thermometer often forecast rain.
- Barometer and thermometer rising together often forecast fine weather.
- A slowly rising barometer forecasts settled weather.
- A steady, slow fall of pressure indicates forthcoming unsettled or wet weather.

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BOAT WEATHER LOG

Yacht _____ At/Passage _____ to _____

Day _____ Date _____ Time Zone _____ Skipper _____

1. Latest Weather Map: Date _____ Time _____ Summary of forecast and of principal regional weather features _____

2. Radio Weather Reports Received (state source and time) _____

3. Local Weather Observations _____

4. Remarks and Local Forecast for Next _____ Hours (state time forecast effective)

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LOCAL WEATHER OBSERVATIONS

Time _____

Latitude --- Degrees, minutes: _____

Longitude --- Degrees, minutes: _____

Course --- Degrees magnetic: _____

--- Degrees true: _____

Speed --- Knots: _____

Barometer --- Inches. or Millibars: _____

--- Tendency: _____

Clouds --- Formation: _____

--- Moving from: _____

--- Amount: _____

--- Changing to: _____

Sea --- Condition: _____

--- Swells: _____

--- Moving from: _____

Temperatures --- Air, dry bulb: _____

--- Dewpoint: _____

--- Water: _____

Visibility: _____

Wind --- Direction, true: _____

--- Shifting to: _____

--- Velocity, true: _____

--- Force (Beaufort): _____

Weather --- Present: _____
