

Simulation of the Lower Stratosphere using COSMO-ART: Validating the Temperature

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COSMO-ART:

- Regional chemistry-transport model
- Gas phase chemistry (via KPP) and aerosol processes

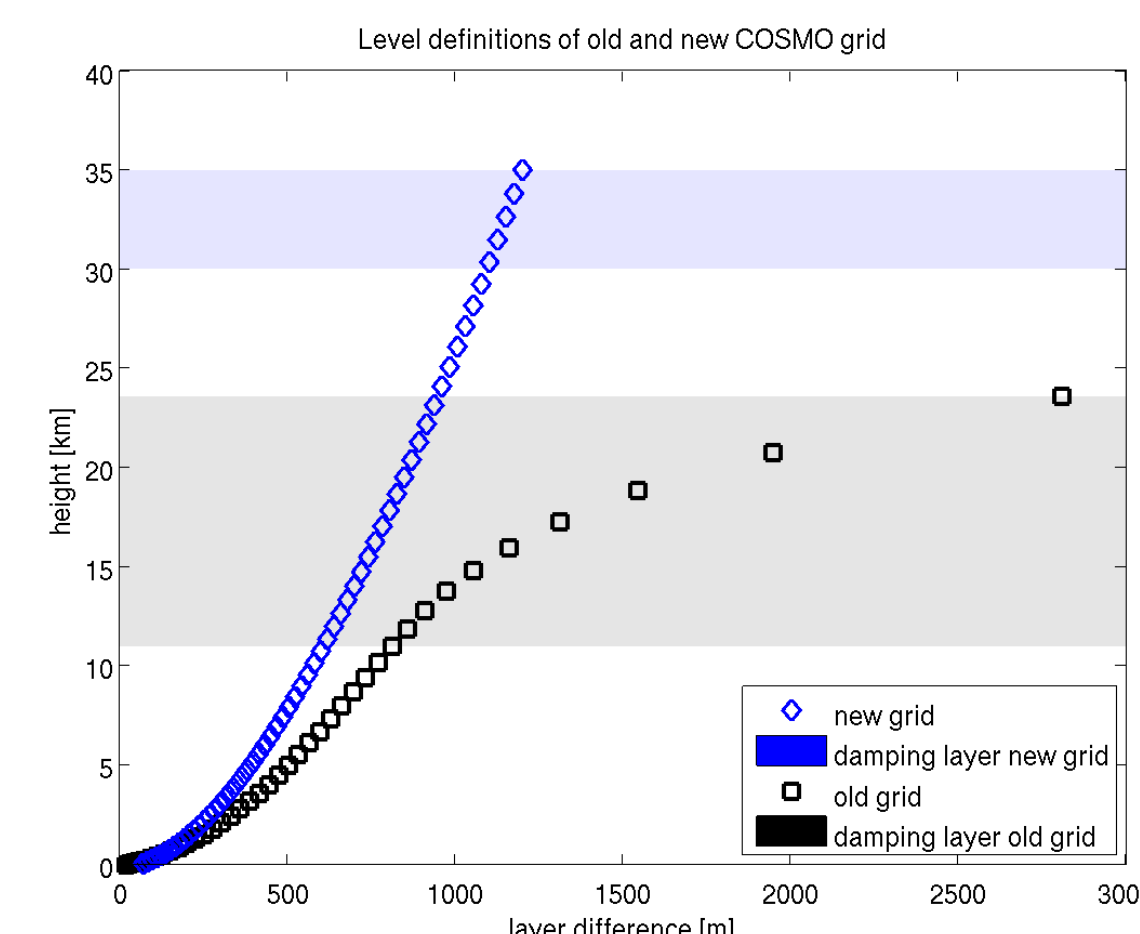
Developments in COSMO-ART to simulate the UTLS

- Extended vertical grid
 - Top layer at 35 km (COSMO standard: ~ 23 km)
 - 61 layers (COSMO standard: 41 layers)
 - Better resolution in the troposphere and stratosphere
 - Much smaller damping layer starting at 30 km
- Extension of the **chemistry** to include processes of the stratosphere (yet to be completed)
 - Gas phase chemistry
 - Heterogeneous processes on supercooled ternary solution droplets (PSC type 1b) by including the model by Carslaw et al. (1995, J. Phys. Chem.)
 - Photolysis calculated online (see poster by J. Schröter)

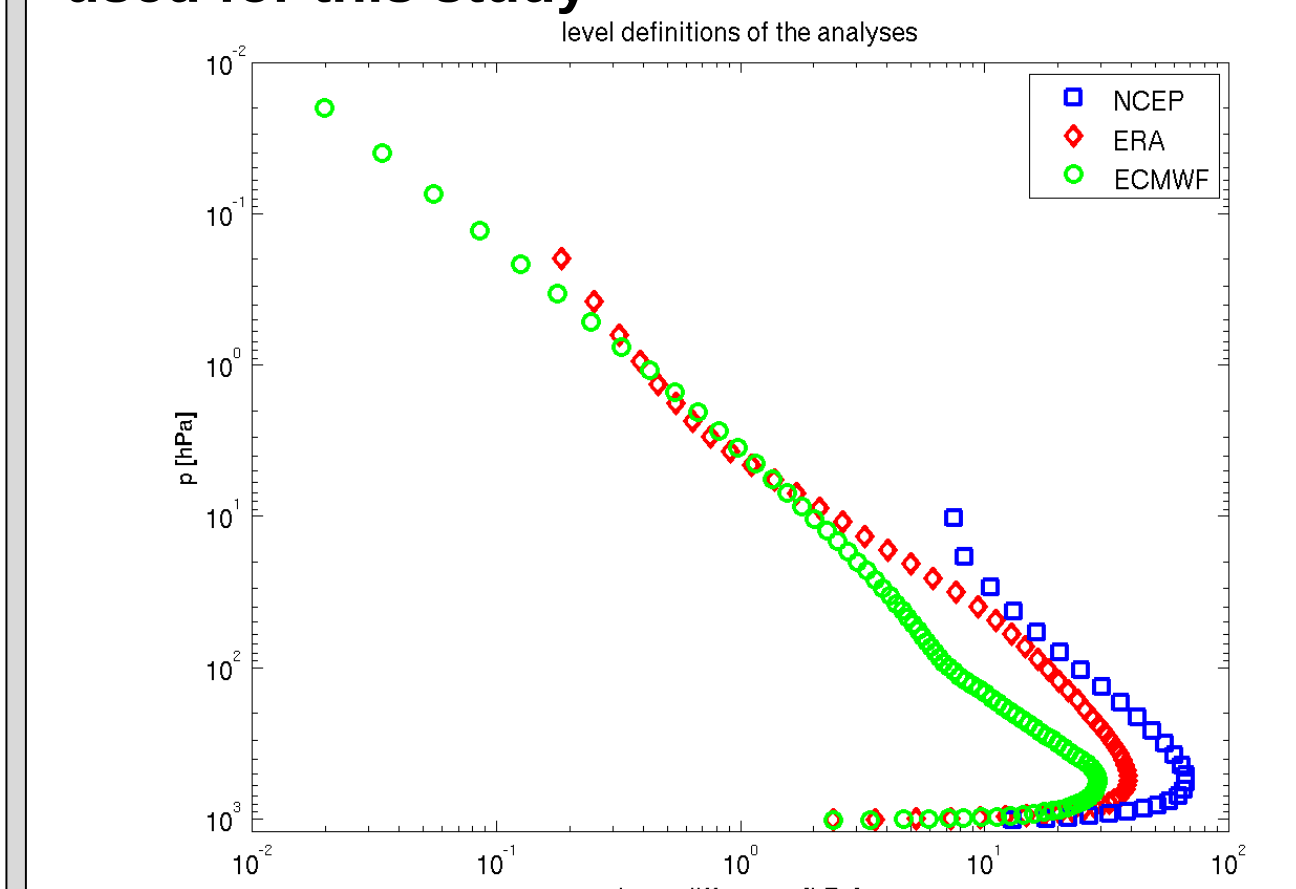
Motivation for an extension of the vertical grid

- Small scale processes and those in the area of strong gradients in the UTLS (tropopause, edge of the polar vortex) has to be simulated with a high resolution model.
- Modelling support for high resolution measurements with aircraft like CARIBIC and HALO
- Preparing COSMO-ART for the transition to ICON-ART

Vertical resolution of the old and new COSMO grid



Vertical resolution of the three analyses used for this study

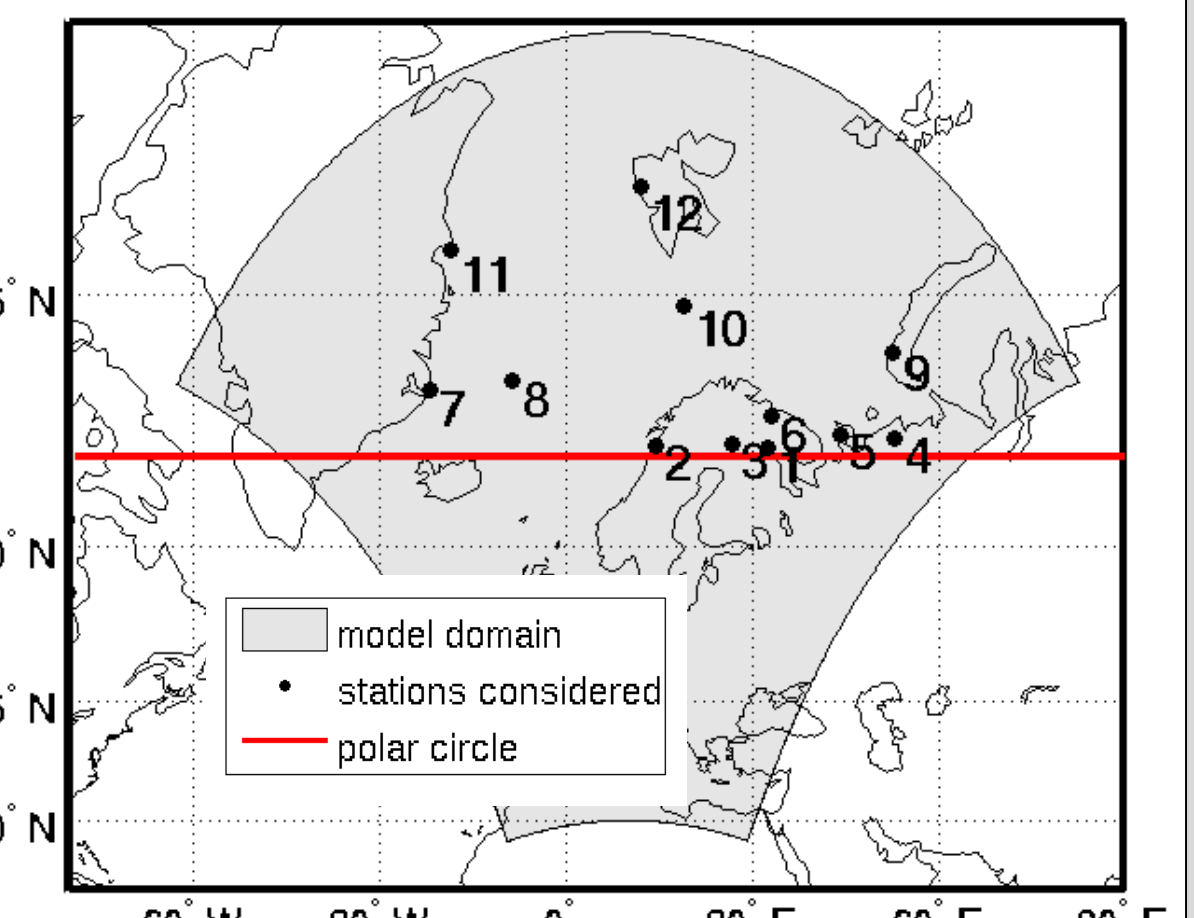


This study: Validation of temperature in the polar UTLS with data from radiosondes

- 12 synoptic radiosonde stations measuring at 0, 12 UTC
- Domain over Europe with a focus on **northern latitudes** (to prepare for the simulation of PSC)
- Two time spans: **Winter 2009/10** (Nov. 09 - May 10) and **summer 2012** (Aug. - Sept. 12)
- Three sources for **boundary** values:
 - ERA-Interim: 0.75°, 60 levels
 - ECMWF: 2°, 91 levels
 - NCEP: 2°, 28 levels

↳ 6 runs in total

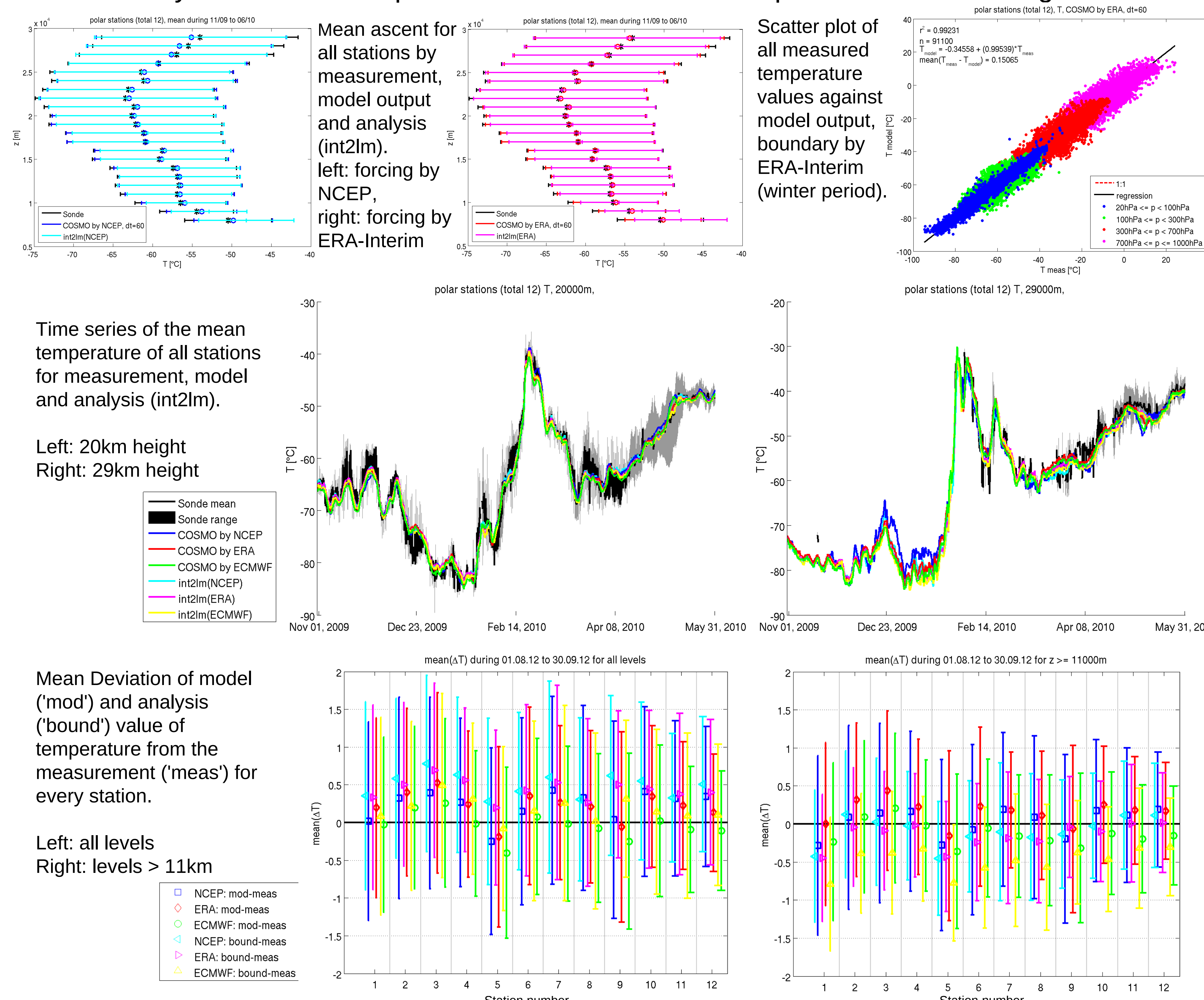
- Kandalaksa
- Bodo VI
- Sodankyla
- Nar'jan-Mar
- Sojna
- Murmansk
- Scoresbysund
- Jan Mayen
- Malye Karmakul
- Bjornoya
- Danmarkshavn
- Ny-Alesund



Sonde data source: ESRL database

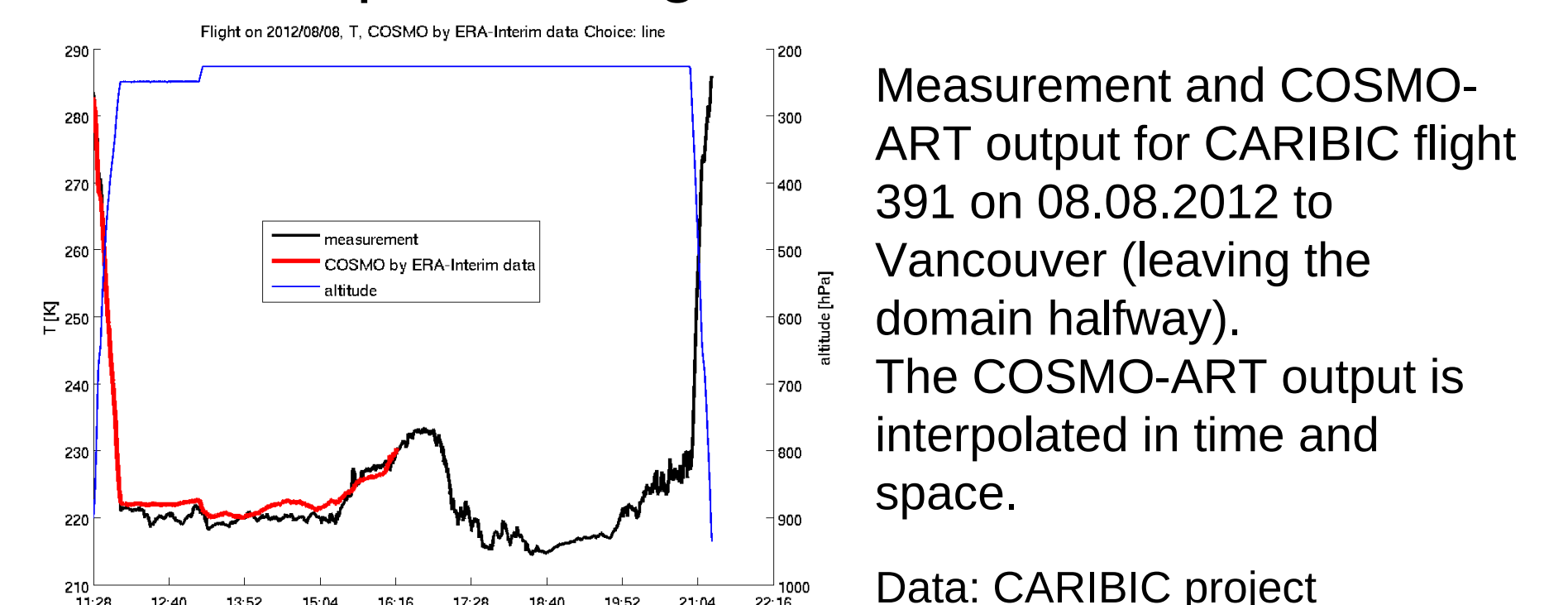
Results: Validation of the Temperature

- Influence of the boundary is small up to 30km.
- Measurements are reproduced. Modeled mean temperatures are slightly lower but higher in great heights (0.5K max) when compared to the analyses.
- Reanalysis of NCEP is up to 7K warmer than ECMWF products in 34km height.



Comparing aircraft measurements

Example of a flight of CARIBIC



Summer 2012: First flights of HALO

