Lecture 2
Outline of Today’s Lecture
• Evolution of Earth’s Early Atmosphere
• Introduction to Satellite Imagery
• Introduction to Weather Maps

Evolution of the Atmosphere
• Early atmosphere formed with large amounts of hydrogen and helium
• What happened to H and He?
  Theories:
  – Lighter gases escaped to space
  – Planetary collisions removing large amounts of the gases
  – Active solar wind blew lighter gases away

Evolution of the Atmosphere
Then what?
• Outgassing (H₂O, N₂ CO₂)
• O₂ added through photosynthesis by anaerobic bacteria

Evolution of the Atmosphere
Then what?
• Ozone formed: O + O₂ = O₃
• Cosmic snowballs (H₂O); 5-30 of these comets enter the atmosphere every minute
**Global Observing System**

Satellites observe:
- Clouds
- Water vapor
- Precipitation
- Surface properties (temperature, snow cover, vegetation, etc.)

**Two Types of Orbits:**
- Geostationary – Monitors fixed spot on Earth’s surface
- Polar orbiting – Orbits poles with Earth revolving below

**On April 1, 1960,** the nation’s first weather satellite, “TIROS I” was launched into orbit.
Polar Orbiters

- Global Coverage
- High resolution
- Passive and Active Sensors
- Non-continuous Coverage

POES Satellites

Polar orbiting satellites are closer to Earth, so can give Higher resolution imagery. They also cover the entire Earth.

Geostationary Satellites

- Continuous Imaging Possible
- No global coverage
- Only passive sensors
GOES Satellites
Geostationary satellites rotate with the Earth, so can provide time lapse movies of storms and cloud motions.

Three common types of imagery
- Visible
- Infrared (IR)
- Water Vapor (WV)

GOES-10 Visible
Visible image not color enhanced

GOES-10 Infrared image color enhanced

GOES-10 Visible
Visible image not color enhanced
Infrared

- Uses IR to measure cloud top or surface temperature
- 4 km resolution
- Useful in determining approx. cloud top altitude

Water Vapor

- Detects water vapor in upper troposphere
- Uses IR (6.2 mm)
- 8 km resolution
Weather Maps

• Weather time: a global standard used by all meteorologists.
• Interpreting Surface Observation Symbols
• Understanding contours.
• Combining data resources.
Plotted Station Data

Analysis of Station Data

Surface Observations

Temperature

Current weather

Dew Point Temperature

Weather Maps

Cloud Cover

Surface Pressure

Wind Speed and Direction (wind barb)
Winds

Direction: wind blows towards the station circle.

Cloud Cover

0% Cloud Cover - Observation: Clear Skies
25% Cloud Cover - Observation: Scattered Clouds
75% Cloud Cover - Observation: Broken Clouds
100% Cloud Cover - Observation: Overcast
Vision Obscured
Missing Data

Common Current Weather Symbols

Understanding Contours

Elevation contours separate lower and higher heights.
**Temperature and Isotherms**

Isotherms are contours that separate lower and higher temperatures.

**Isobars and Isotherms:**

Color Adds Information

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Isobars are contours that separate lower and higher pressures.
Isobars and Wind

Combining Data Resources