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Long-term Variations in the Microwave Brightness Temperature of the Uranus Atmosphere

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Uranus' appearance is changing as its 2007 equinox approaches. Latitudinal banding and discrete cloud features are reported at visible wavelengths and evidence of aerosol variability in the upper atmosphere has been reported in the near-IR. At radio wavelengths, the south pole has appeared brighter than lower latitudes. Microwave observations probe the ~5 to ~50 bar region of the atmosphere, well below the cloud tops. Changes in microwave brightness temperature with time and wavelength are expected to provide insights into seasonal processes affecting the planet's deep atmosphere.

Here we report observations of changes in Uranus' 3.5-cm microwave brightness temperature using NASA's Deep Space Network (DSN) antennas at Goldstone, California. Twelve observing "campaigns" from 1984 through 2002 with the 70-m diameter antenna indicate that Uranus' brightness temperature declined from a maximum of ~255 +/- 10 K (circa 1984-86) to ~200 +/- 8 K in 2002.

The "2002 Campaign" is primarily being carried out by middle-school and high-school students from classrooms across the nation. The students and their teachers are participants in the Goldstone-Apple Valley Radio Telescope (GAVRT) science education project, which is a partnership involving NASA, JPL and the Lewis Center for Educational Research in Apple Valley, CA. Working with the Lewis Center over the Internet, GAVRT students conduct remotely controlled radio astronomy observations using 34-m antennas at Goldstone. Their data are validated by professional scientists and incorporated into the data base.

We intend to observe Uranus for several years and to coordinate our work with observers at visible and infrared wavelengths and the Very Large Array. The objective is to develop a comprehensive description of the troposphere and improve dynamical models of the planet.

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