



wege entstehen, indem wir sie gehen  
*ways emerge in that we go them*

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Atmospheric Remote Sensing and Climate System Research Group

**ARSCISys**

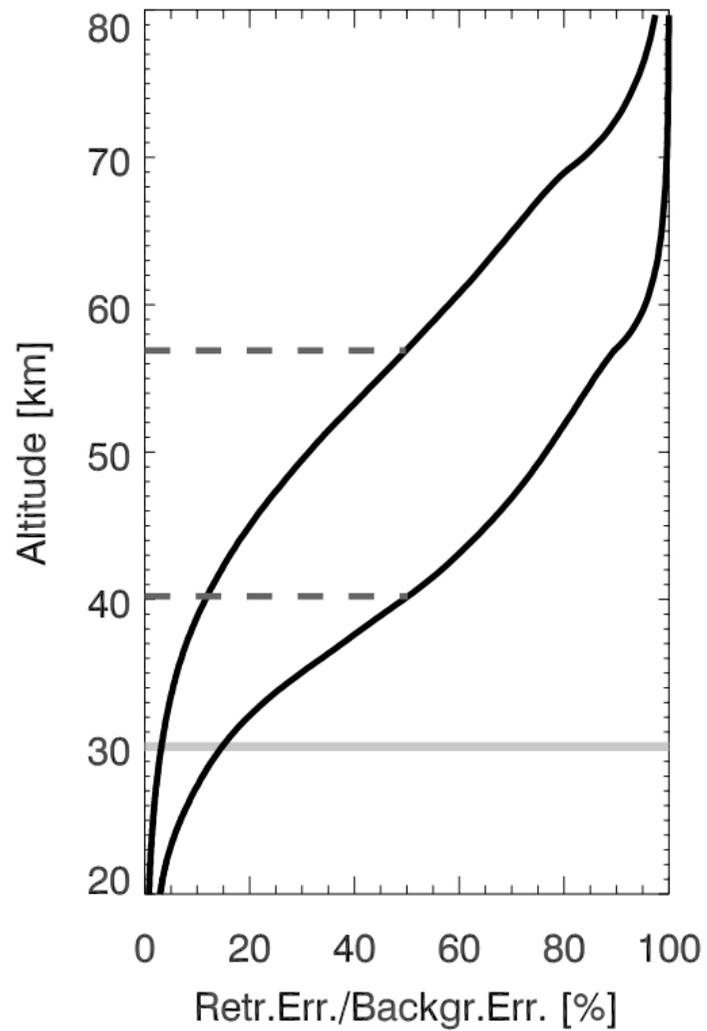
# Monitoring the Tropical Tropopause with Radio Occultation Data

**Michael Borsche,  
Gottfried Kirchengast, and Ulrich Foelsche**

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OPAC-3, Graz, 17. – 21. September 2007

- Dry air, geometric optics retrieval
- Upper-boundary initialization at 120 km
- Statistical optimization using ECMWF analyses
- Phase delays delivered by GFZ Potsdam
- Several enhancements, including:
  - Outlier correction
  - Filter profiles after Abel transform *and* dry air profile retrieval
  - Retrieval to a priori error ratio
  - Continuous bug removal



A. Gobiet, et al. (2007),  
Atmos. Chem. Phys. 7,  
3519-3536

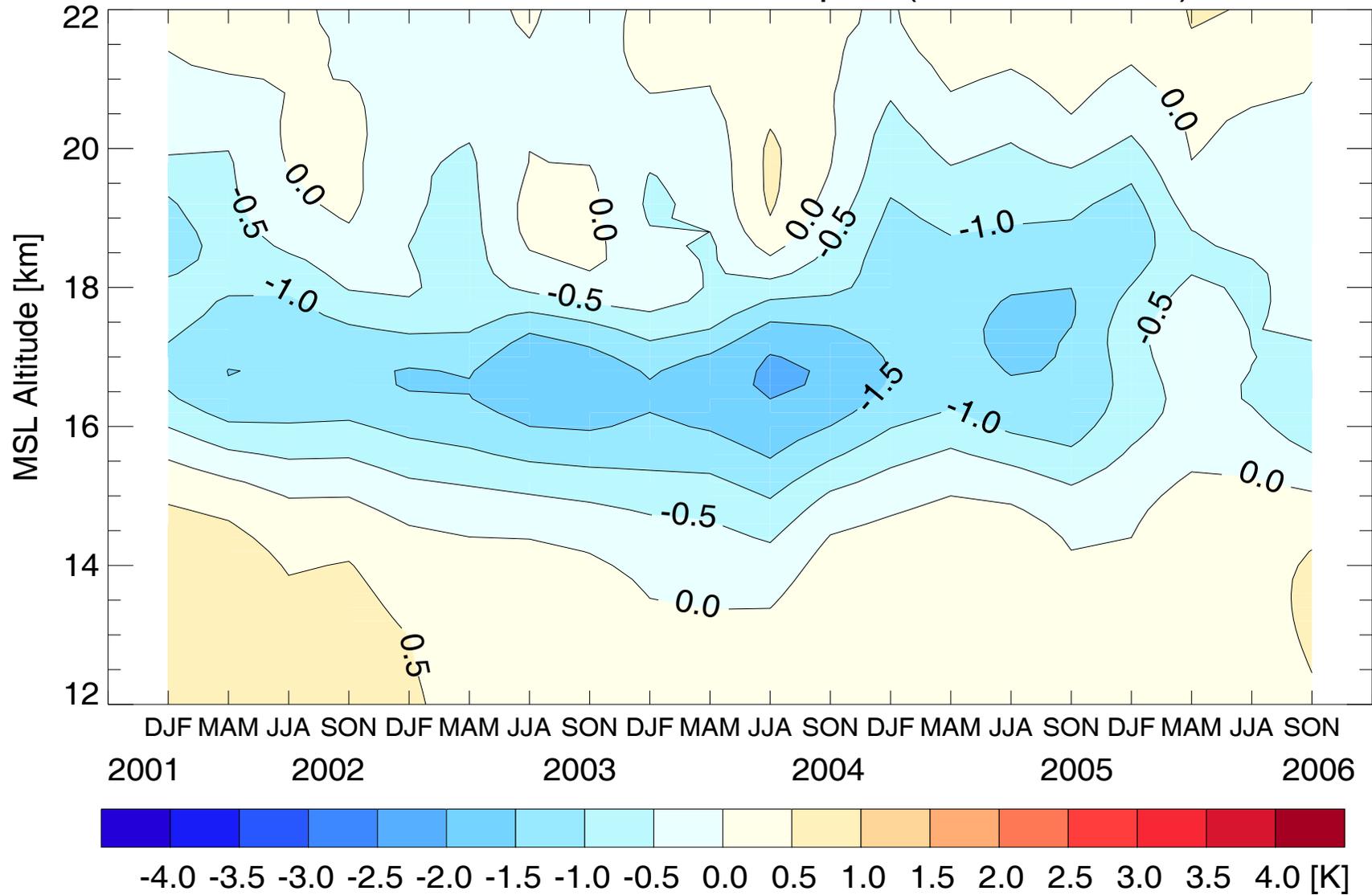
- More than a five year CHAMP climatology from 09/2001 to 12/2006
- More than a one year COSMIC climatology from 08/2006 to 08/2007
- Selected periods of GPS/Met in 1995 and 1997
- Selected months of SAC-C in 2002
- Selected month of GRACE of 07/2006
- Waiting for MetOp data

- Lapse rate tropopause (LRTP) height and temperature:
  - WMO definition: Lowest level at which lapse rate is lower than  $2^{\circ}$  C/km
- Cold point tropopause (CPTP) height and temperature:
  - (local) minimum above lapse rate tropopause
- Validation of ECMWF analyses in the tropopause by means of RO data

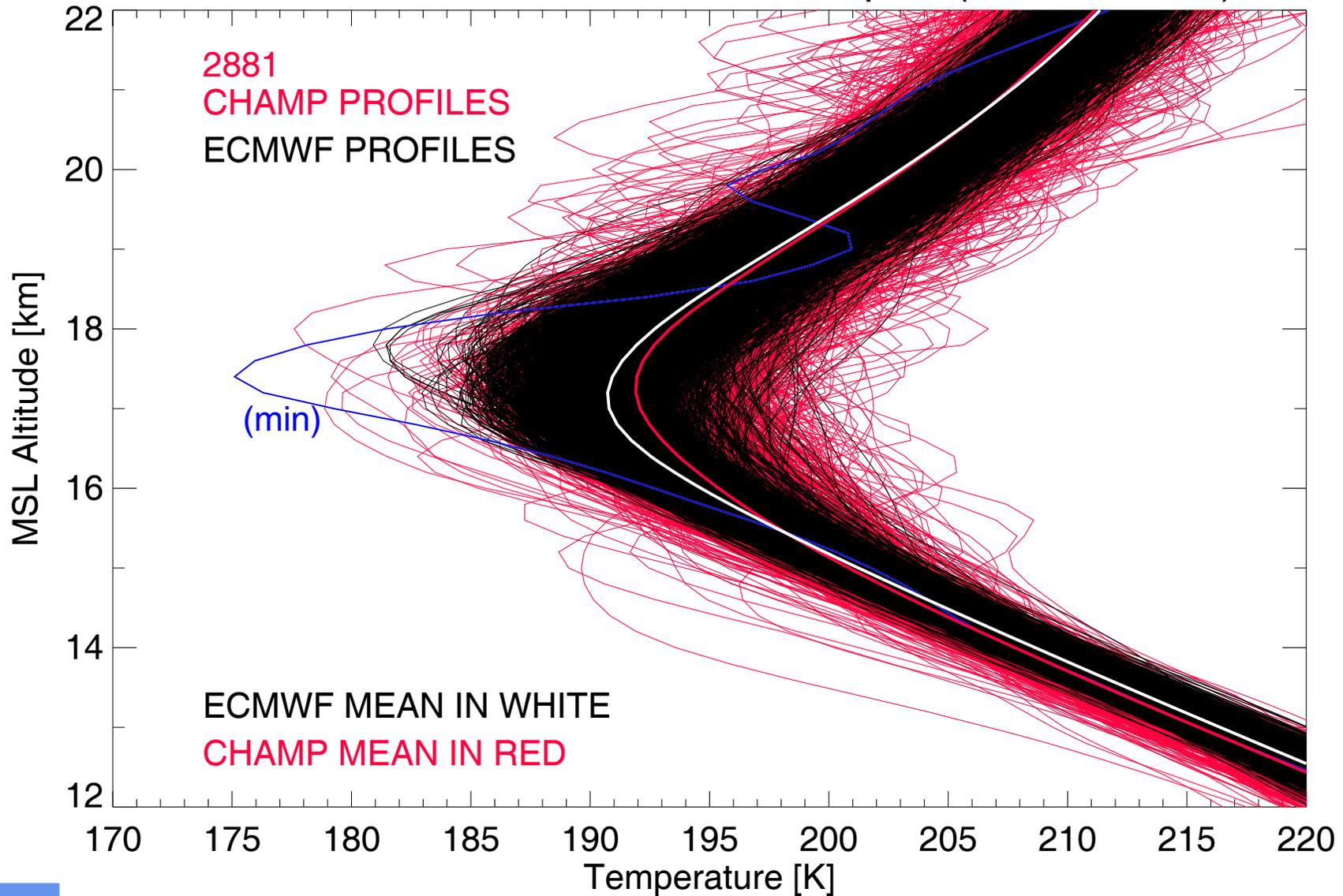
Borsche, M., et al. (2007), Geophys. Res. Lett., 34, L03702, doi:10.1029/2006GL027918

# Temporal Evolution

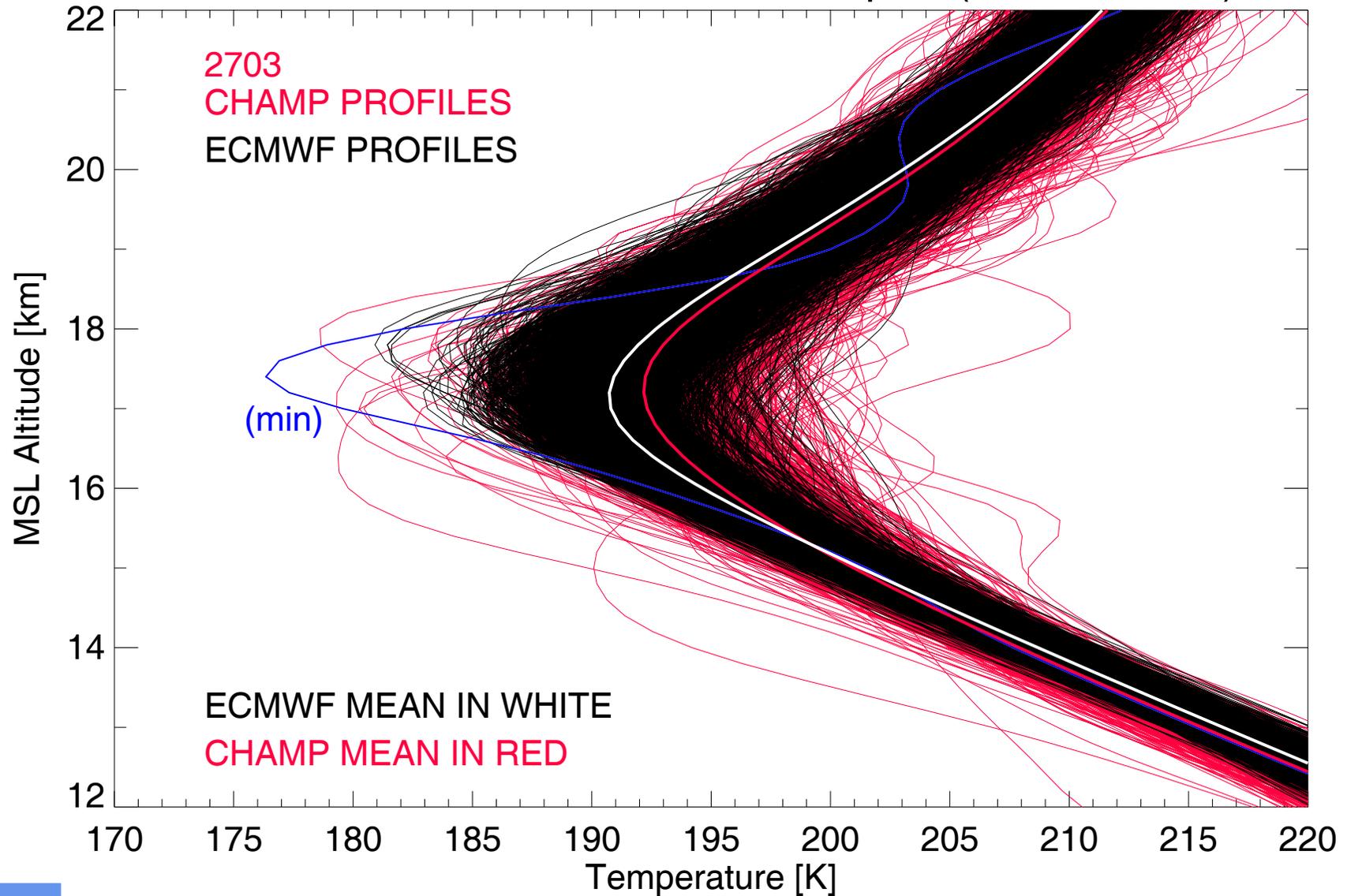
## ECMWF - CHAMP in the Tropics (15° S to 15° N)



## Cluster Plot of MAM2002 in the Tropics (15°S to 15°N)



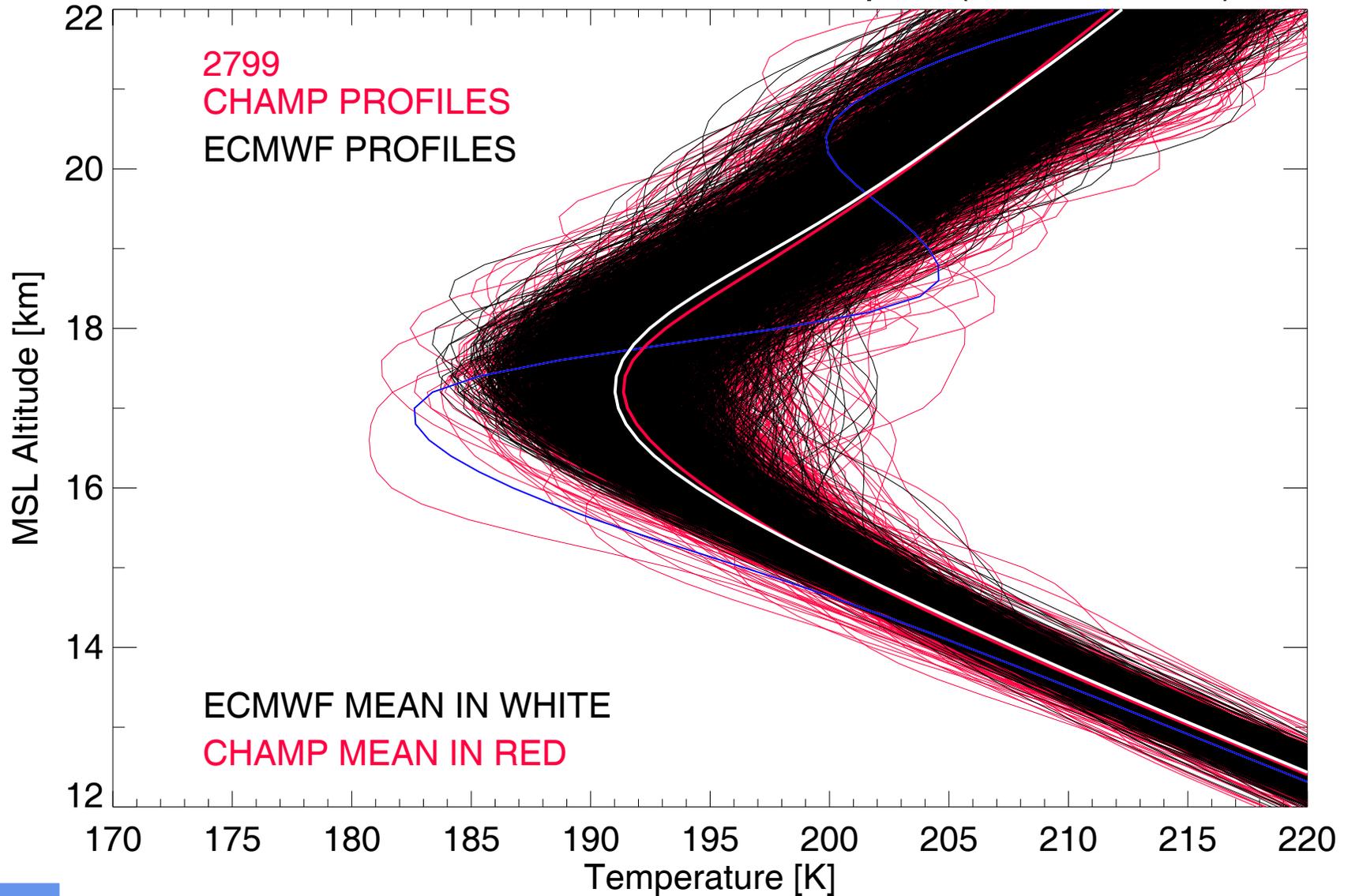
## Cluster Plot of MAM2002 in the Tropics (15°S to 15°N)



# CHAMP MAM2006 (new)



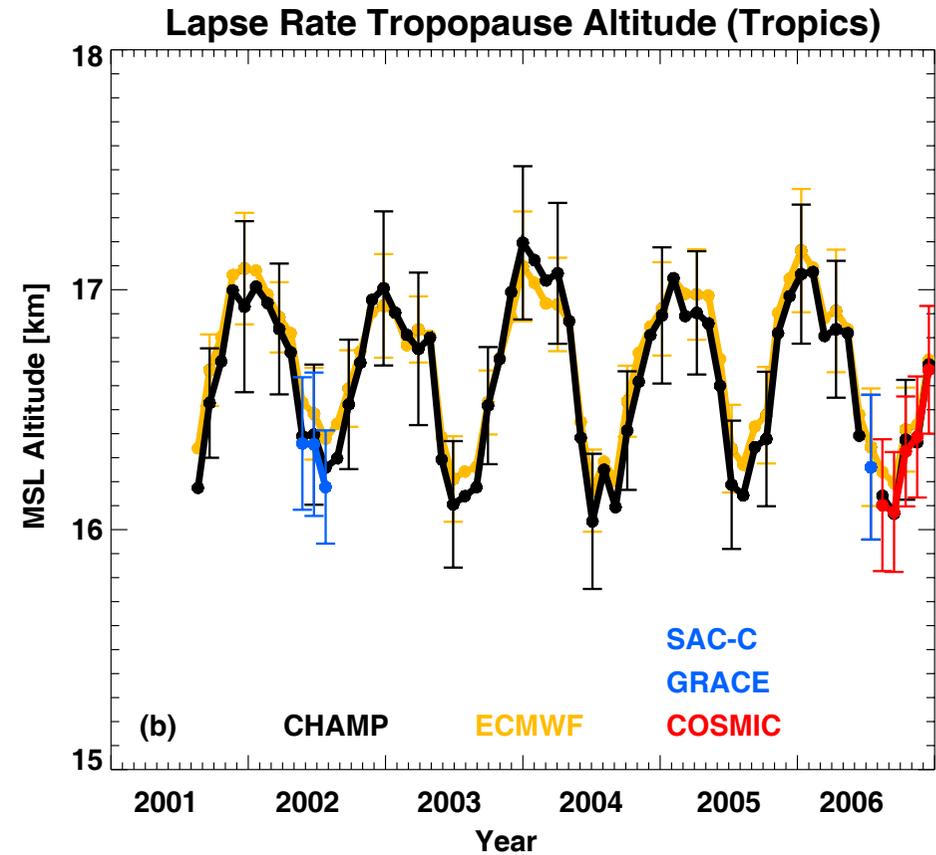
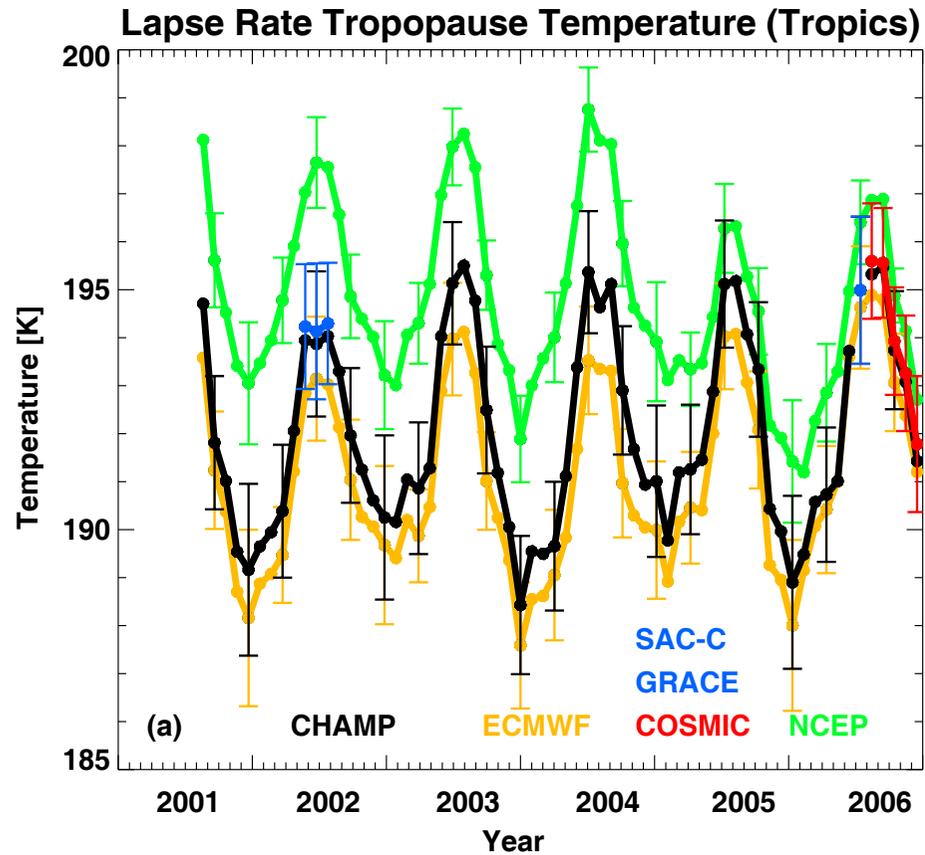
## Cluster Plot of MAM2006 in the Tropics (15°S to 15°N)



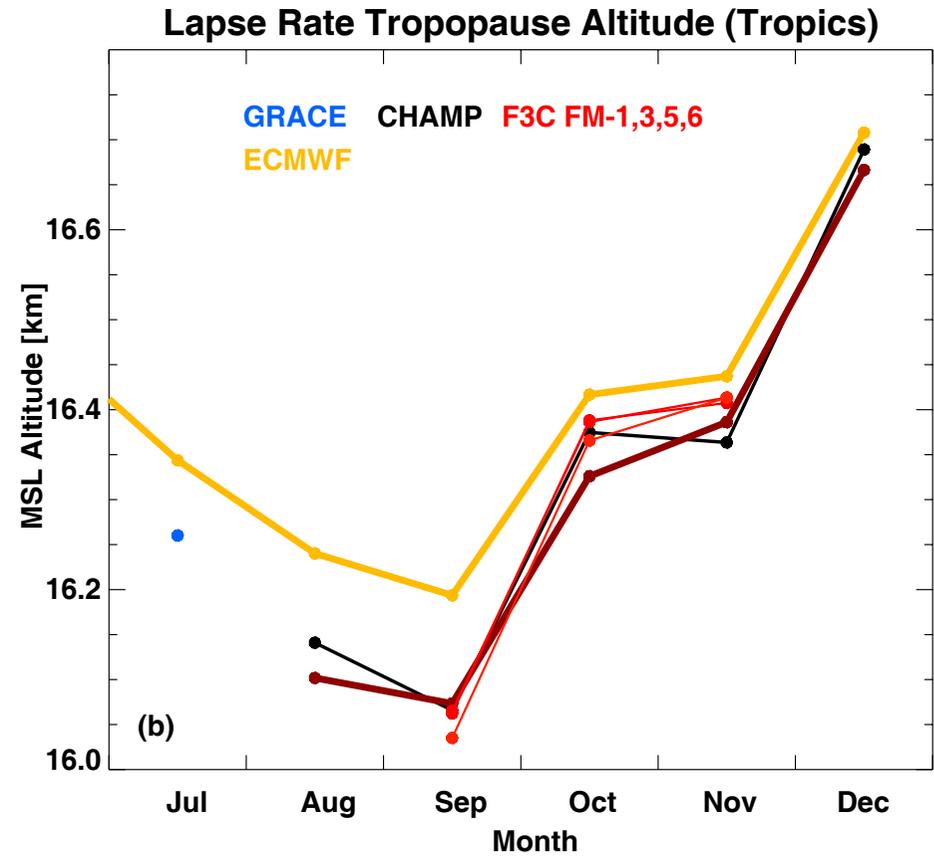
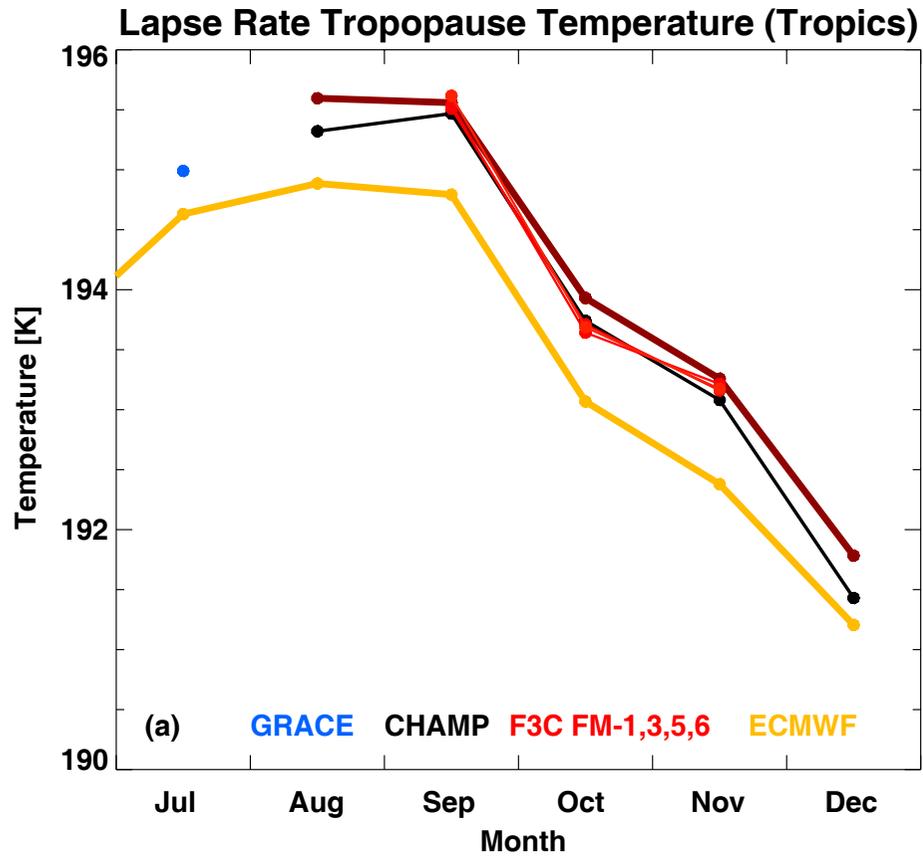
- Tropopause temporal evolution and intercomparison of different RO satellites
  - SAC-C 2002
  - GRACE-A 07/2006
  - COSMIC 08-12/2006

Foelsche, U., et al. Terr. Atmos. Oceanic Sci.,  
submitted, 2007

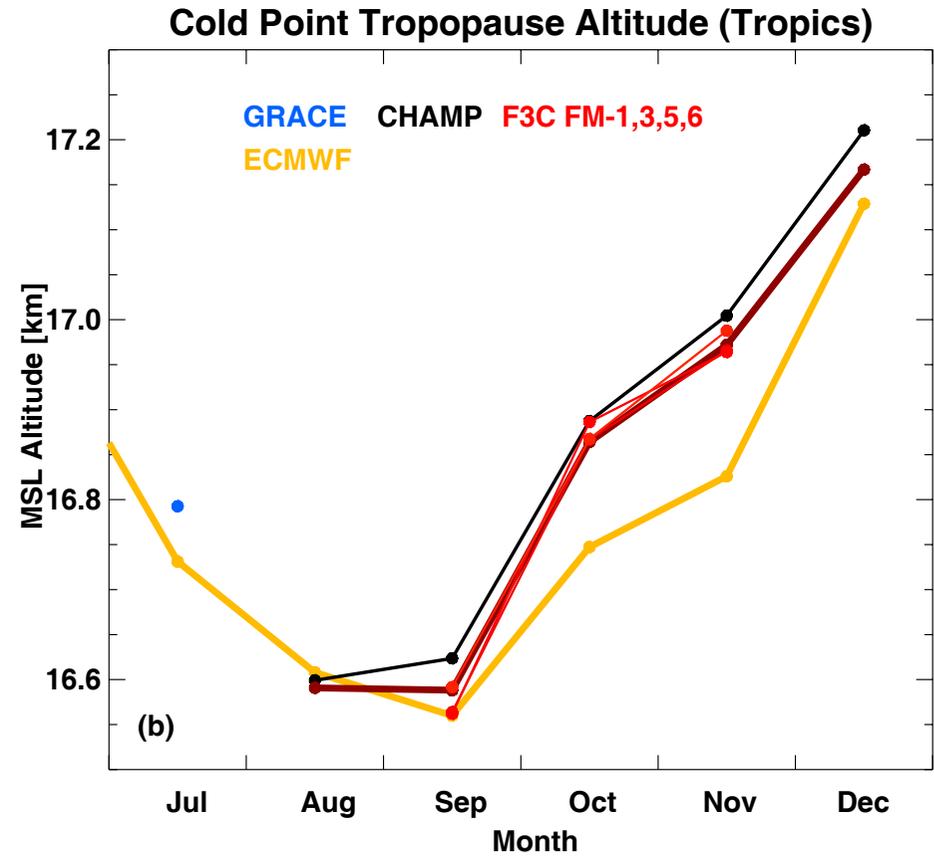
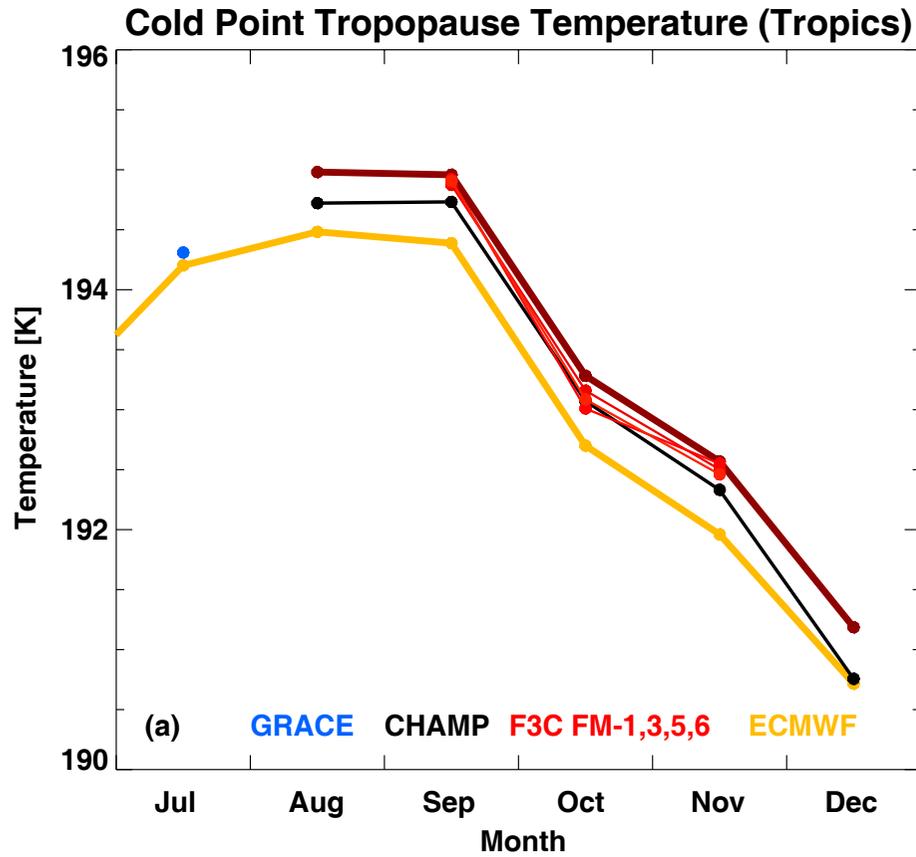
# Tropopause temporal evolution



# LRT temp & height



# CPT temp & height



- Ongoing improvement and enhancement (adding new satellite data) of retrieval
- CHAMP (and other) RO data suitable for climatological tropopause studies
- Different RO satellite data intercomparable
- Statistical optimization with ECMWF forecast files
- Use high resolution NCEP analyses as reference data