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

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Variations in Microwave Temperature of Uranus

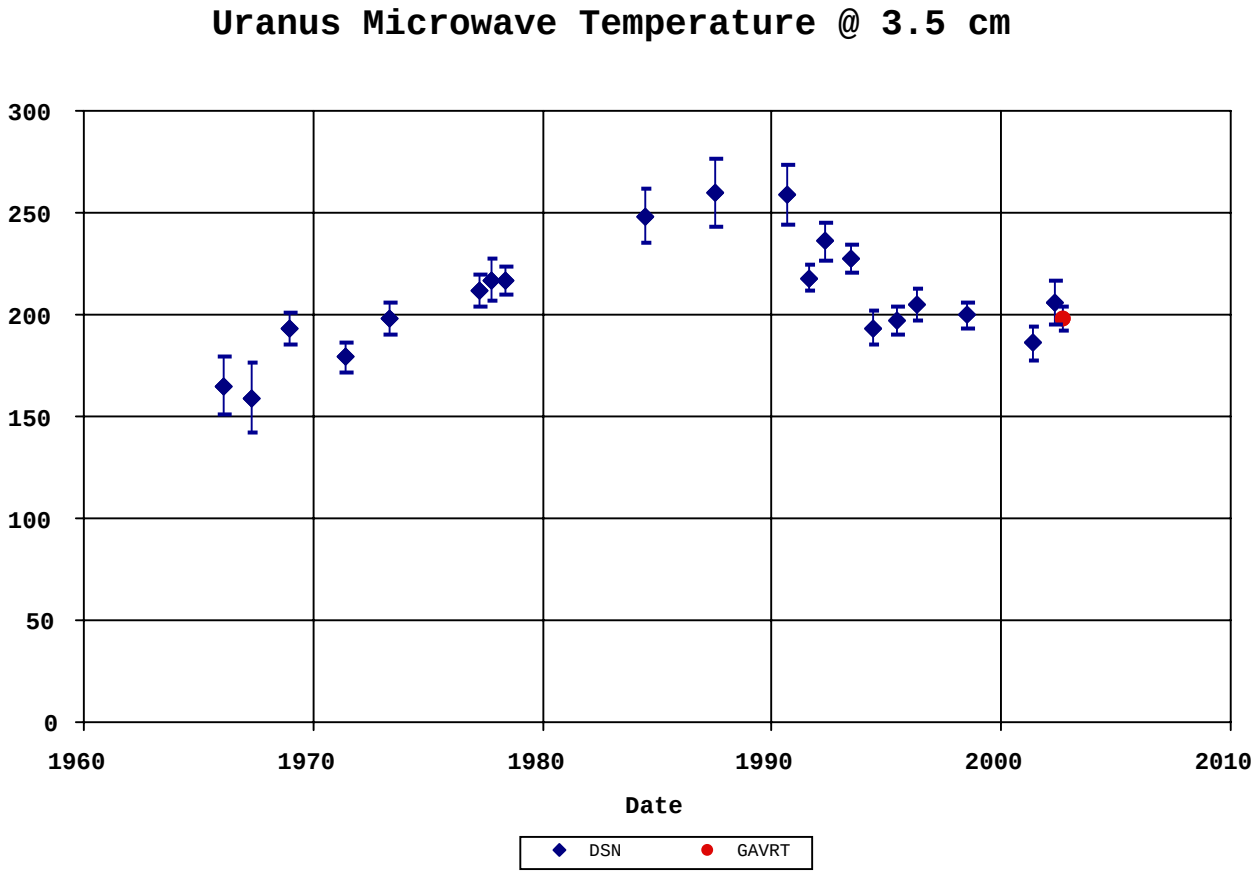
Long-term changes in microwave brightness temperature have been observed near 3.5 cm wavelength for 38 years

Klein et al 1966, Klein & Turegano 1978, and this work)

Microwave emission near 3 cm originates below the visible clouds deep in the atmosphere where p ~15-40 bars

Are the temperature changes

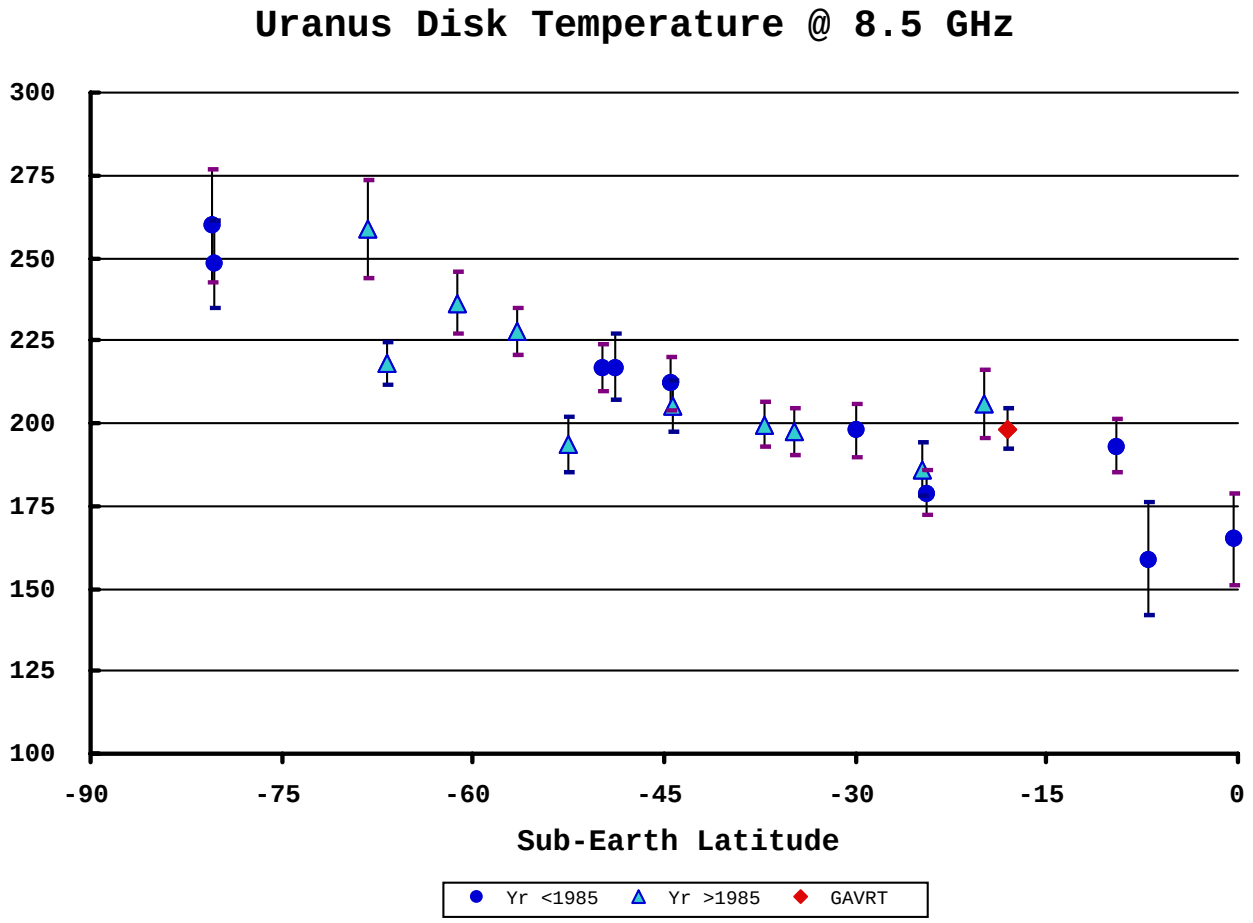
- seasonally driven?
- produced by viewing geometry (latitude)?



Variations in Microwave Temperature of Uranus

Plotted as a function of sub-earth latitude, the long term changes appear to be geometric and consistent with a “south polar cap”:

- Microwave opacity is less near the poles and microwave emission originates from depths where T~250K and pressure P~40 bars
- Microwave opacity is greater at lower latitudes & microwave emission originates higher in the atmosphere where (T~185K; p~ 15 bars)



Variations in Microwave Temperature of Uranus

VLA maps at 2 cm & 6 cm show the contrast between the bright South Pole and lower latitudes increased significantly from the 1980's to the 1990's

(Hofstadter & Butler 2002; and this meeting)

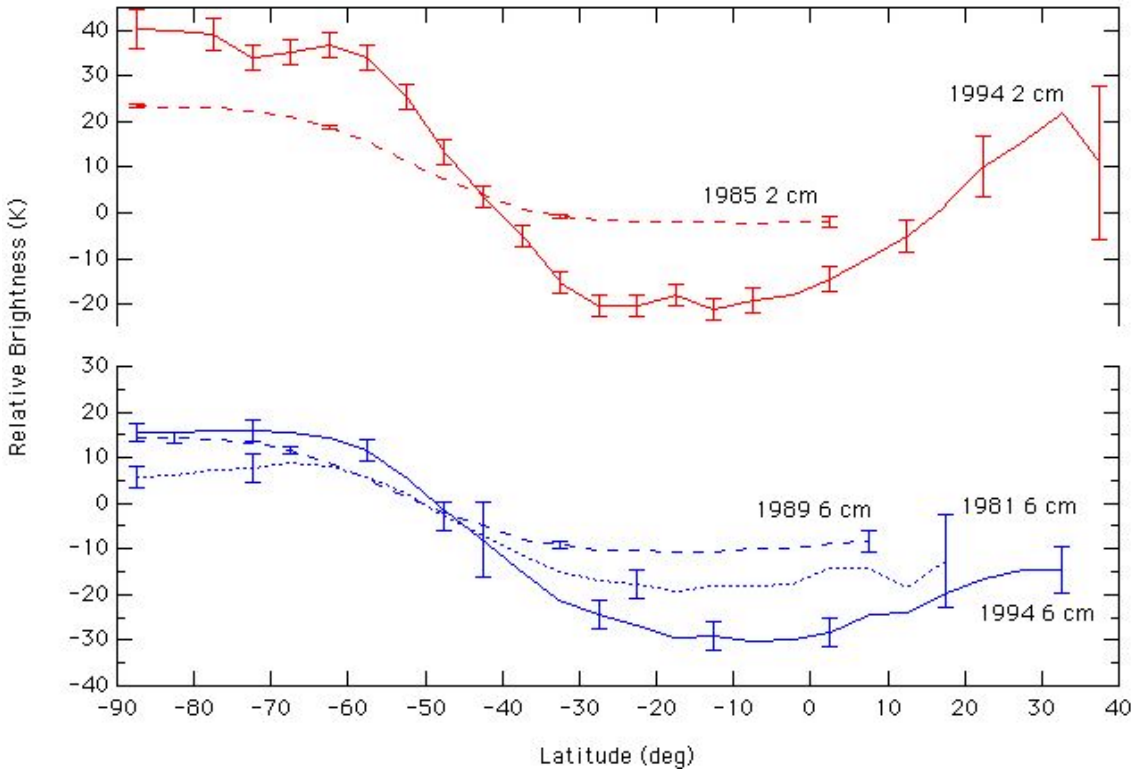
- DSN observations yield average disk temperature from 1984-1990 was

T_d~254 K +/- 6 K

- DSN observations from 1990 to 1994 show ~50 K drop in temperature

T_d ~254 K ==> ~200 K

- Computer modeling work will be done to learn how the VLA maps and DSN disk temperatures are related.



The 3.5 cm microwave observations will be extended in partnership with GAVRT

Goldstone-Apple Valley

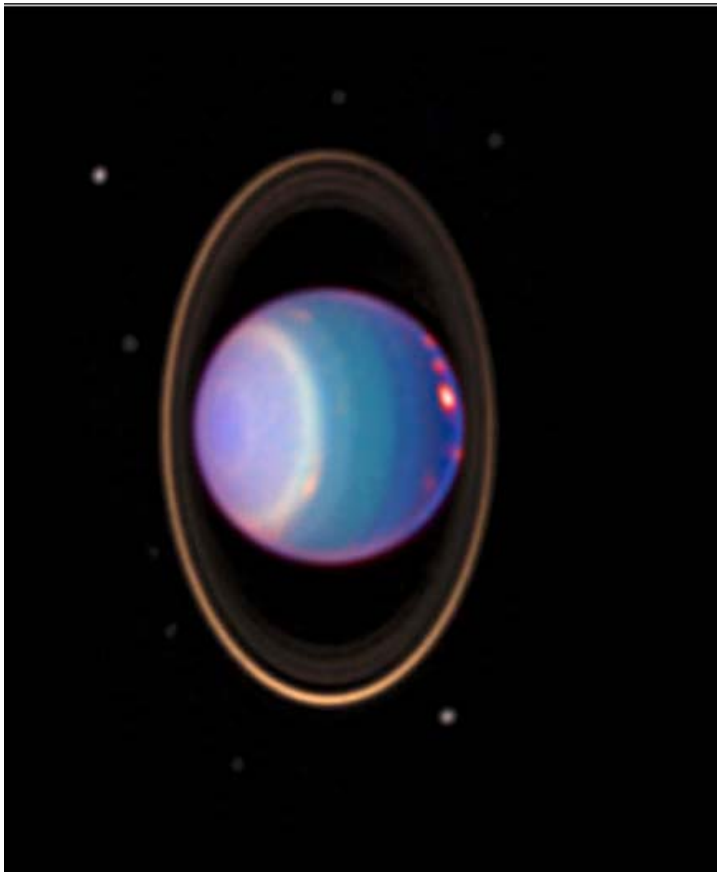
Radio Telescope Project

Education and Science in Partnership to Bring the Universe to America's Classrooms ...

Variations in Microwave Temperature of Uranus

GAVRT students will be conducting observations of Uranus during the months of July-December each year beginning in 2002.

- Students will watch for detectable changes in Uranus' atmosphere as it approaches equinox in 2007.
- The GAVRT team of teachers and scientists are developing curriculum with a focus on the extreme seasons and atmospheric dynamics of Uranus.
- As with our Cassini-JMOC Project, the data provided by the teachers and students will be used by scientists to address important scientific issues related to Uranus.



Variations in Microwave Temperature of Uranus

GAVRT is an educational program involving three partners, NASA, JPL, and the Lewis Center for Educational Research (LCER).

- GAVRT enables K-12 students to become active members of a real science team –
  - they study Jupiter, the Sun, and distant quasars using radio astronomy.
  - they link via the Internet to the Operation Control Center at LCER.
  - they connect to and control a 34-meter radio telescope, once part of NASA's Deep Space Network.
  - they collect science data which they analyze then forward to JPL scientists.
  - they communicate with scientists.

- In 2001 GAVRT students collected data for use by NASA's Cassini science team as the spacecraft flew by Jupiter on its way to Saturn.

The Technology Building on the LCER Campus, Apple Valley CA