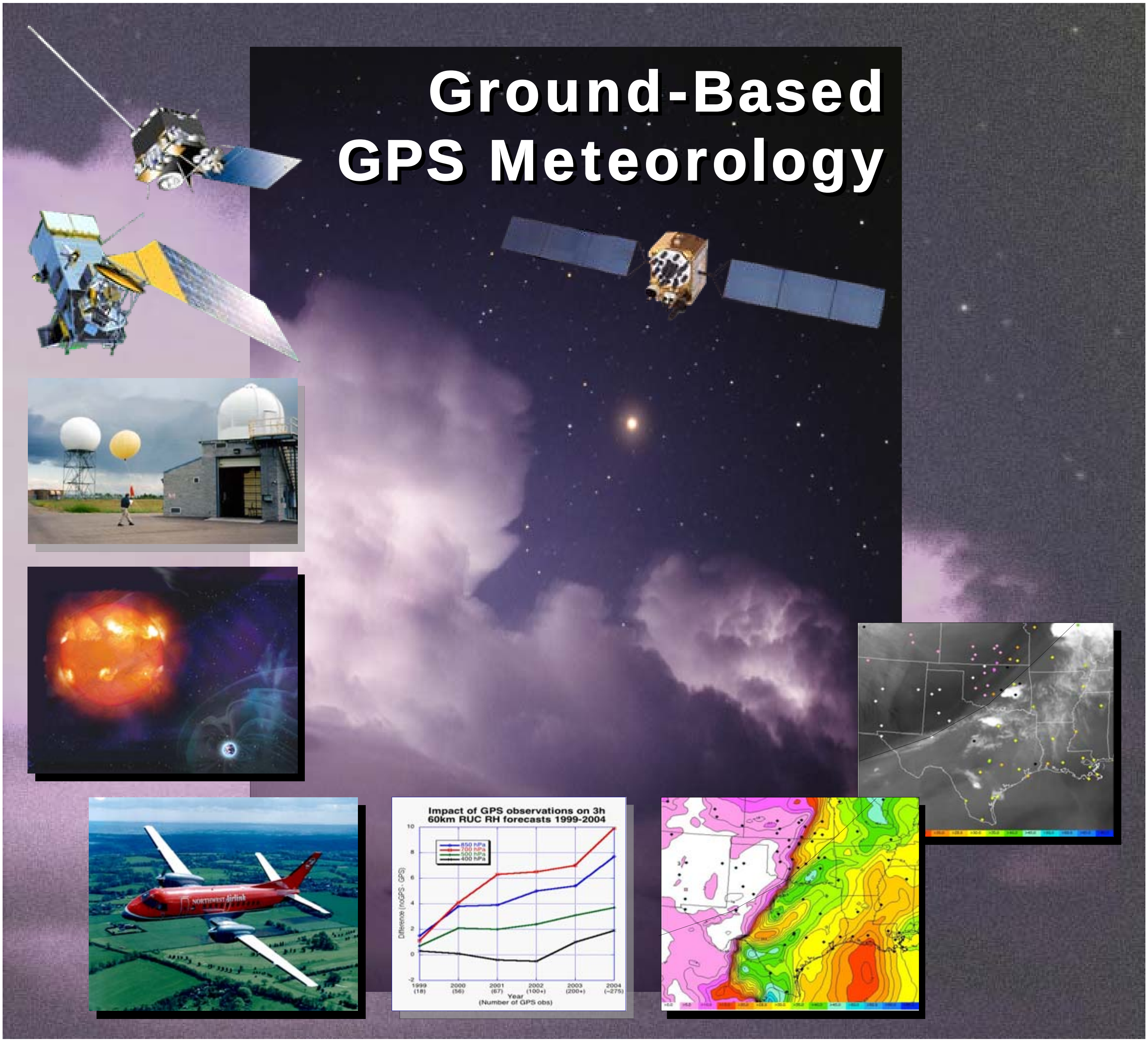
Ground-Based GPS Meteorology



Ground-Based Global Positioning System Meteorology (GPS-Met)

- Measures water vapor in the troposphere
- Monitors total electron content (TEC) of the ionosphere
- Provides low-cost, high-accuracy data under all weather conditions

Applications in:

- Weather/Space Weather forecasting
- Climate monitoring
- Observing systems verification
- Satellite calibration/validation
- Improved GPS positioning

NOAA Mission Goals Addressed:

- Climate
- Weather and Water
- Commerce and Transportation
- Environmental Satellite Data Quality and Reliability

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GPS Meteorology

NOAA Research – Earth System Research Laboratory in Boulder, Colorado developed GPS Meteorology in collaboration with the University Corporation for Atmospheric Research (UCAR) and several NOAA Joint Institutes to develop, test, and evaluate techniques to use the Global Positioning System (GPS) to monitor water vapor in the lower atmosphere.

Observing water vapor in the atmosphere is important because it is the means by which moisture and latent heat are transported to cause "weather". As a greenhouse gas, water vapor plays a critical role in the global climate system. This role is not restricted to absorbing and radiating energy from the sun, but includes the effect it has on the formation of clouds and aerosols and the chemistry of the lower atmosphere.

Atmospheric processes over a wide range of temporal and spatial scales depend on water vapor, but it is still one of the least understood and poorly described constituents of the Earth's atmosphere. There are many reasons for this, most of which involve the fact that the distribution of water vapor can vary greatly in time and space, especially during active weather conditions. This makes water vapor difficult to observe with conventional observing systems such as:

- Radiosondes (weather balloons) which are launched only twice daily from widely spaced locations in the U.S. and around the world. Radiosondes capture regional features fairly well under most circumstances, but generally miss the smaller-scale events like thunderstorms, tornados, and heavy precipitation. Radiosondes provide the standard data set against which all other measurements are compared, but they have problems that can be difficult to identify without additional information.
- Surface measurements of dew point temperature convertible to relative humidity are made frequently at land sites throughout the world, mostly at airports, but these tell us very little about moisture content in the atmosphere above the surface.
- Satellite observations are made globally, but also have limitations. In general, satellite-based water vapor estimates derived from upwelling infrared radiation have high horizontal resolution but coarse vertical resolution, and are reliable only in cloud-free regions. Estimates derived from space-based microwave radiometers are valid in cloudy regions, but are generally reliable only over the ocean.

Along with the other observing systems in the Integrated Earth Observing System/ Global Earth Observing System of Systems (***IEOS/GEOSS***), GPS provides improved, reliable, high-accuracy environmental measurements for global weather forecasts, climate monitoring, GPS positioning and navigation, and research. By collocating GPS with other observing systems such as the ***GCOS/Global Upper-Air Network***, we can ensure the accuracy and reliability of climate observations made by radiosondes and satellites far into the future. This is because the accuracy of GPS measurements using atomic clocks actually improve with time, making GPS an ideal climate observing system for today and tomorrow!