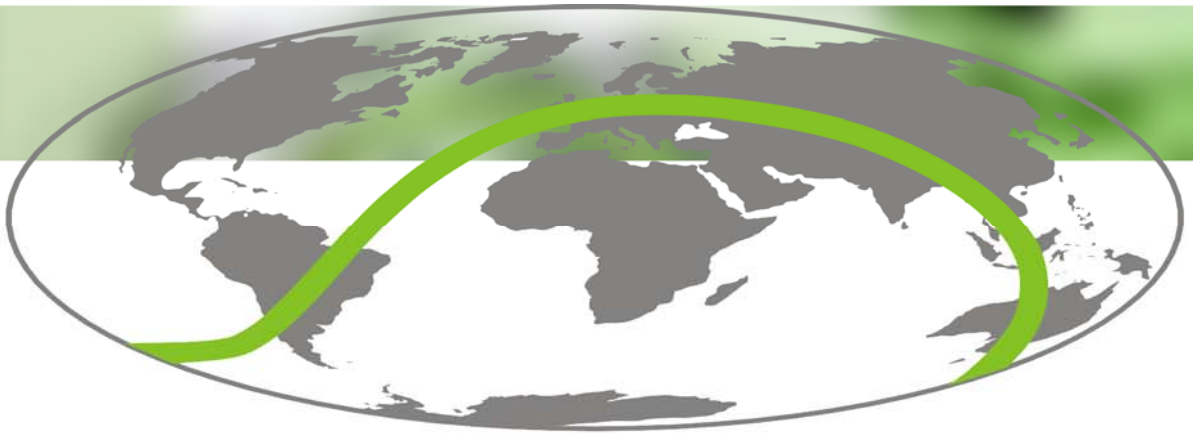

wege entstehen, indem wir sie gehen
ways emerge in that we go them

Wegener Center
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Atmospheric Remote Sensing and Climate System Research Group
ARSCliSys

Local Time Sampling with Formosat-3/COSMIC

Barbara Pirscher, Ulrich Foelsche, Gottfried Kirchengast
Wegener Center for Climate and Global Change, University of Graz

OPAC-3 @ Graz, 18 September 2007

Outline

- Satellite orbits
  - Sun-synchronous satellites
  - Non Sun-synchronous satellites
- Temperature diurnal cycle in July
- Local time component of the sampling error in Formosat-3/COSMIC temperature climatologies
- Summary

Satellite Orbits

- Mean motion of the Earth

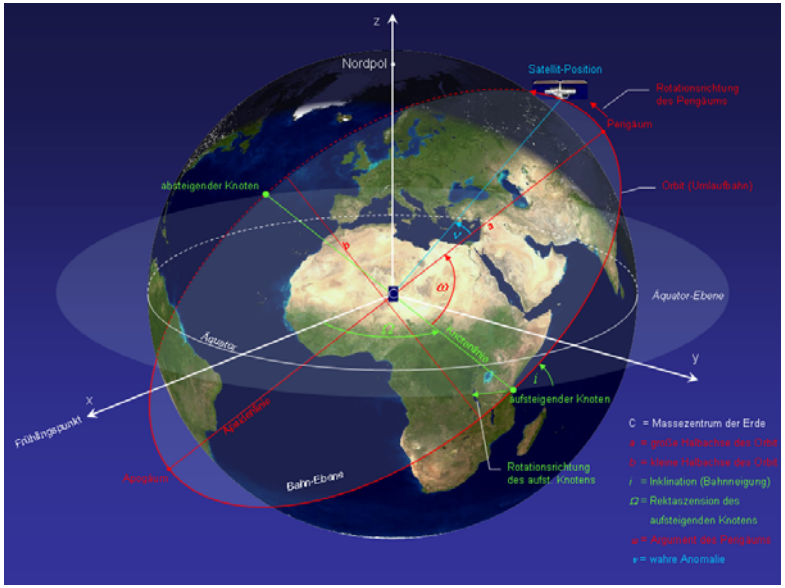
$$\dot{\Omega} = 360^\circ / 365.24\ \mathrm{d}$$
$$= 0.9856^\circ/\mathrm{d}$$

- Satellite's drifting rate:

$$\dot{\Omega} = -\frac{3}{2} J_2 \left(\frac{a_e}{a} \right)^2 n \cos i$$

- Drifting rate with respect to the sun:

$$\dot{\Omega}_{sun} = 360^\circ / 365.24\ \mathrm{d} - \dot{\Omega}$$



Source: Wikipedia

Satellite Orbits

- Sun-synchronous orbit (e.g., MetOp):

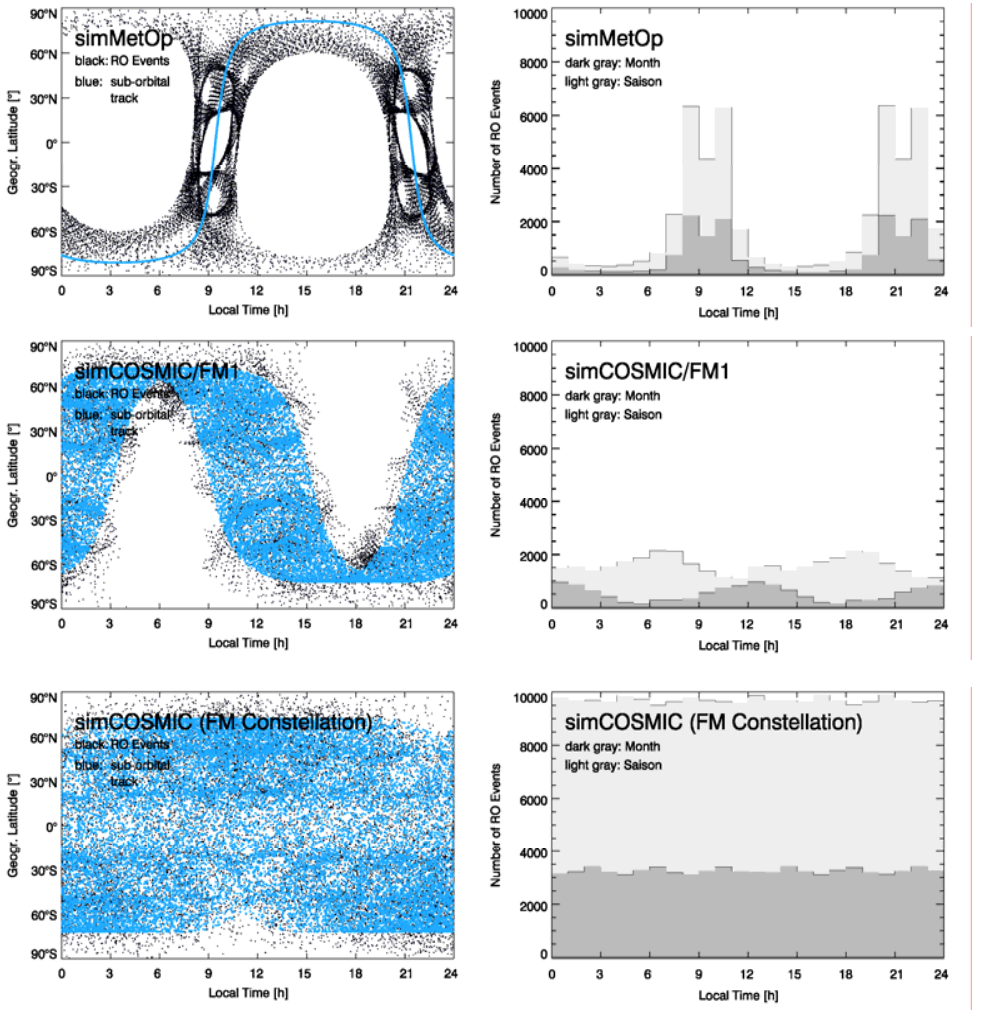
$$\dot{\Omega} = 0.9856°/\mathrm{d}$$

$$\dot{\Omega}_{\mathrm{Sun}} = 0°/\mathrm{d}$$

- Non Sun-synchronous orbit (e.g., COSMIC in final orbit)

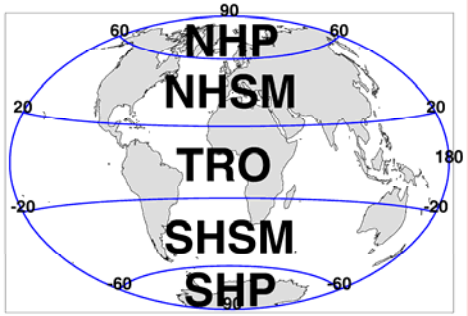
$$\dot{\Omega} = -2.0361°/\mathrm{d}$$

$$\dot{\Omega}_{\mathrm{sun}} = 3.0218°/\mathrm{d}$$

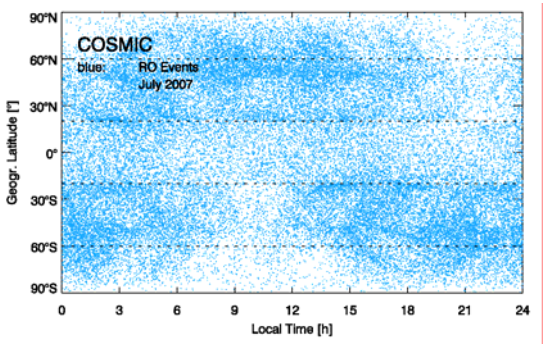


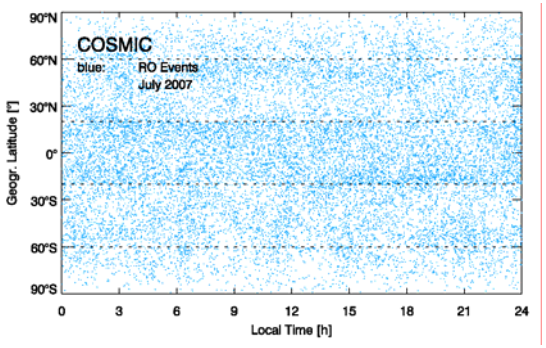
Diurnal Cycle

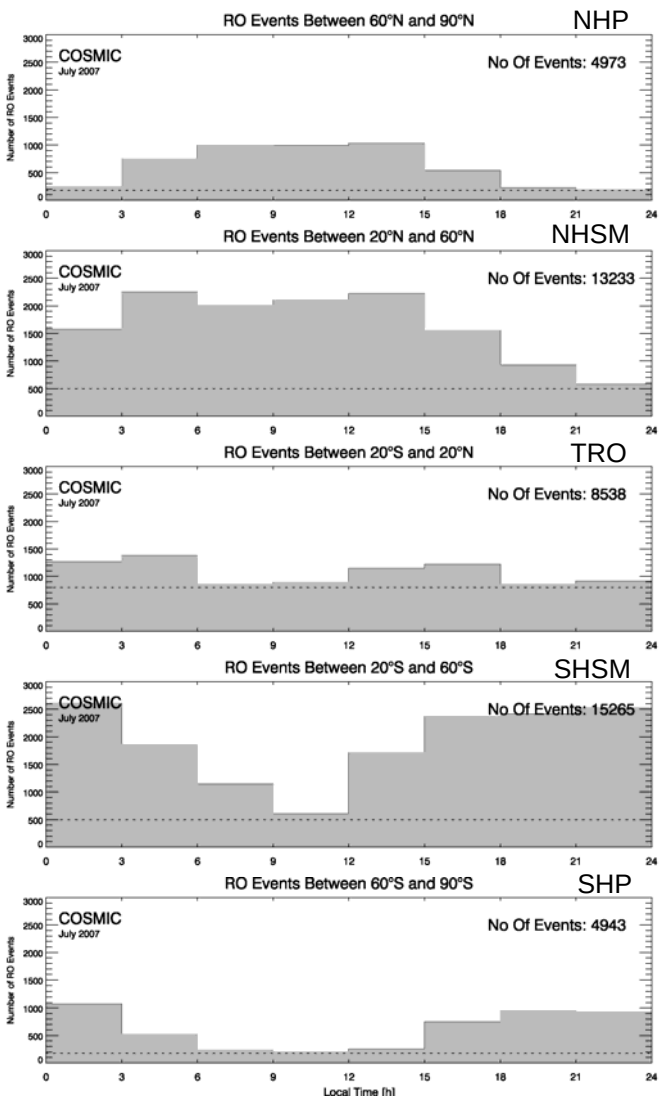
COSMIC, July 2007



Event distribution







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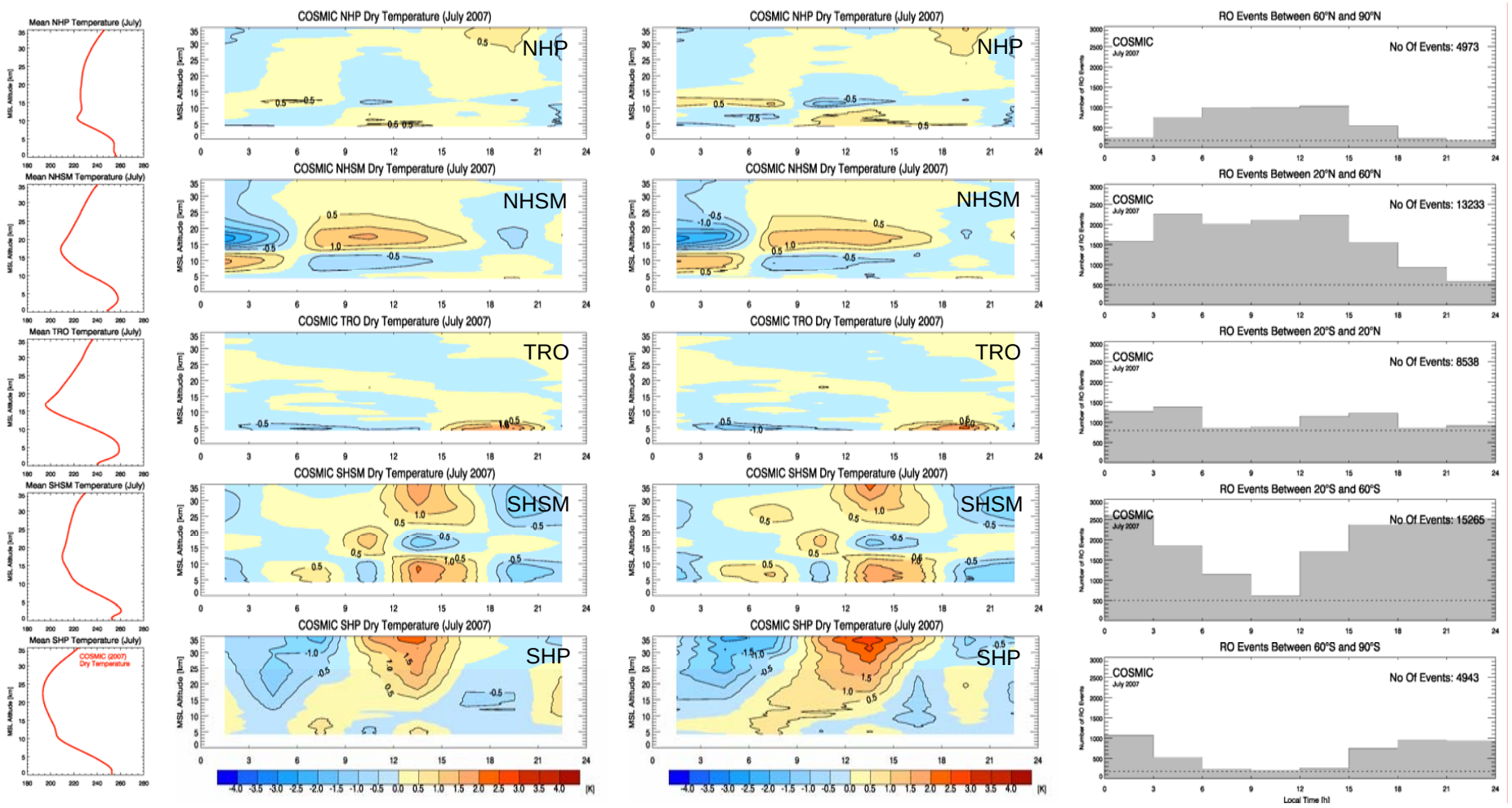
COSMIC, July 2007

mean profiles COSMIC: July reduced number of data



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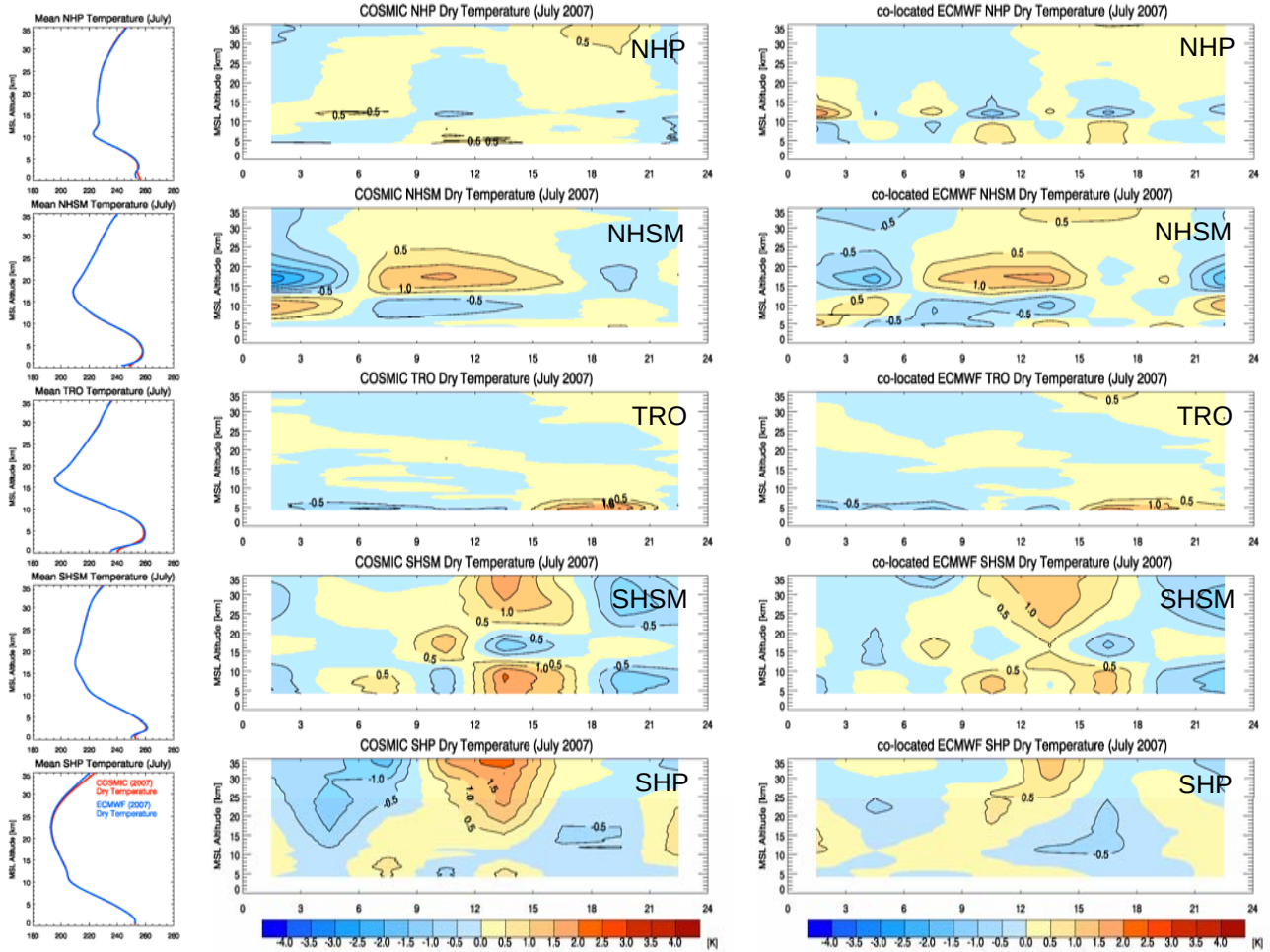
COSMIC - ECMWF, July 2007

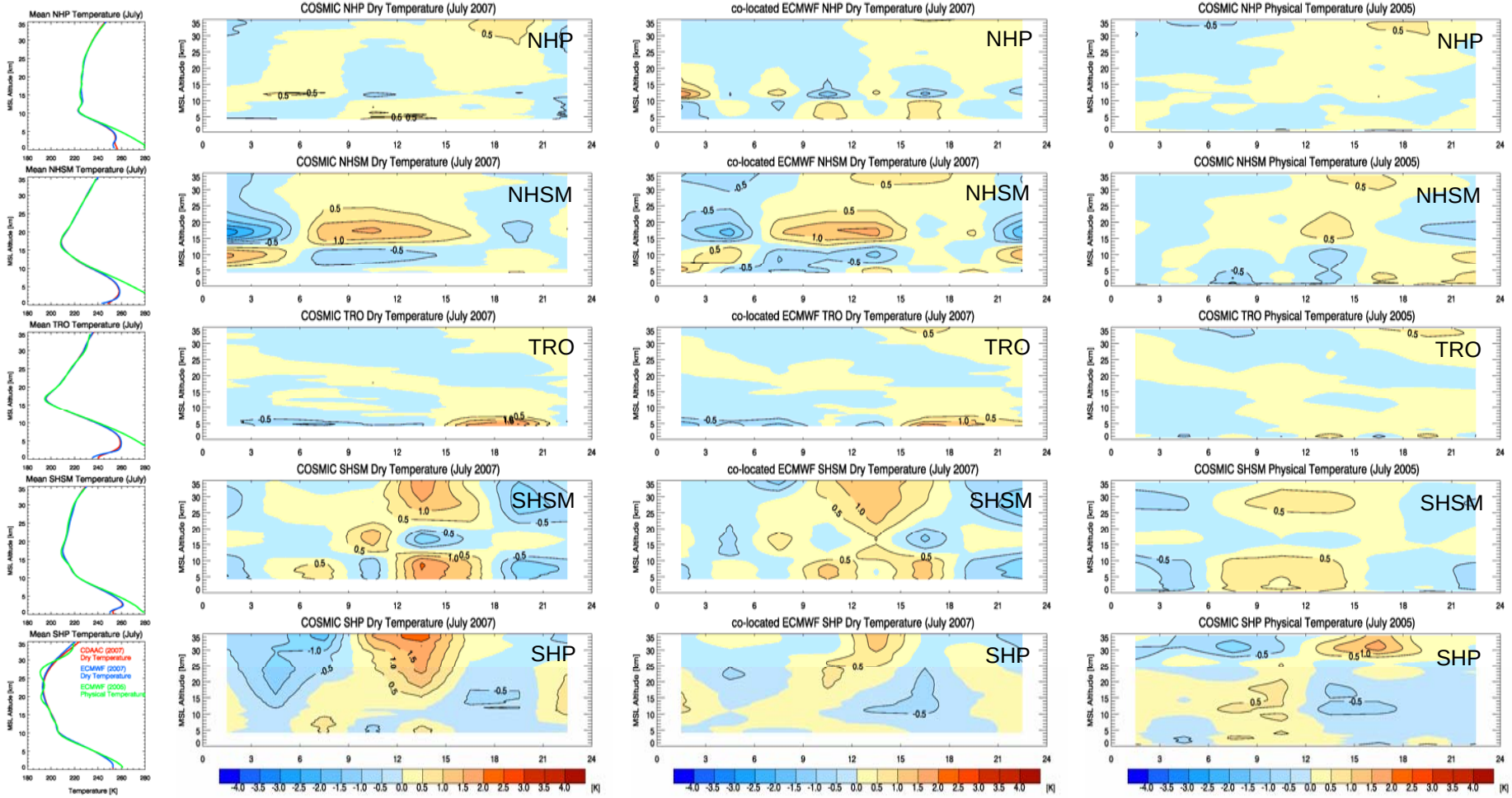
mean profiles COSMIC: July 2007 ECMWF: July 2007



Diurnal Cycle

July 2005 - July 2007

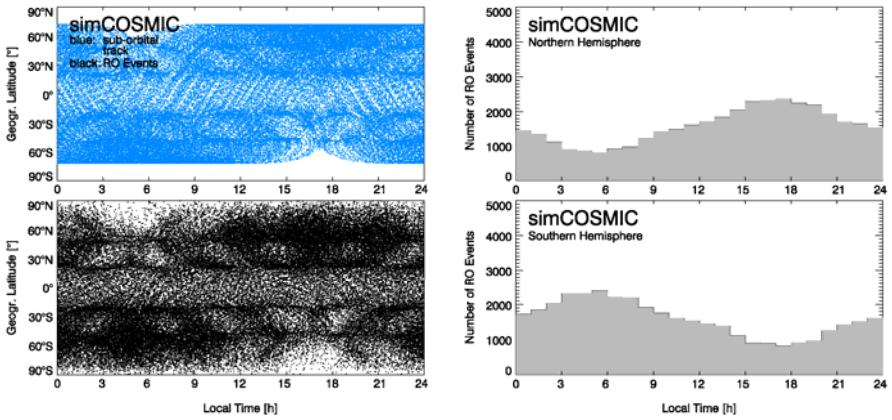
mean profiles	COSMIC: July 2007	ECMWF: July 2007	(Simulation) ECMWF: July 2005

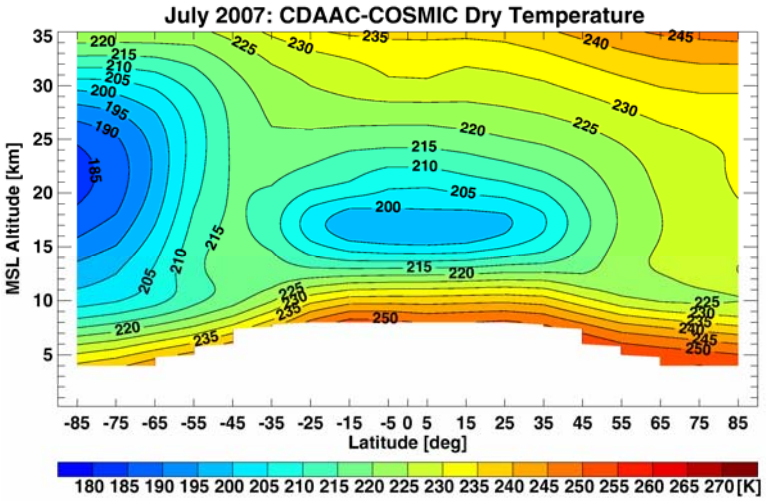


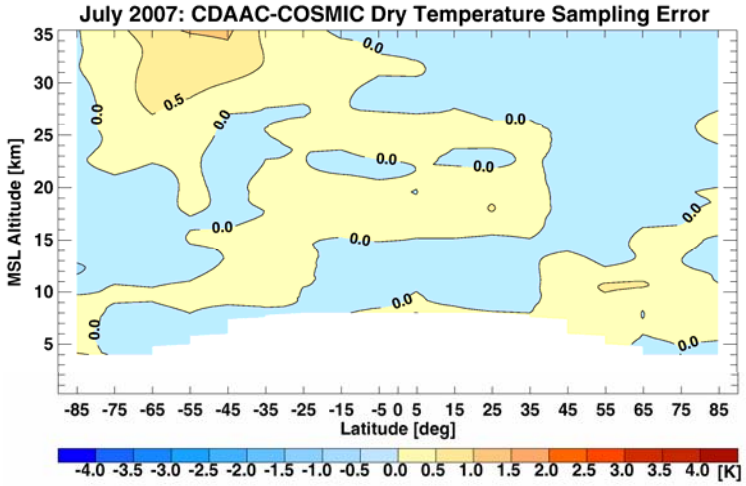
Local Time Sampling

Temperature Climatologies:
Sampling Error

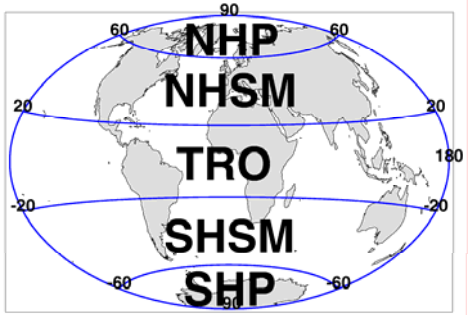
- Results from spatio-temporal undersampling of the „true“ atmospheric variability
- Spatial and temporal component
- Local time component is part of the sampling error

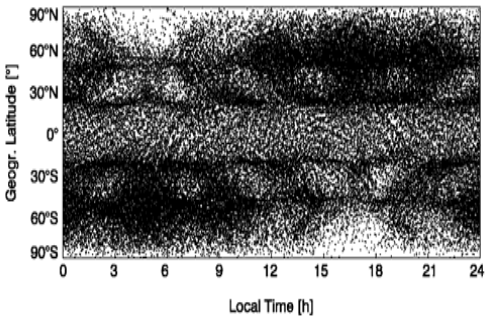




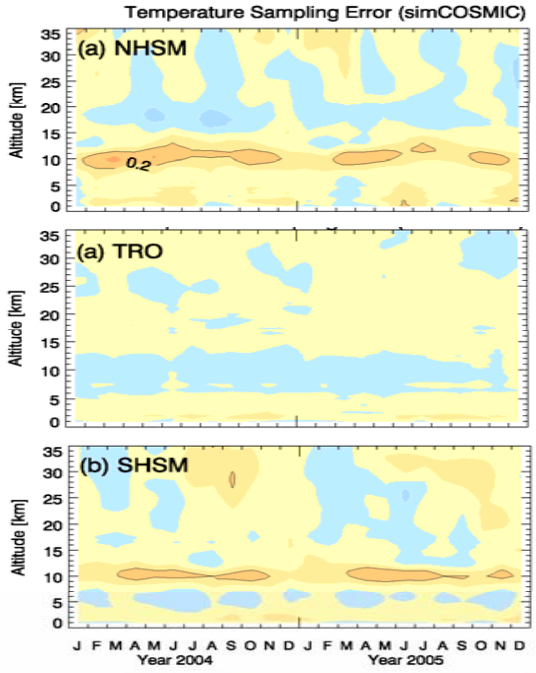


Local Time Sampling

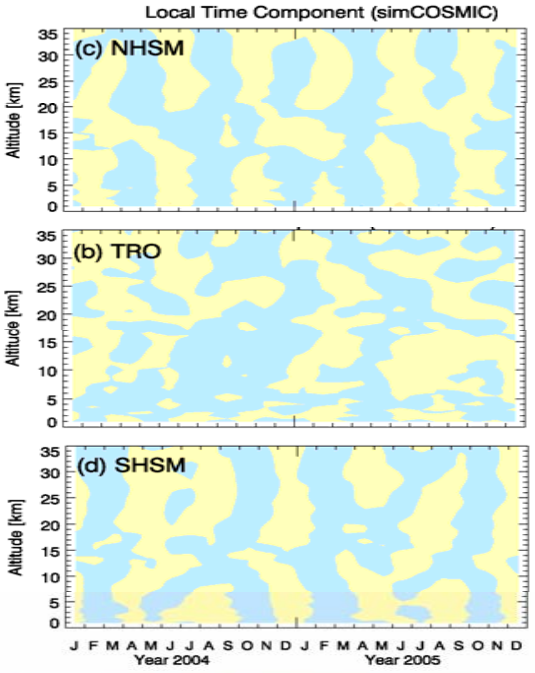


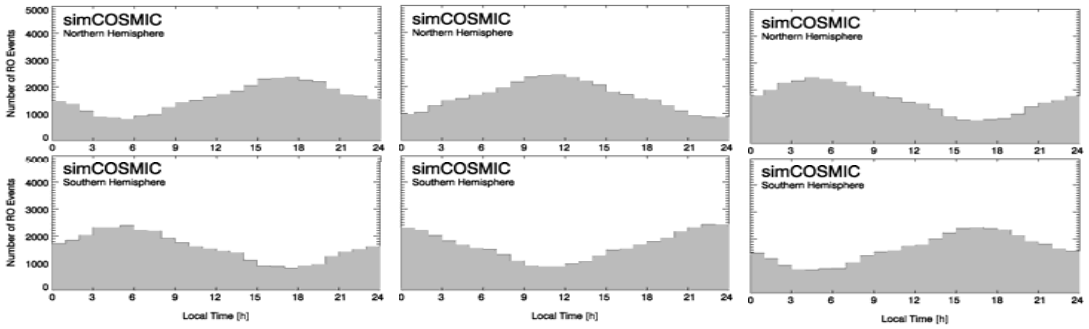


Sampling Error



Local Time Component





Summary

Diurnal cycle:

- Formosat-3/COSMIC is able to detect the diurnal cycle of atmospheric parameters in different geographical regions
- Preliminary results but have to be analyzed in detail

Climatological point of view:

- Uneven local time sampling at higher latitudes
- Alternating small positive and negative deviations in the local time component of the sampling error
- Local time component of monthly-mean zonal-mean climatologies amounts to ±0.03 K

THANK YOU!!