VALIDATING THE MSU RECORD USING GPS OCCULTATION DATA

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Earth' s climate is traditionally monitored according to surface air temperature. In order to monitor upper air temperature one must either use radiosonde data or space observation. Space observation provides global coverage, while the measurement in itself becomes indirect and bulks a certain volume.
Since 1978 the nadir-viewing Microwave Sounding Units (MSU) aboard the NOAA series of TOVS satellites have yielded trends in brightness temperature, conforming to the emission of greenhouse gases that correlate strongly to specific pressure levels. Channel four measures outgoing radiation from oxygen, the brightness temperature of which is a surrogate for atmospheric temperature in a several kilometer layer centered at 70hPa. Five view angles are used to average out instrument noise. Calibration is accomplished by interpolating radiance between an onboard hot target and free space. Systematic errors may arise because each of the eleven (thus far) satellites was launched in a slightly different orbit with slightly different calibration targets. Complex averaging techniques have been applied to obtain a data set suitable for long-term trend detection. The intended representation of bulk tropospheric or stratospheric temperature has however been questioned due to calibration difficulties.
Since 1995 low-Earth orbiting research satellites have intermittently tracked radio signals from the GPS satellites as Earth's atmosphere occulted them. Precise knowledge of the signals Doppler shift and hence its bending leads directly to refractivity versus height profiles, which in turn is a function of atmospheric density and humidity. Since humidity contributes little to refractivity above the lower troposphere, refractivity profiles can in conjunction with the hydrostatic equation be inverted to pressure and temperature profiles in the stratosphere and upper troposphere. These data have the unique property of absolute calibration.
We collect GPS occultation data from GPS/MET, Oersted, Sac-C, and Champ, to pinpoint periodic misjudgments in the existing climate record. Global and zonal results of the two alternatives are compared with those from the NCEP reanalysis project.