Atmosphere

Atmospheric temperature

As with humidity, atmospheric temperature data are a core requirement for weather forecasting and are addressed within the CGMS framework. The data are used for NWP, for monitoring inter-annual global temperature changes, for identifying correlations between atmospheric parameters and climatic behaviour, and for validating global models of the atmosphere.

Data on atmospheric temperature is derived partly from satellite observations. For global NWP, polar satellites provide information on temperature with global coverage, good horizontal resolution and acceptable accuracy, but improvements in vertical resolution are needed. Performance in cloudy areas has been poor, but the new microwave measurements such as AMSU have provided substantial improvements. As in the case of humidity profiles, the Aqua, METOP, NOAA, and NPOESS missions offer comparable improvements in vertical resolution for measuring atmospheric temperature (using AIRS+, AMSU-A, CrIS, HIRS, IASI, MSU).

For regional NWP, polar orbiting satellites provide information on temperature with acceptable accuracy and good horizontal resolution, but with marginal temporal frequency and vertical resolution for mesoscale prediction. Advanced radiometers or interferometers planned for future satellites should improve on the vertical resolution and accuracy of current radiometers.

Geostationary satellites provide frequent radiance data, but their use over land is hindered because of the difficulty in estimating surface emissivity. In nowcasting, the temperature and humidity fields are particularly useful for determining atmospheric stability for predicting precipitation type, the amount of frozen precipitation, and convective storms. As with humidity profiles, nowcasting predictions using atmospheric temperature data will benefit from hourly geostationary infrared soundings (such as from the GOES and MSG series).

The combination of the HIRS/3 and AMSU instruments on the NOAA and METOP series allows improved information, sufficient to infer temperature within several thick layers in the vertical. On the METOP series, IASI will also be used with other instruments to deliver comparable sounding capacity. CrIS on the NPOESS series, which will replace HIRS, is designed to enable retrievals of atmospheric temperature profiles at 1K accuracy for 1km layers in the troposphere. The GRAS instrument on METOP will provide temperature information of high accuracy and vertical resolution in the stratosphere and upper troposphere (helping to improve analyses around the tropopause). Its information will thus be complementary to that provided by the passive sounding instruments on METOP. China's FY-2 series of satellites, will feature improved measurements from 2003 with the addition of new spectral channels to their IVISSR instrument.

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