# Global TPW and UTH Trends Inferred from 10 Years of HIRS Data


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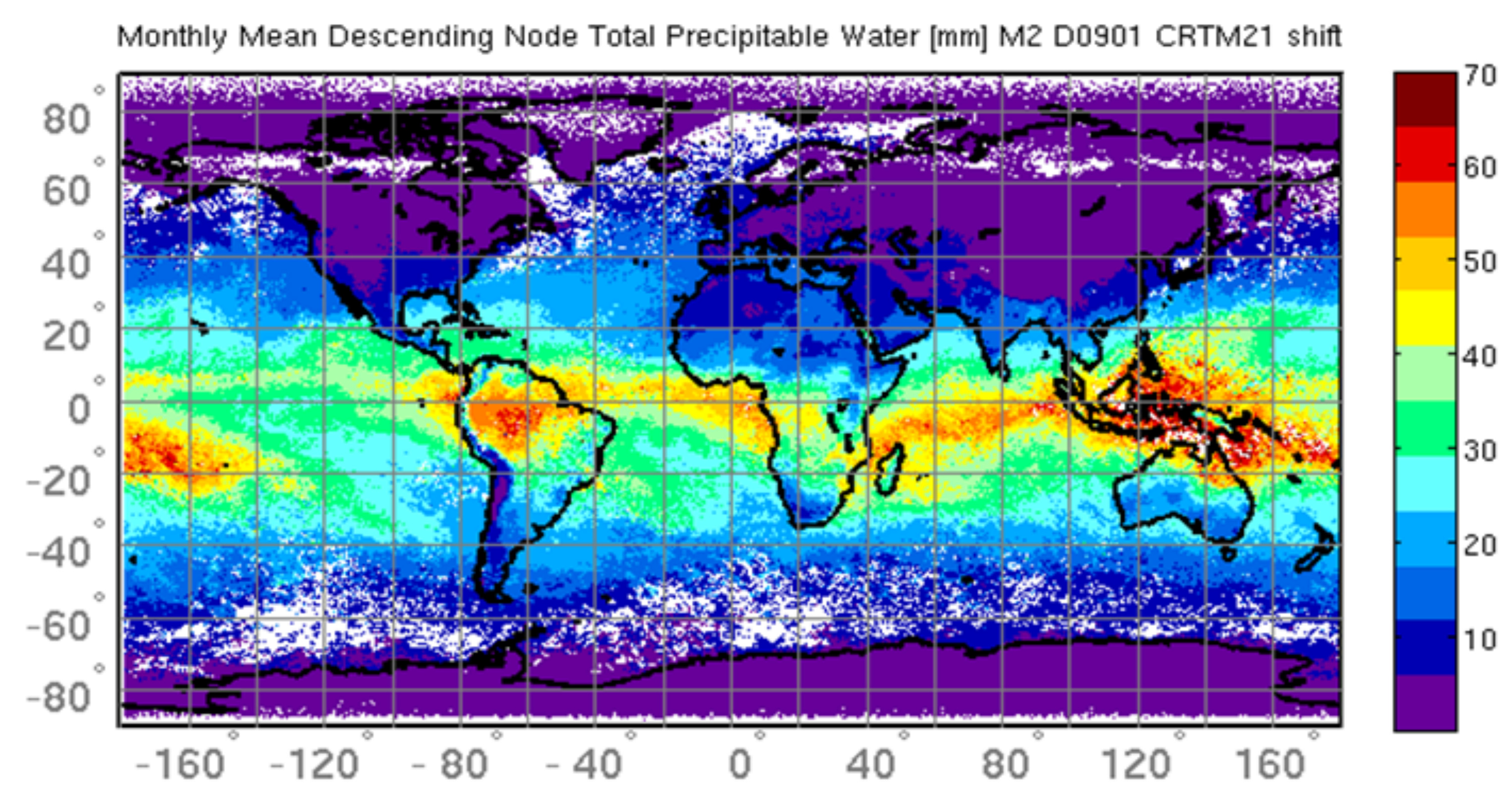
## 1. HIRS TPW and UTH Algorithm Overview

The HIRS TPW and UTH algorithm retrieves total column precipitable water vapor and integrated high (UTH), mid, and low layer tropospheric humidity. It is a statistical regression developed from the SeeBor data base (Borbas et al. 2005) that consists of geographically and seasonally distributed radiosonde, ozonesonde, and ECMWF ReAnalysis data. TPW and UTH are determined for clear sky radiances measured by HIRS (at 20km and later 10km resolution) over land and ocean both day and night. The retrieval approach is borrowed from MODIS (Seemann et al. 2003, 2008).

## 2. UW HIRS TPW and UTH Data Set

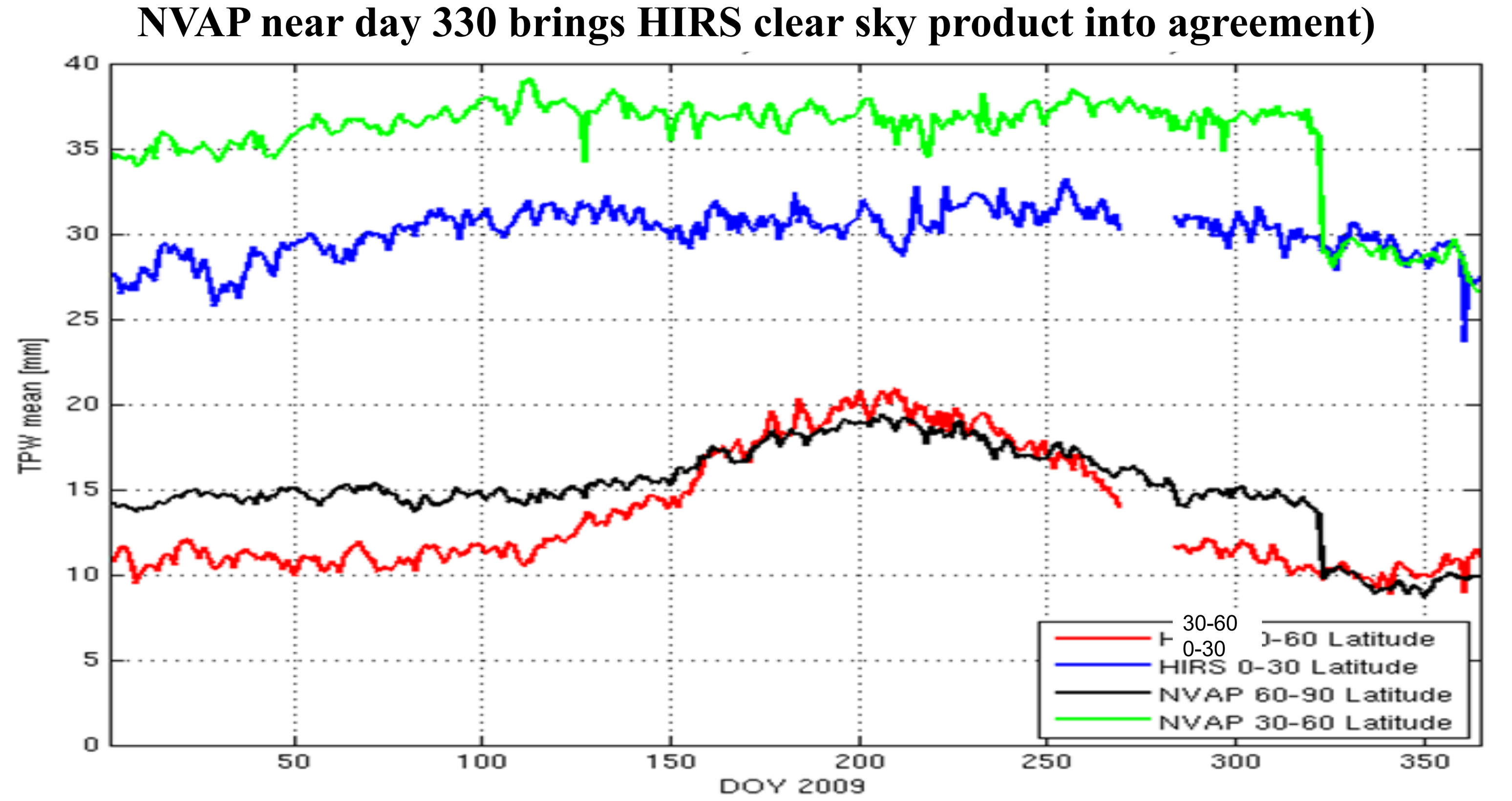
| | |
|---|---|
| Spectral Bands | IR only using CO2, H2O, and IRW bands |
| Orbits processed | Both ascending and descending<br>for 730 am and 130 pm |
| Coverage | Single FOVs over whole globe<br>(contiguous 20km nadir resolution for HIRS/3,<br>spaced 10 km for HIRS/4) |
| Cloud mask | AVHRR PATMOS-x GAC 4km resolution |
| Parameters processed | Total column Precipitable Water vapor (TPW)<br>Low, Mid, High Integrated Water vapor (IWV) |

## 3. METOP-A/HIRS4 descending node TPW (mm) mean for January 2009



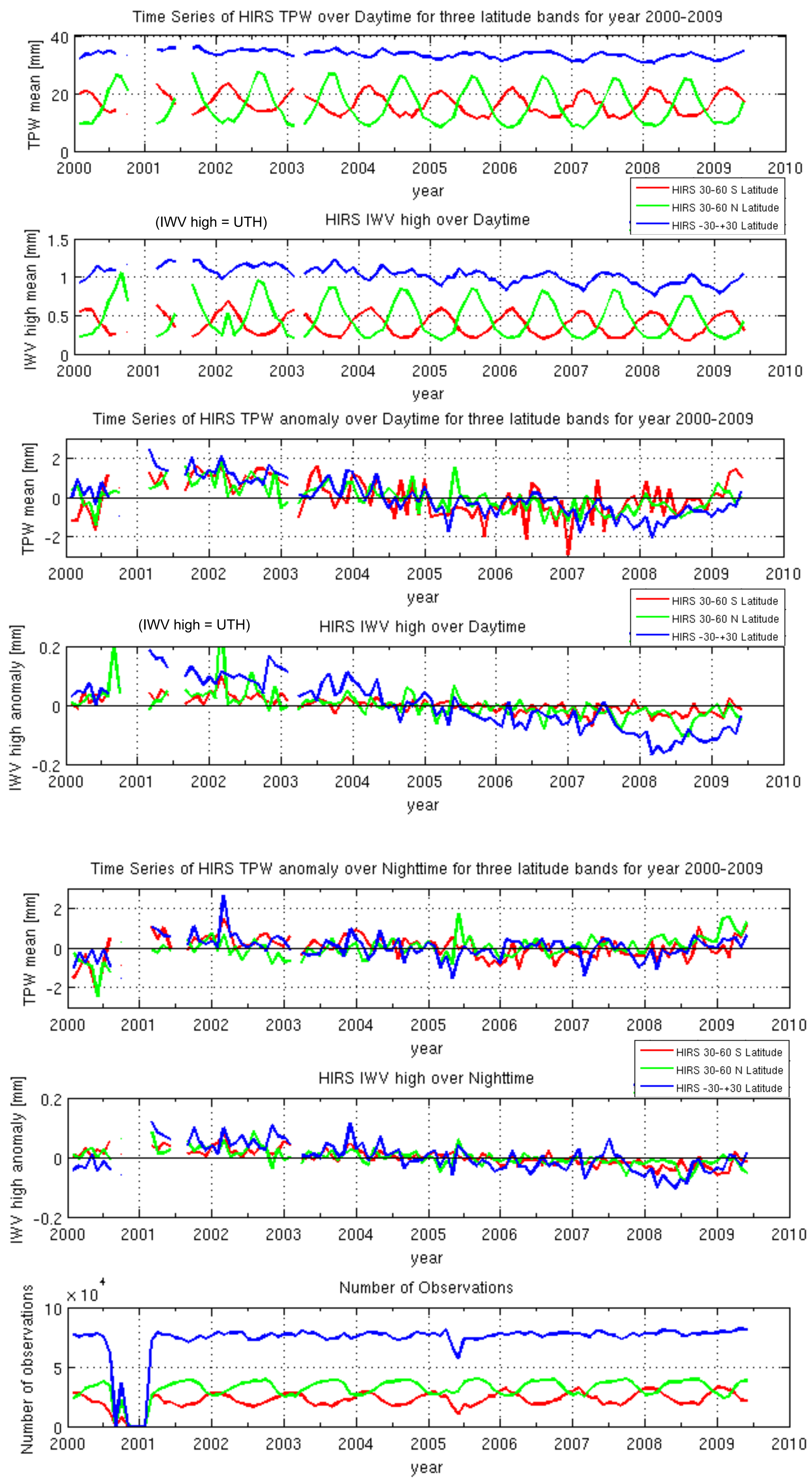

## 4. METOP-A/HIRS4 TPW (mm) compared to NASA NVAP TPW

**2009 Results for Tropics and Mid-latitudes (note that absence of MW input to NVAP near day 330 brings HIRS clear sky product into agreement)**



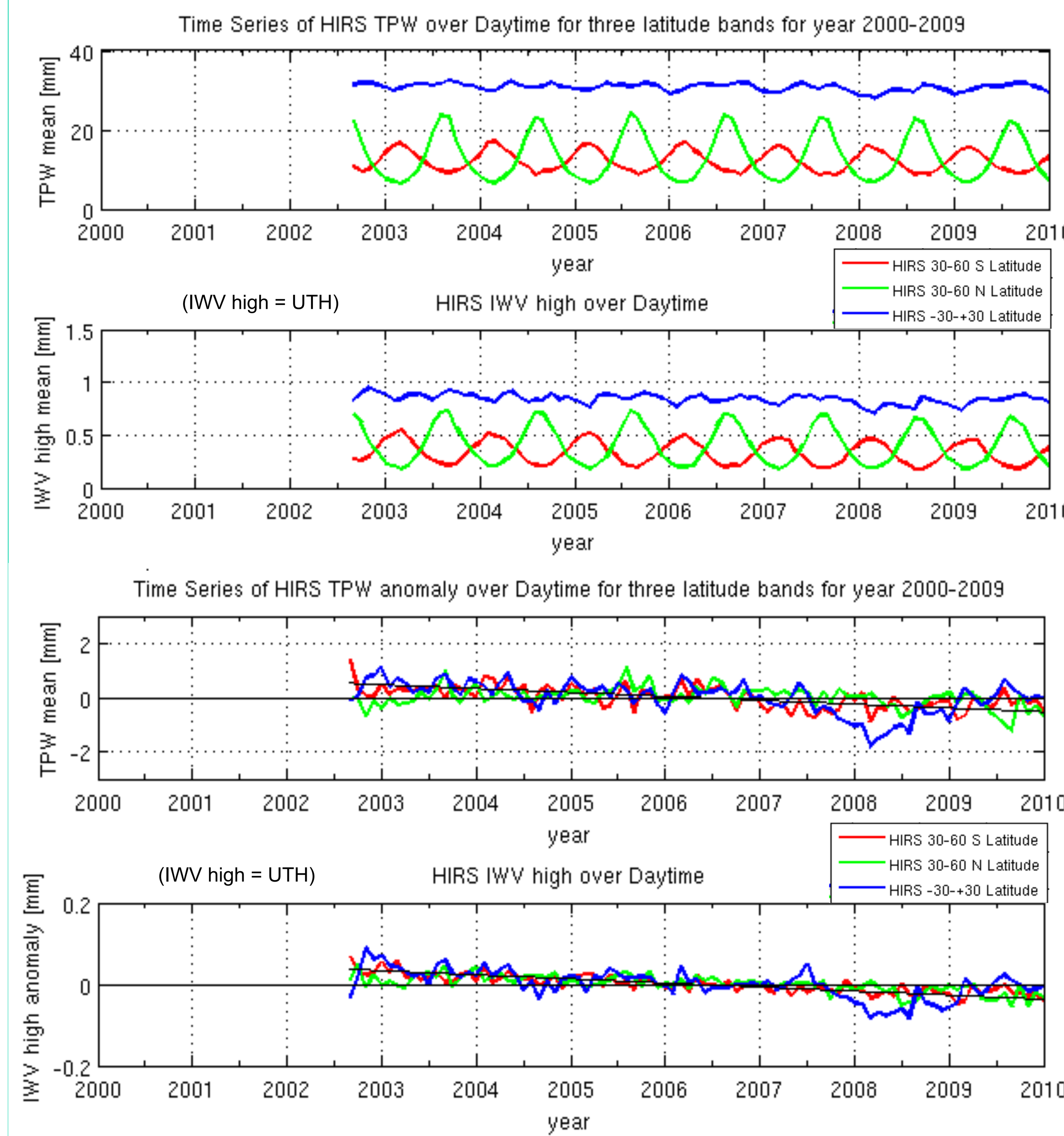

## 5. N15 HIRS TPW & UTH for 2000 – 2009 from 60N to 60S

**Using descending and ascending nodes to define day vs night**




## 6. N17 HIRS TPW & UTH for 2002 – 2009 from 60N to 60S

**Using descending and ascending nodes to define day vs night**




## 7. References


**Borbas, E., S. W. Seemann, H.-L. Huang, J. Li, and W. P. Menzel, 2005: Global profile training database for satellite regression retrievals with estimates of skin temperature and emissivity. Proc. of the Int. ATOVS Study Conference-XIV, Beijing, China, 25-31 May 2005, pp763-770.**

**Seemann, S. W., J. Li, W. P. Menzel, and L. E. Gumley, 2003. Operational retrieval of atmospheric temperature, moisture, and ozone from MODIS infrared radiances. J. Appl. Meteor., 42, 1072-1091.**

**____, Borbas, E.E., Knuteson, R.O., Stephenson, G.R., and Huang, H-L., 2008: Development of a global infrared emissivity database for application to clear sky sounding retrievals from multi-spectral satellite radiances measurements. J. Appl. Meteor. and Clim. 47, 108-123**


## 8. Conclusions

- **HIRS TPW is in good agreement with NVAP when MW is removed**
- **Seasonal UTH cycle is strongest in northern mid-lats and weakest in tropics**
- **N15 moisture values are somewhat higher than those from N17**
- **Decrease in TPW and UTH from 2002 to 2008 is evident in both N15 and N17**
- **Increase in tropical TPW and UTH after 2008 is suggested**
- **Day and night results do not differ significantly**
- **Processing other decades will bring trends in better focus**
- **HIRS data record extends from 1978 to the present**