Comparison Of Lidar And Cosmic Radio Occultation Temperature Profiles At High Latitude

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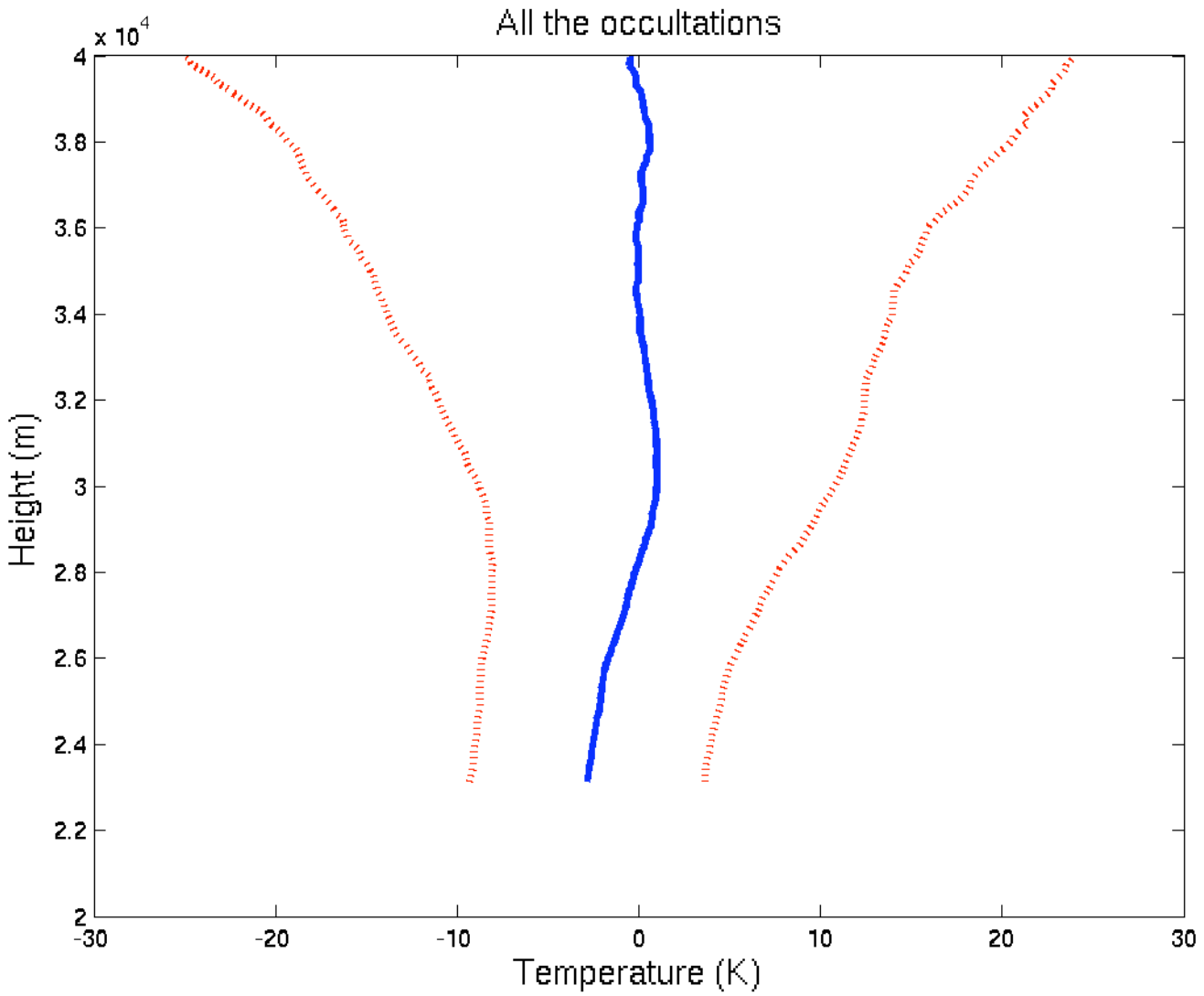
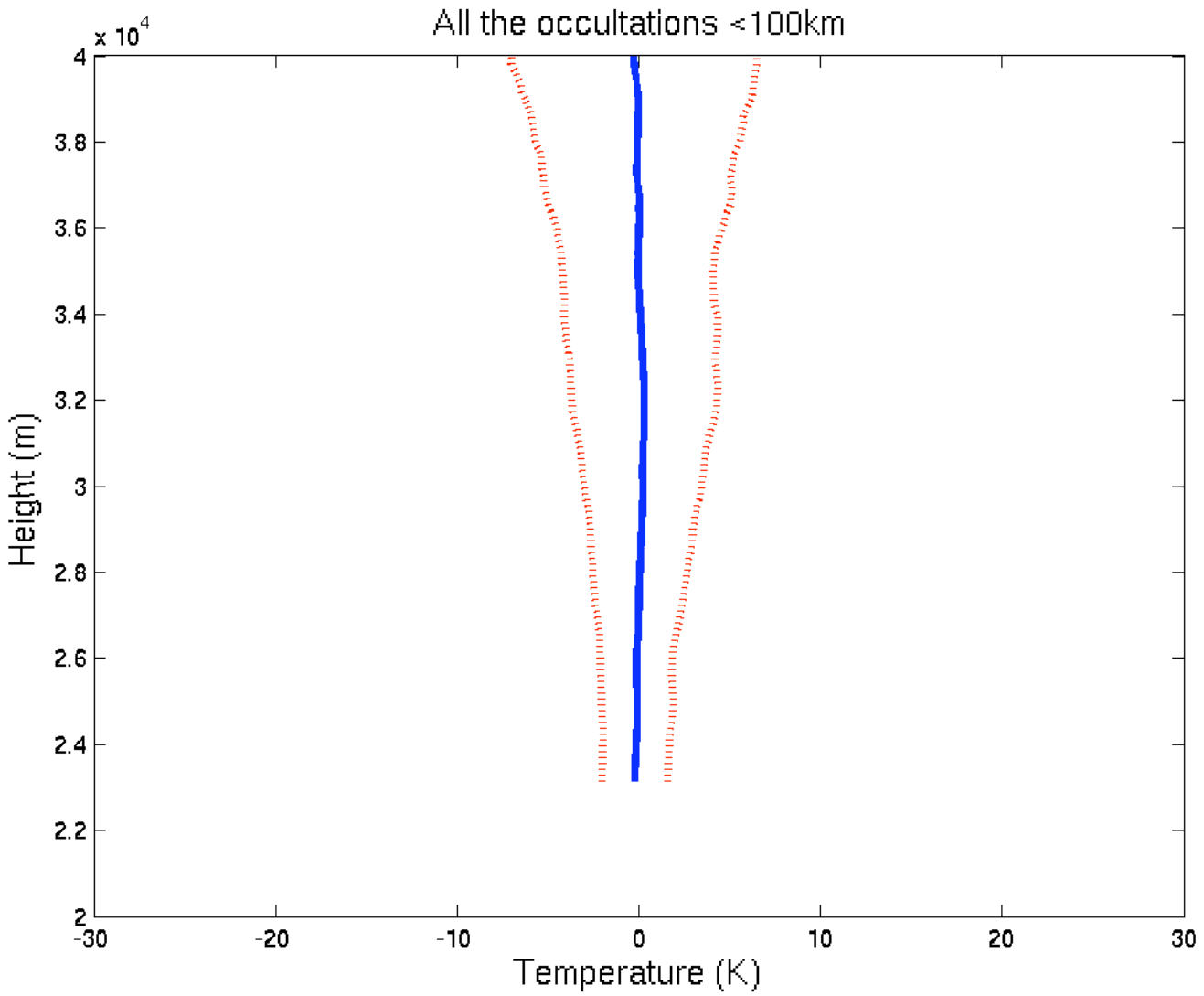
Introduction

- Comparison between LIDAR profiles and COSMIC RO profiles during winter 2006-2007
- RO data in a area around Thule (±5°lat-lon)
- Also not only simultaneous measurements are selected.
- 4 cases are selected:
    1. LIDAR and RO both inside the Polar Vortex
    2. LIDAR and RO both on the border of the Polar Vortex, but enoght close
    3. LIDAR and RO both outside the Polar Vortex and a great distance
    4. Polar Vortex tilted

Mean and STD bias for all the occultations



Mean and STD bias for occultations < 100km



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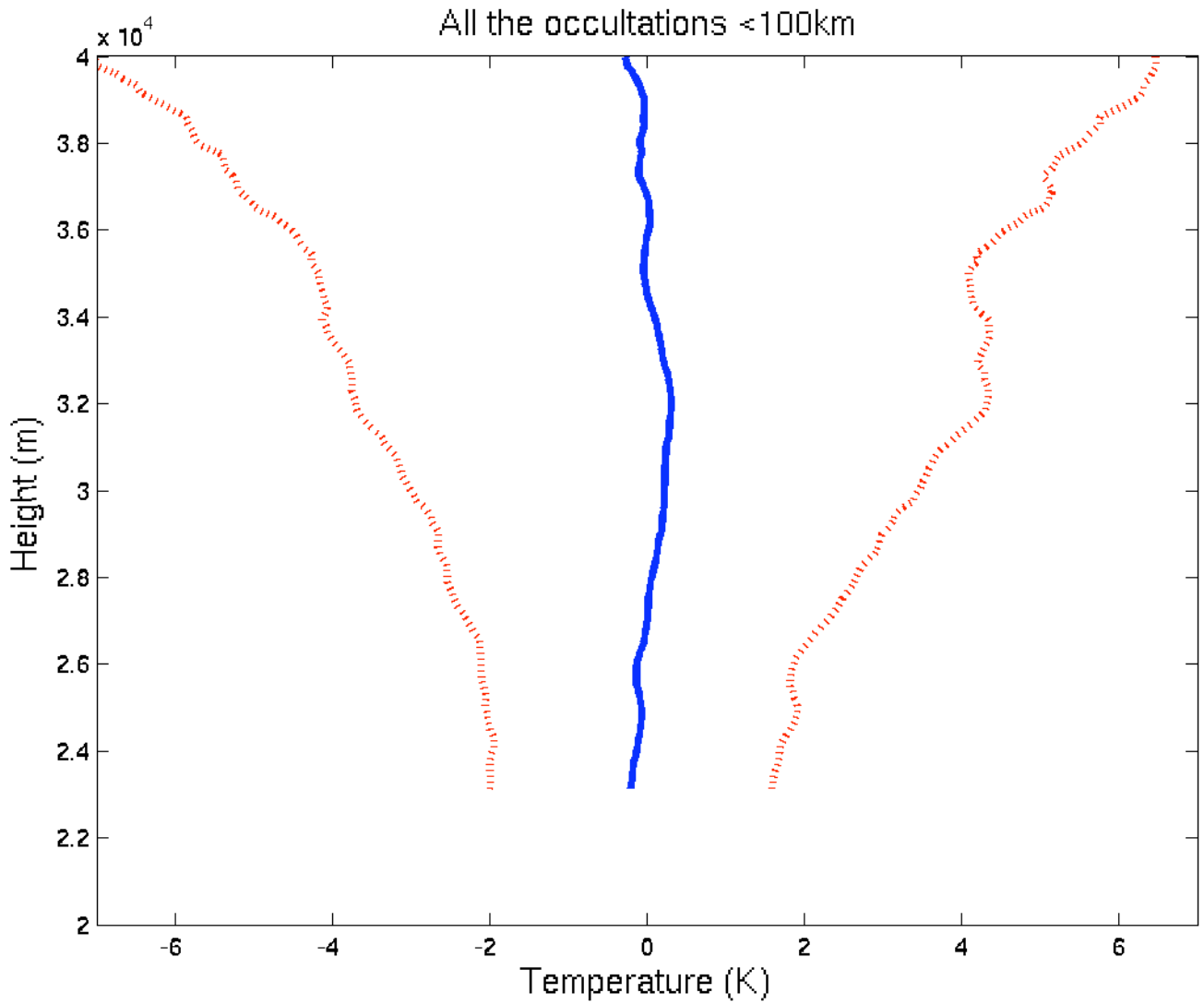

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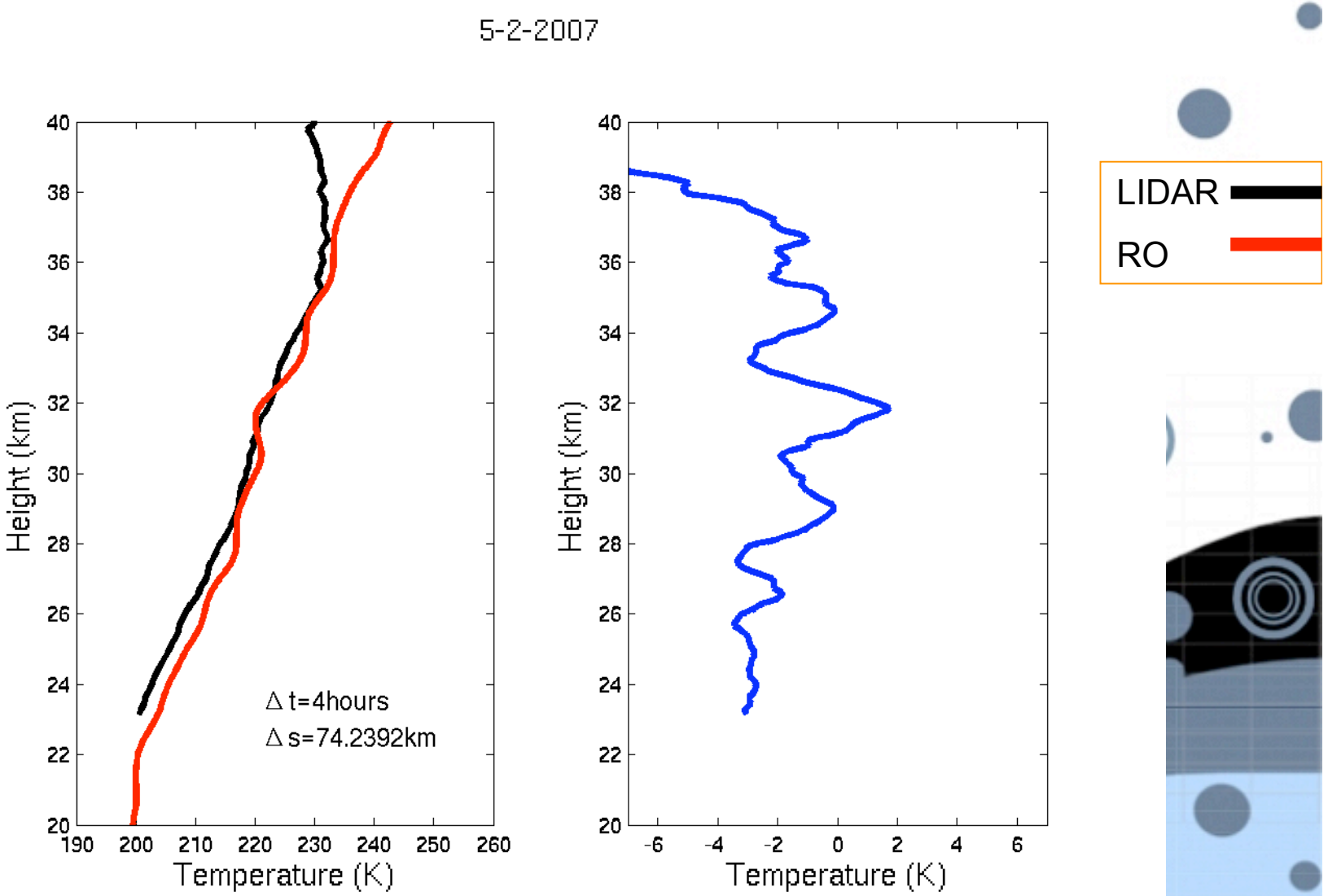
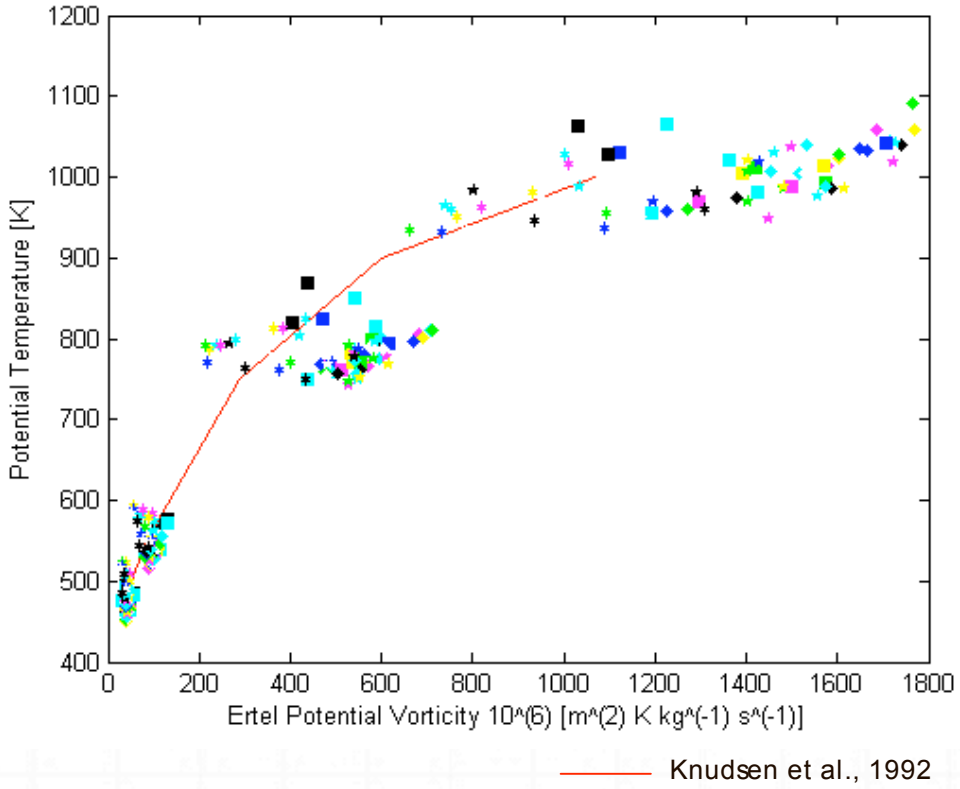
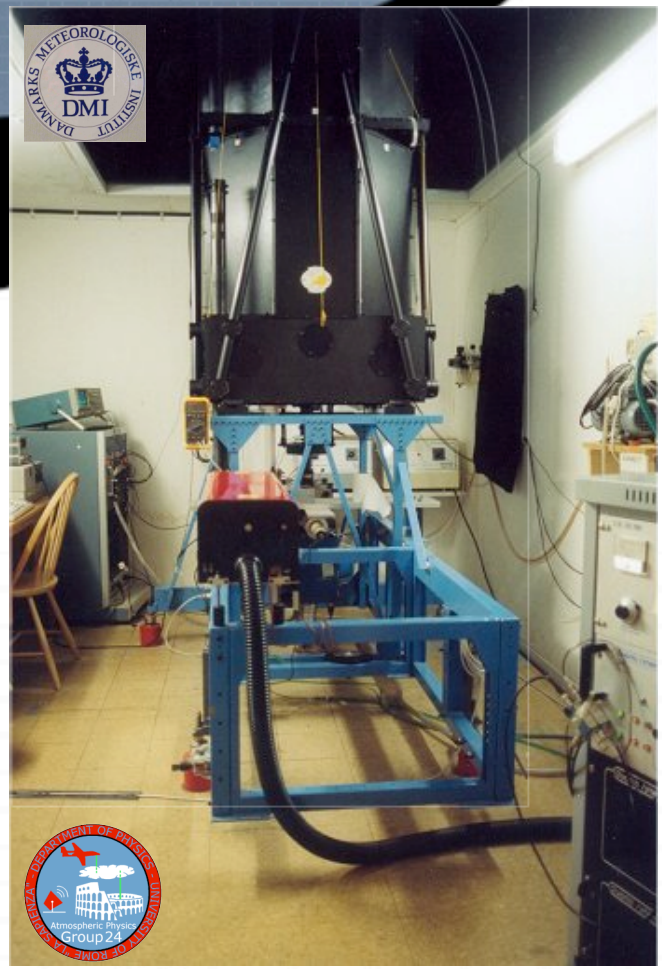


Thule Air Base, Greenland (76.5°N, 68.8°W)



Ertel Potential Vorticity over Thule
in comparison with value of polar vortex edge (red line) during last winter

LIDAR (LIght Detection And Ranging)



At Thule Air Base

Laser: Nd – YAG (1064 nm – 532 nm – 355 nm)

Telescope: Cassegrain 800 mm diameter

Receiver: two polarizations acquired both in A/D and photon counting modes

Chopper: prevents saturation from short range echoes

Vertical resolution: 75m Aerosols studies
150 m Temperature profiles

DATASET

Winter 2006 - 2007

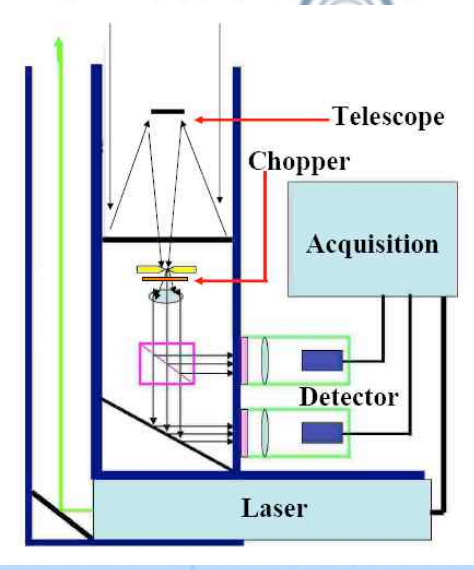
Winter 2002 - 2003

Winter 2001 - 2002

1992 - 1997

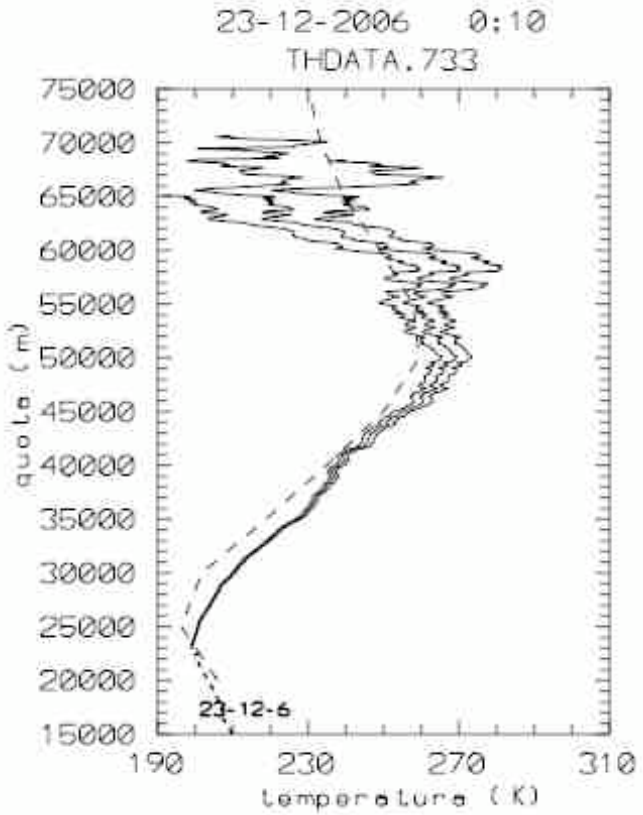
Winter 1991 - 1992

Winter 1990 - 1991

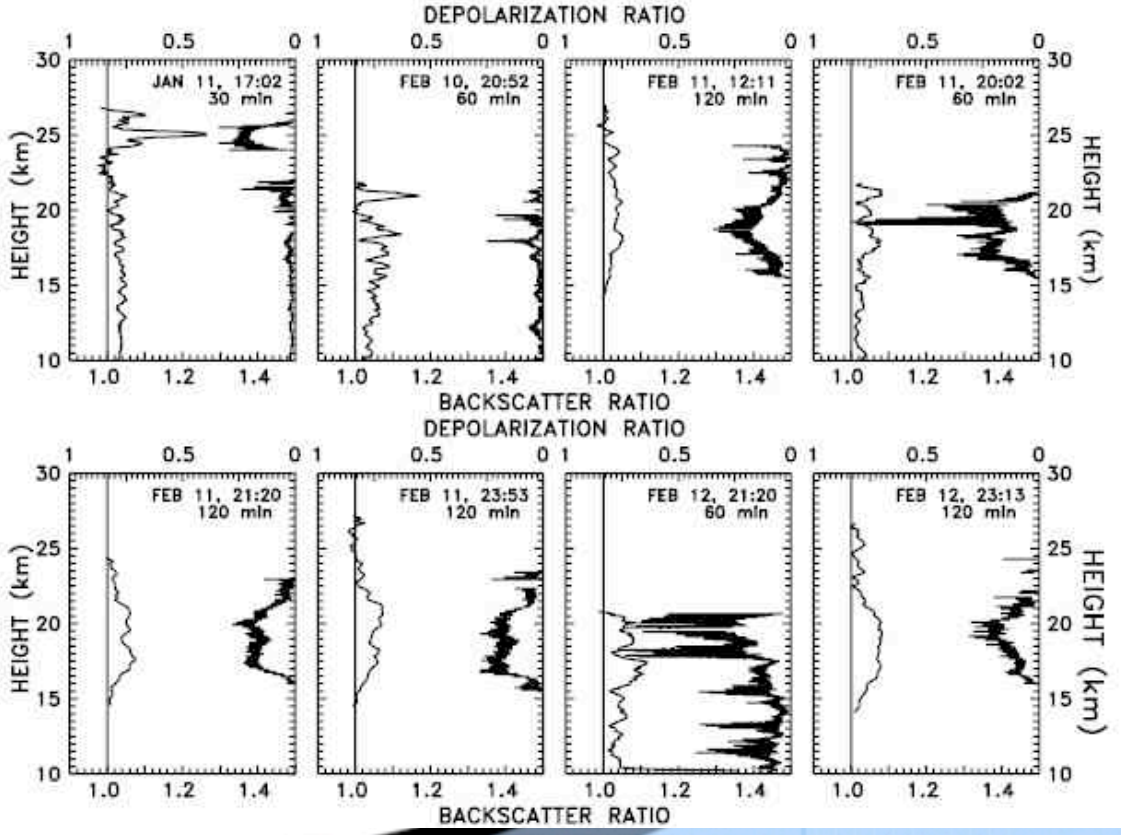


Lidar output

Temperature profile [23 – 70] km



Polar Stratospheric Cloud



di Sarra et al., 2002

Inside The Polar Vortex (case A)

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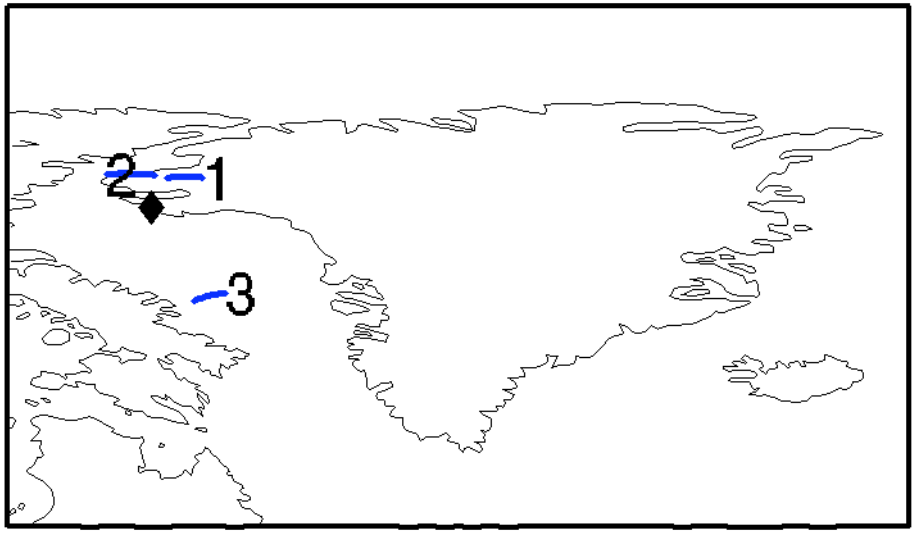
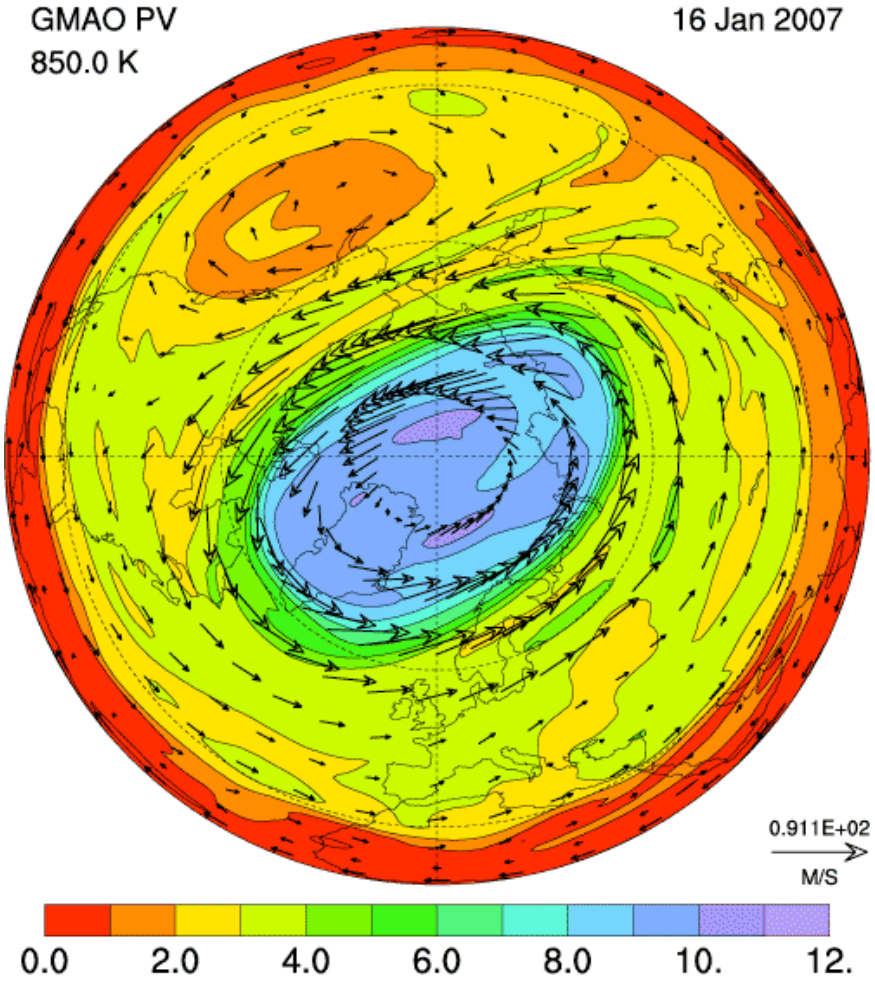
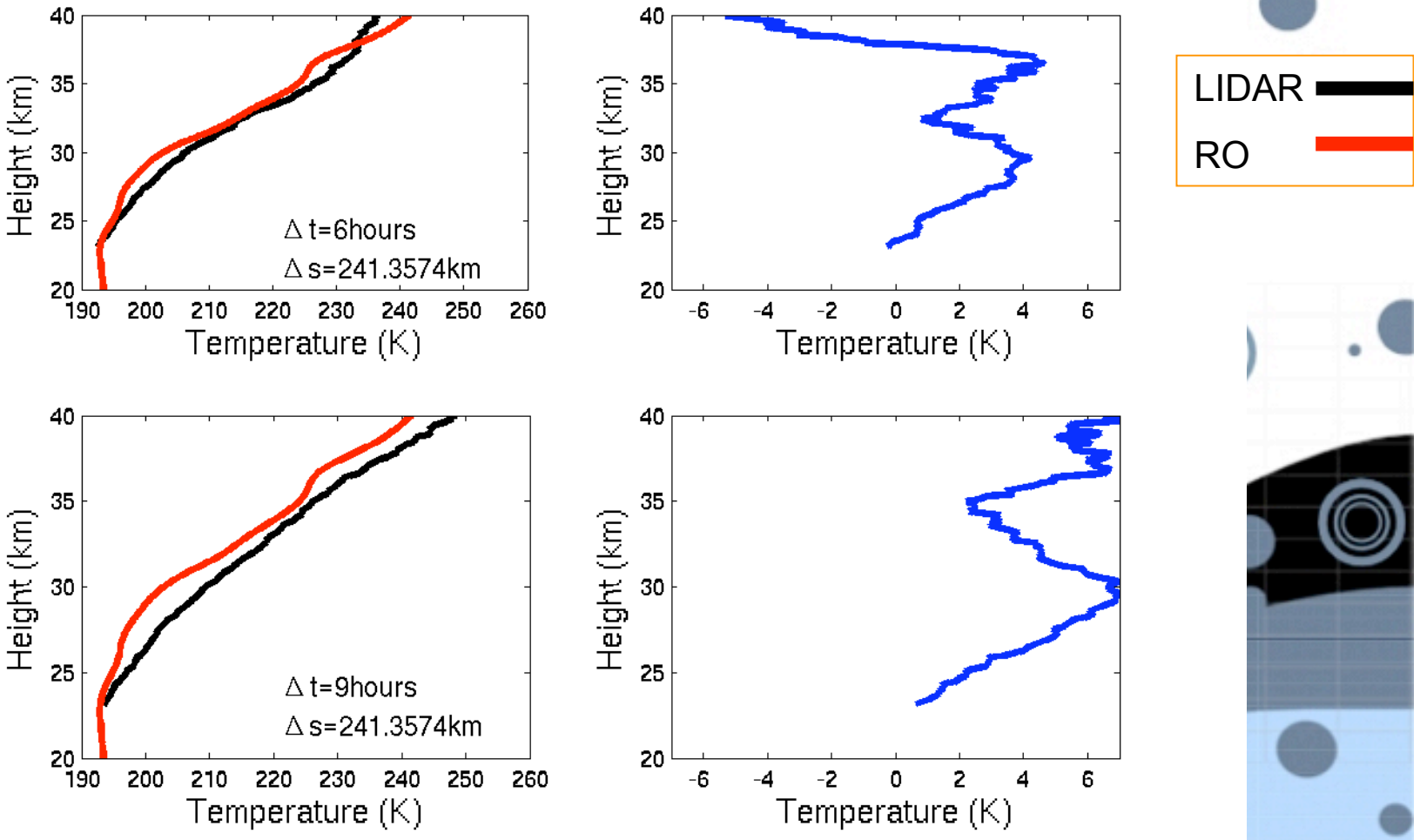




850 K

Inside The Polar Vortex (case A)

16-1-2007



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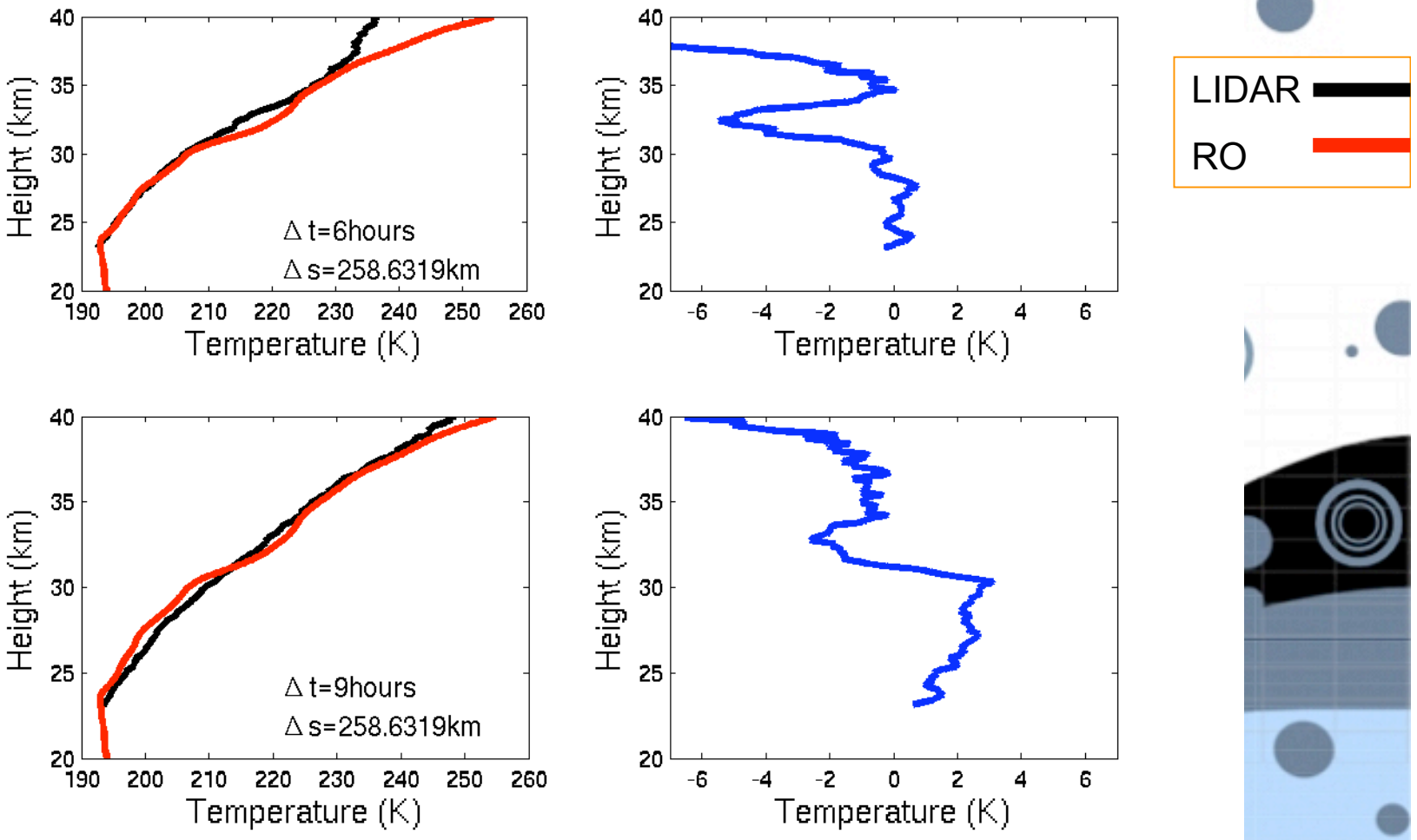
16-1-2007



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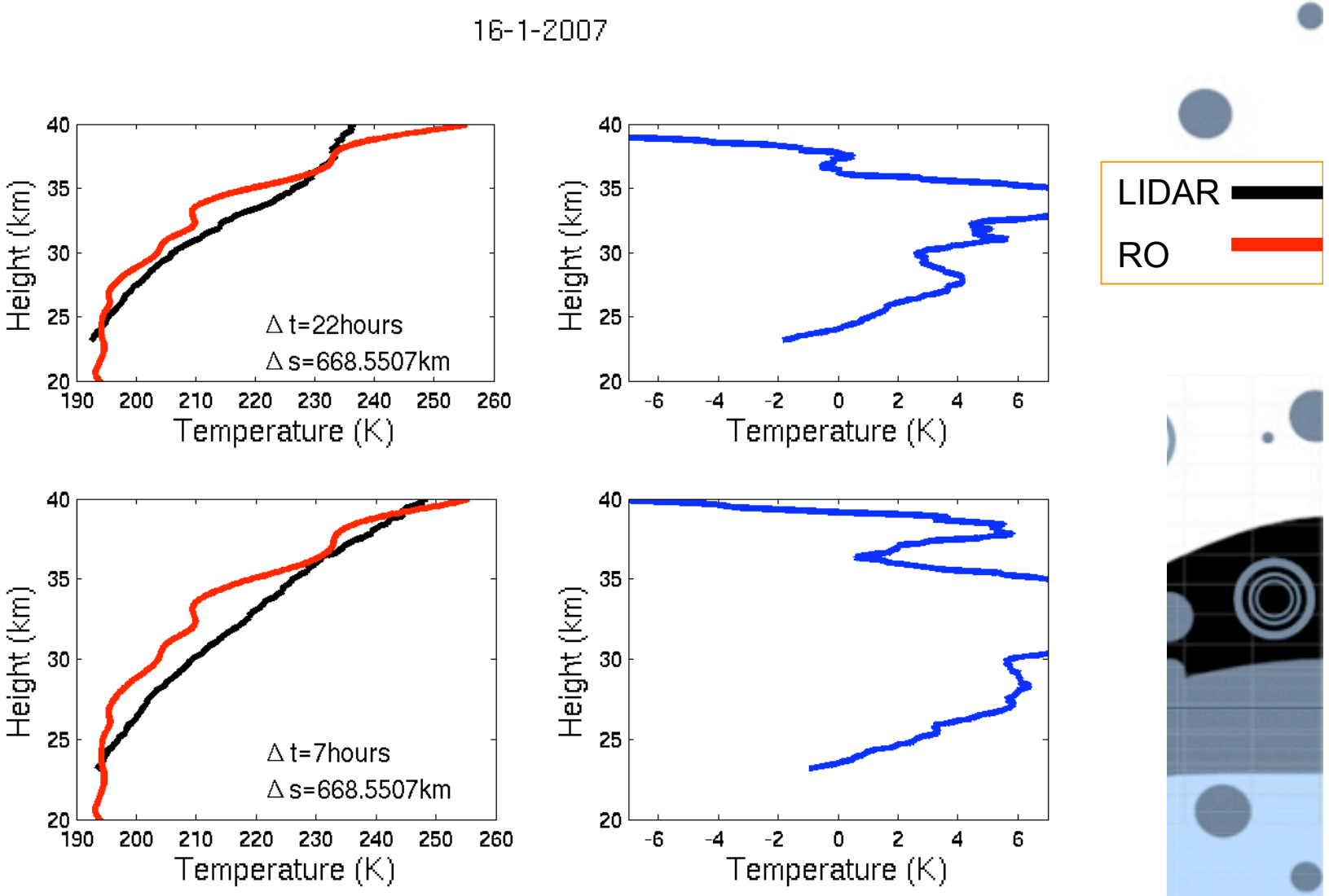
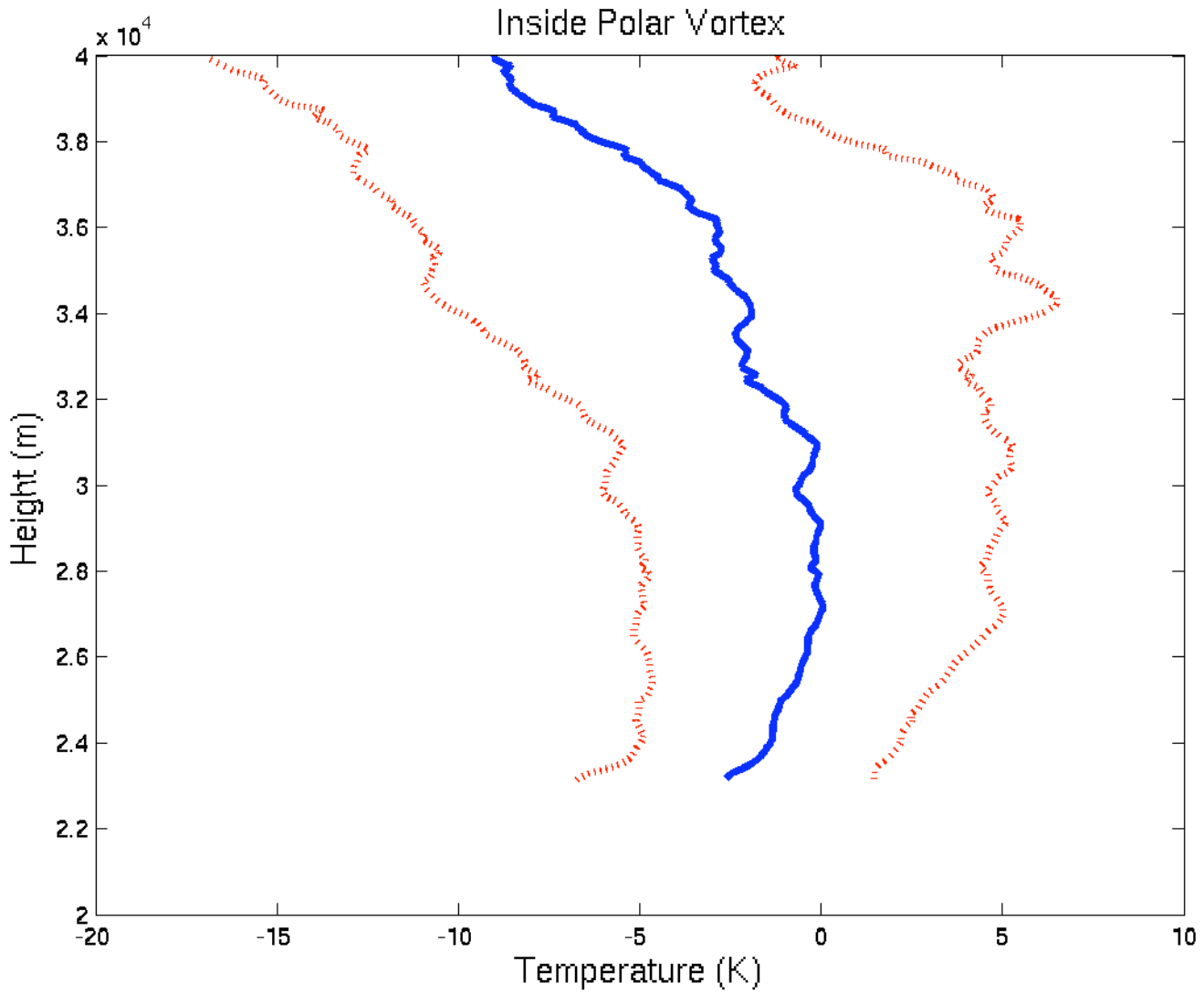


Mean and STD bias for events inside the vortex (case A)



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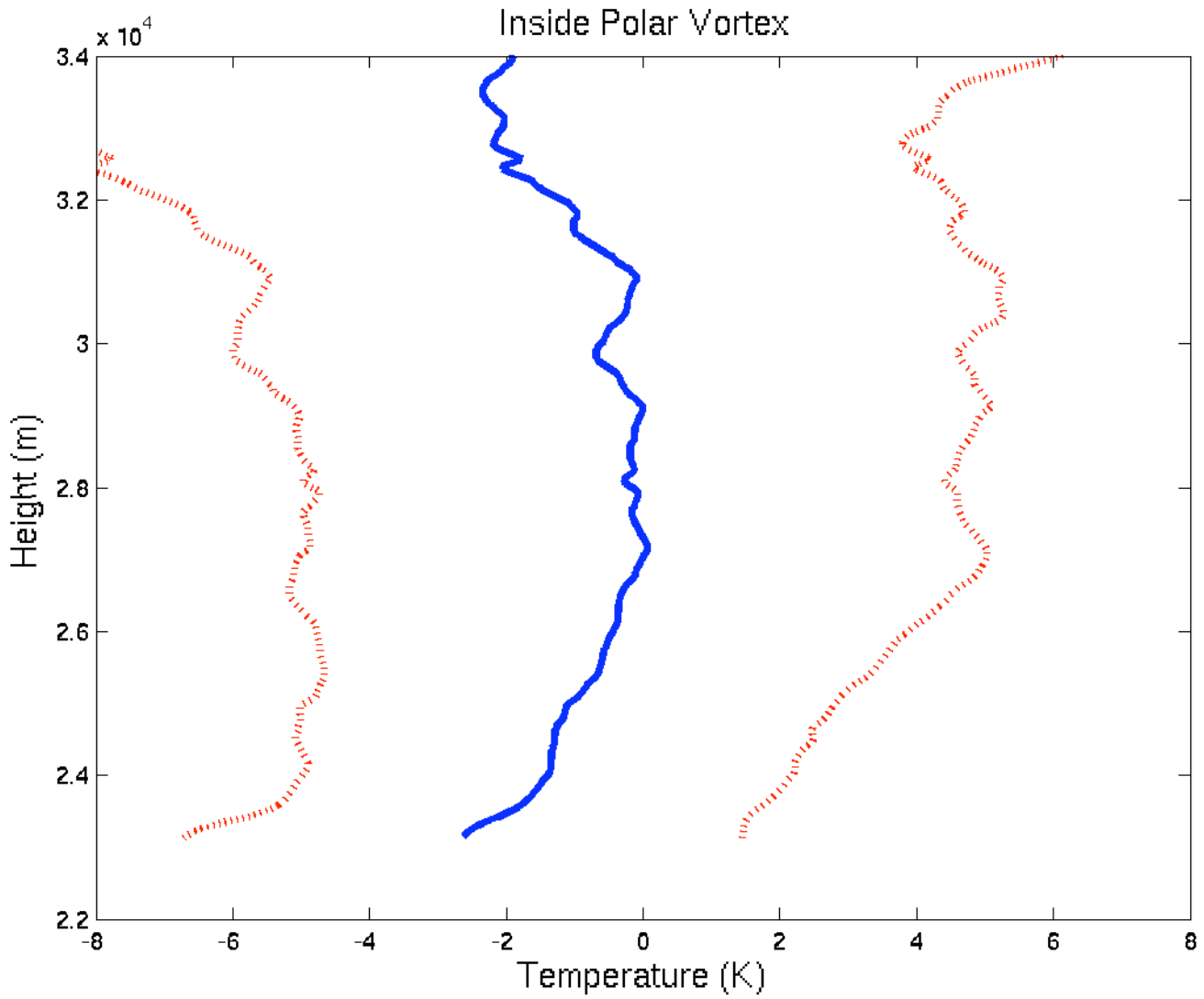

On the border of The Polar Vortex (case B)

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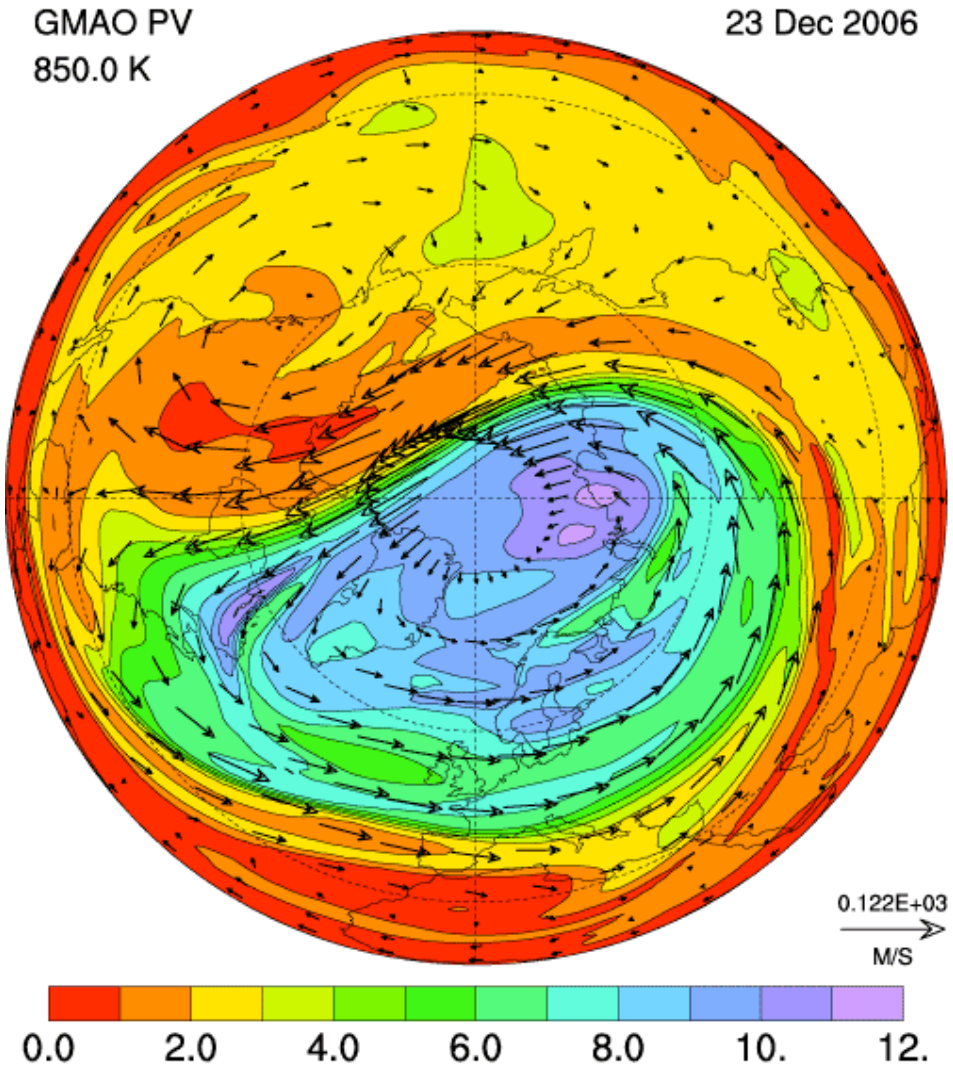
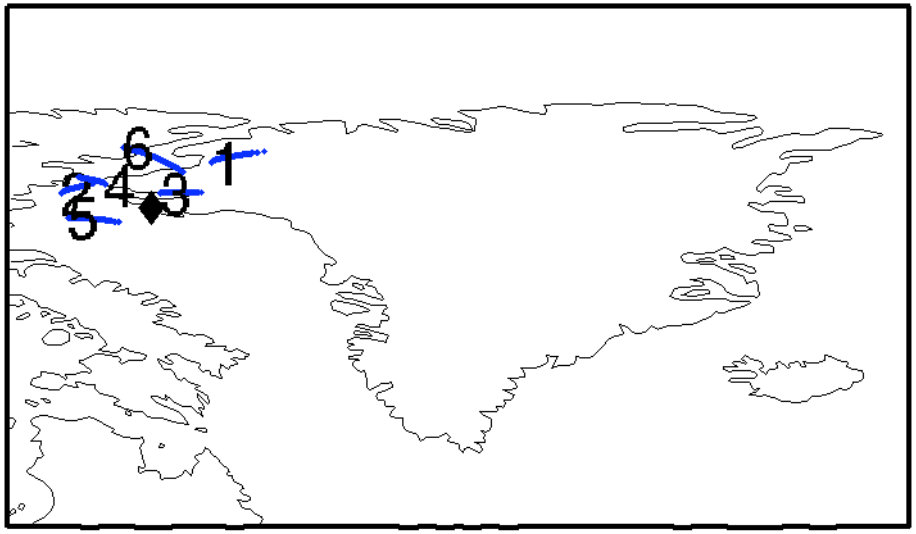
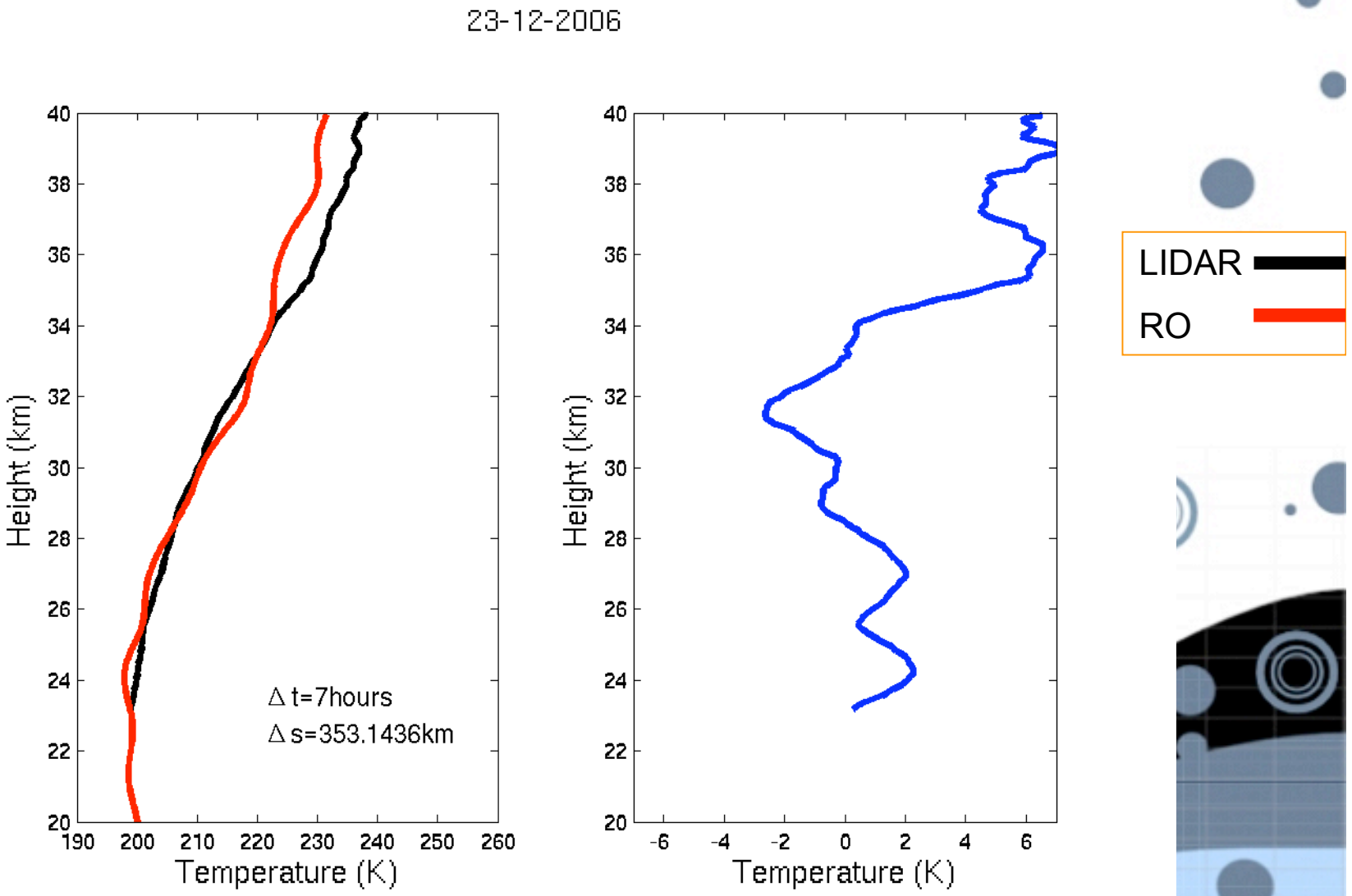


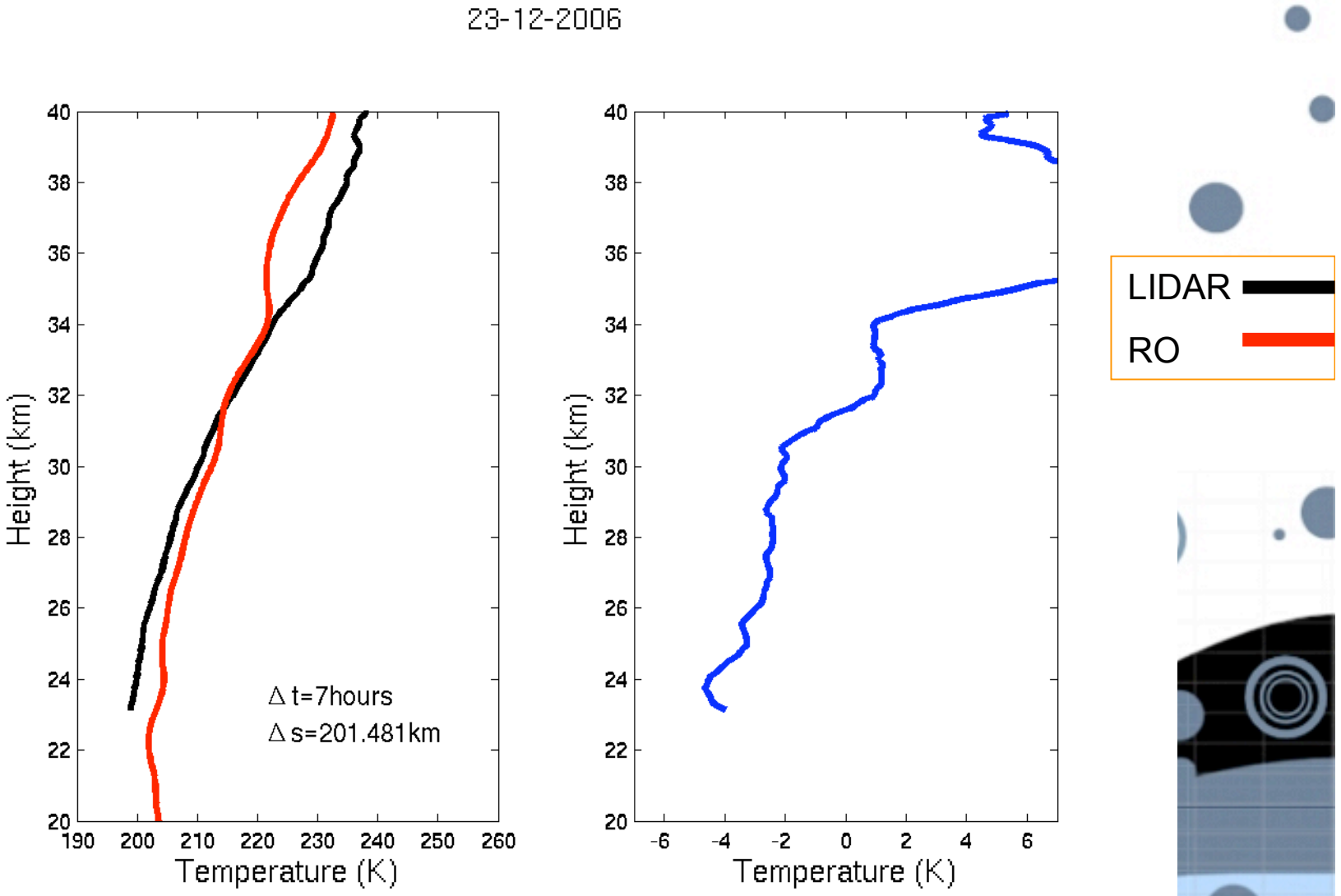


850 K

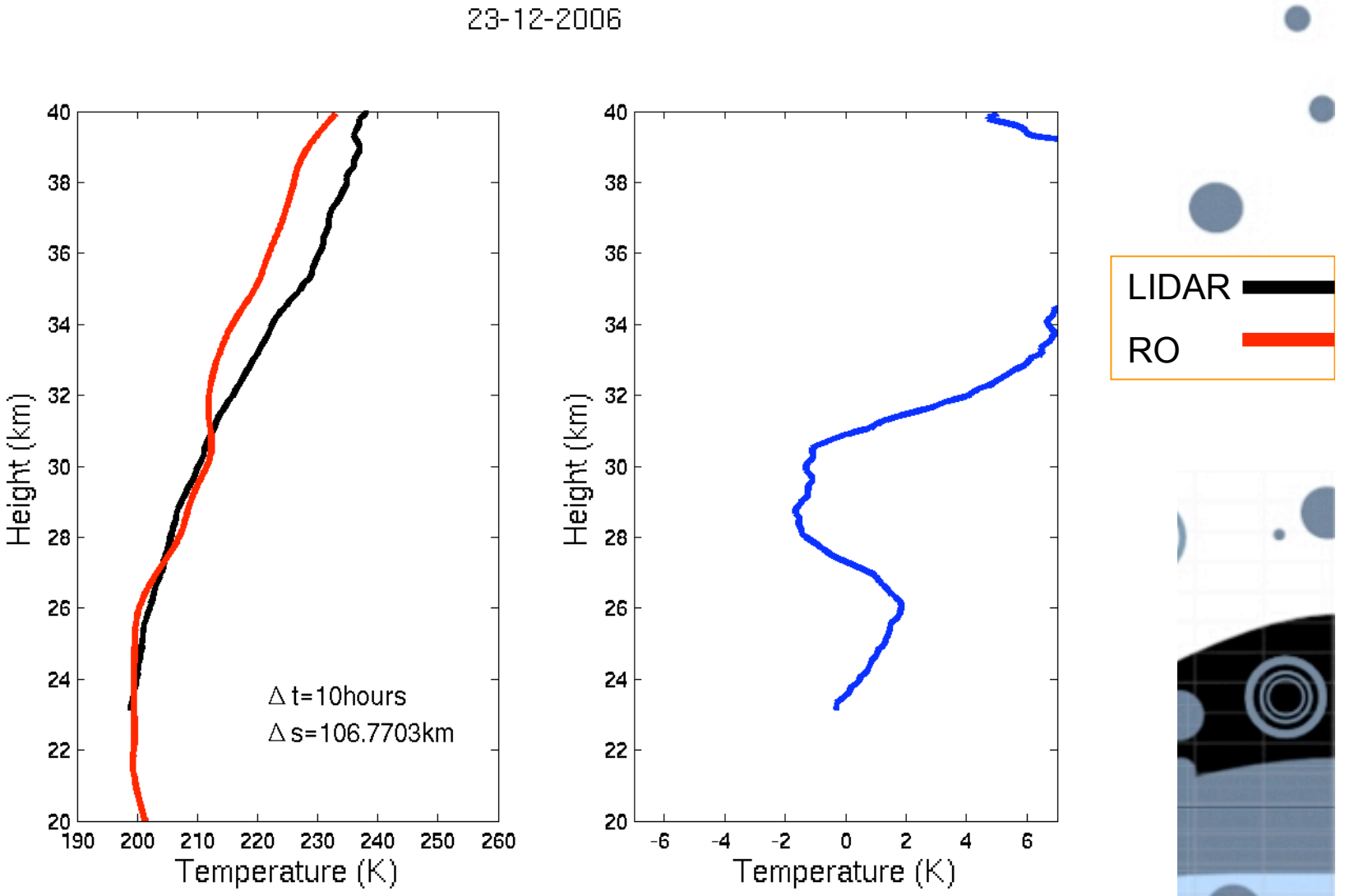
On the border of The Polar Vortex (case B)



On the border of The Polar Vortex (case B)



On the border of The Polar Vortex (case B)



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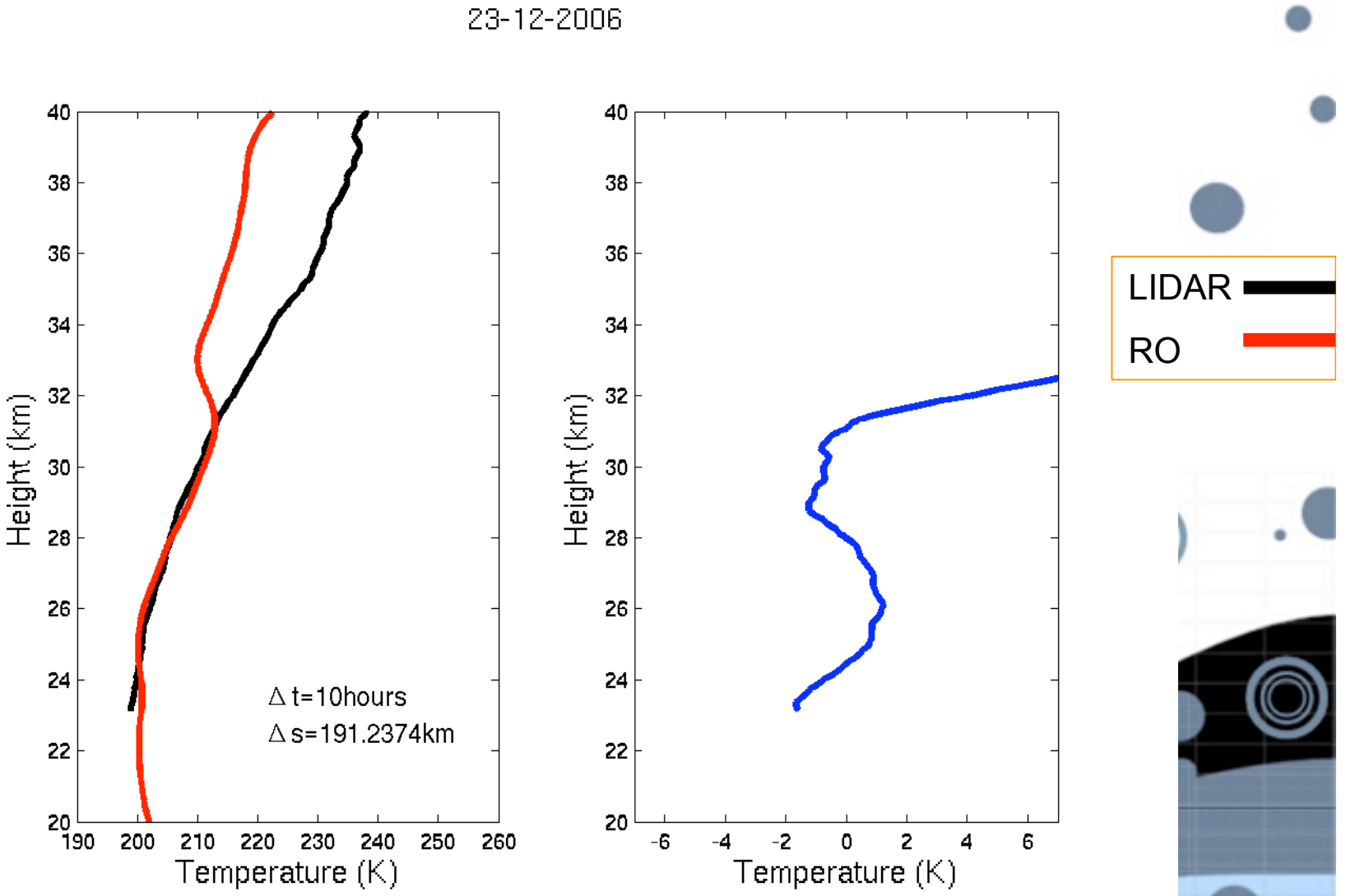

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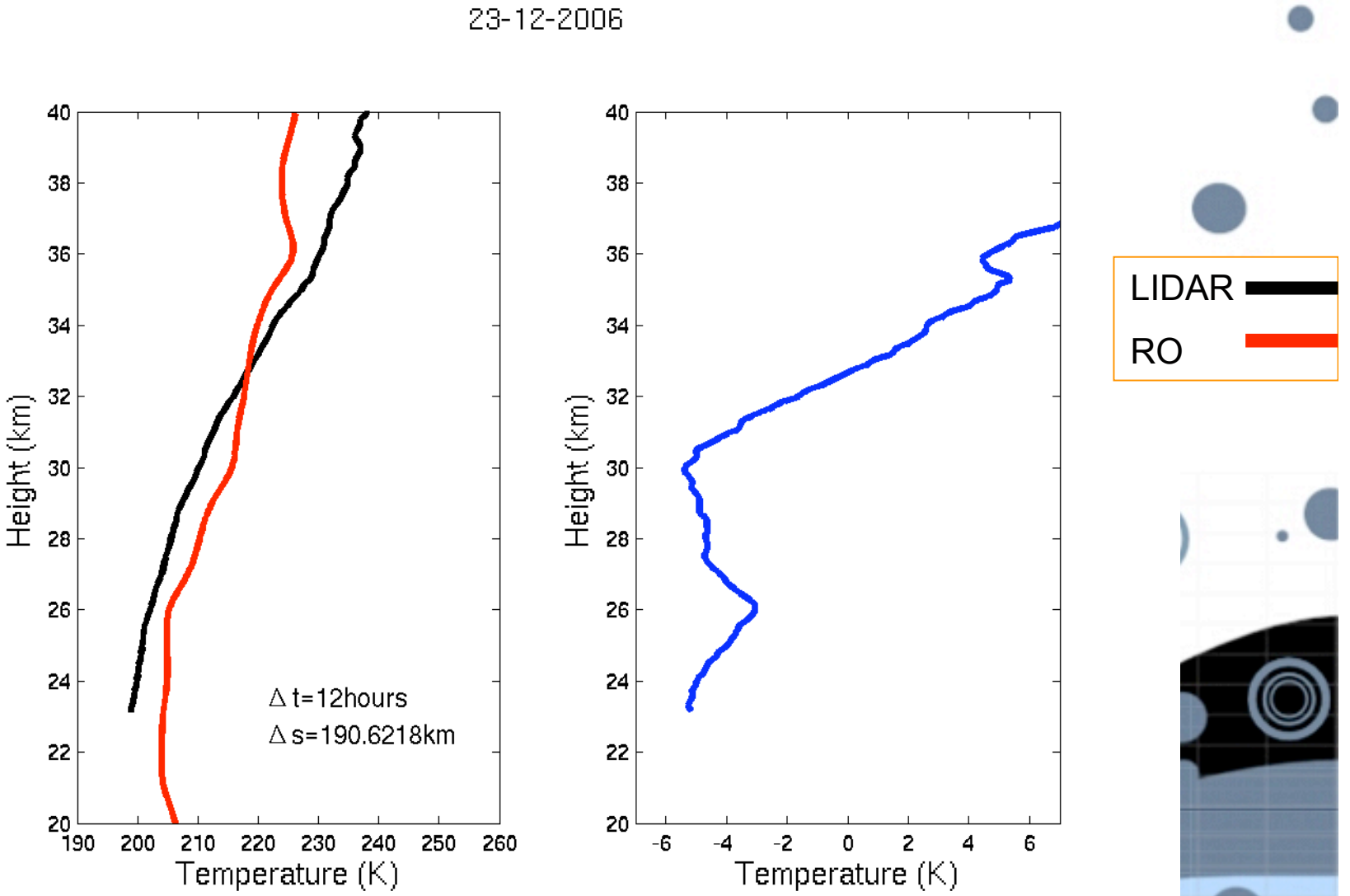

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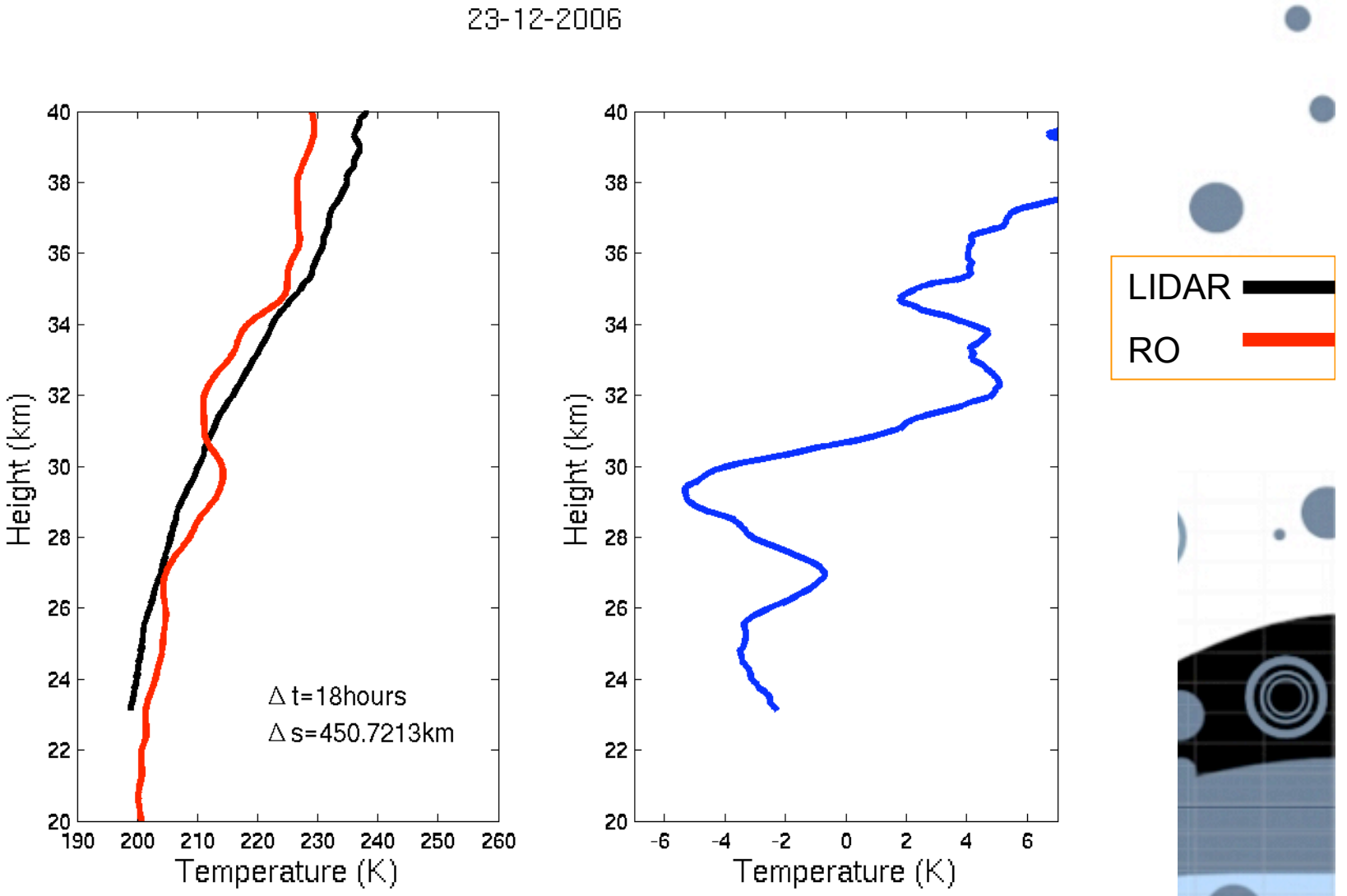
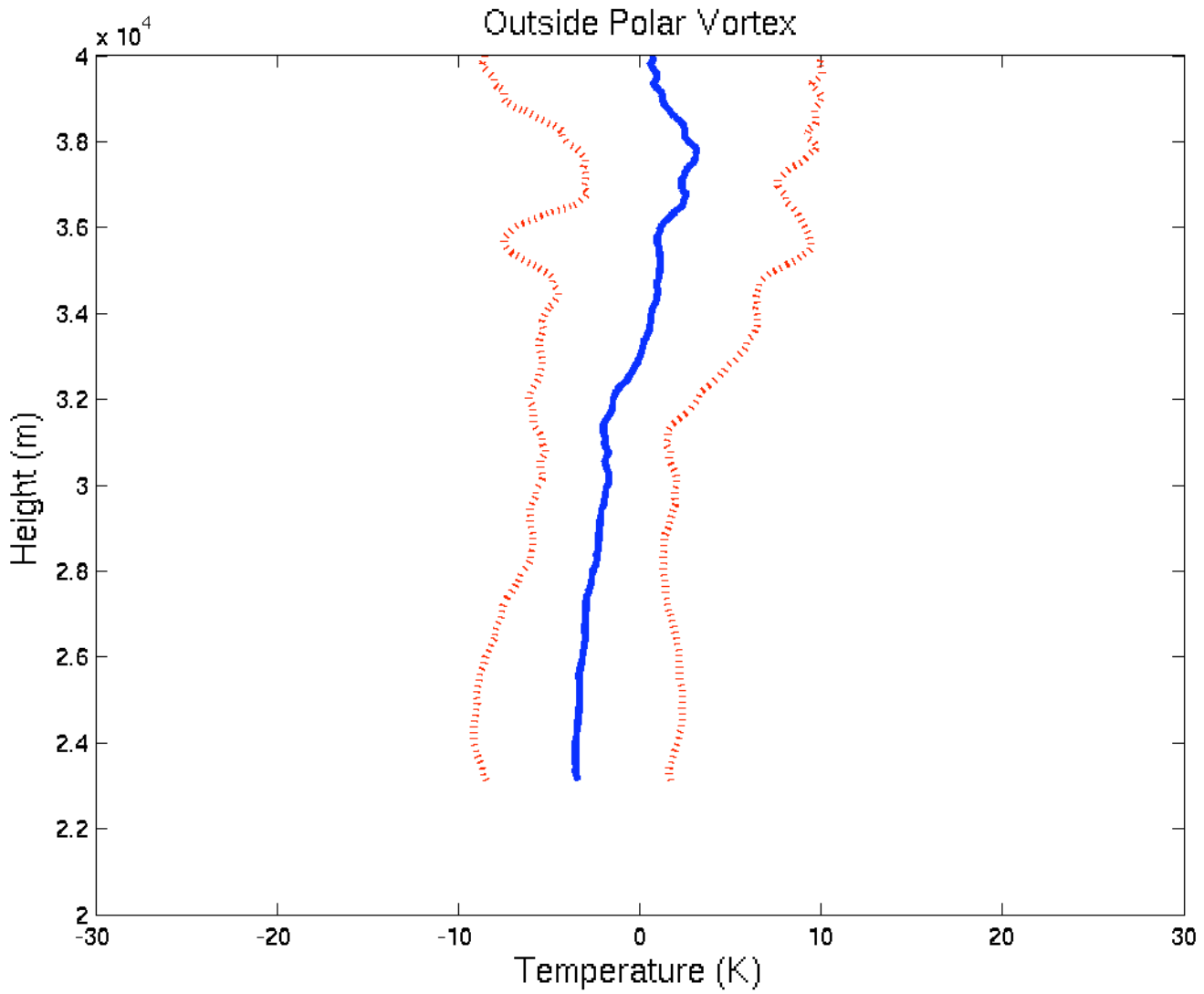
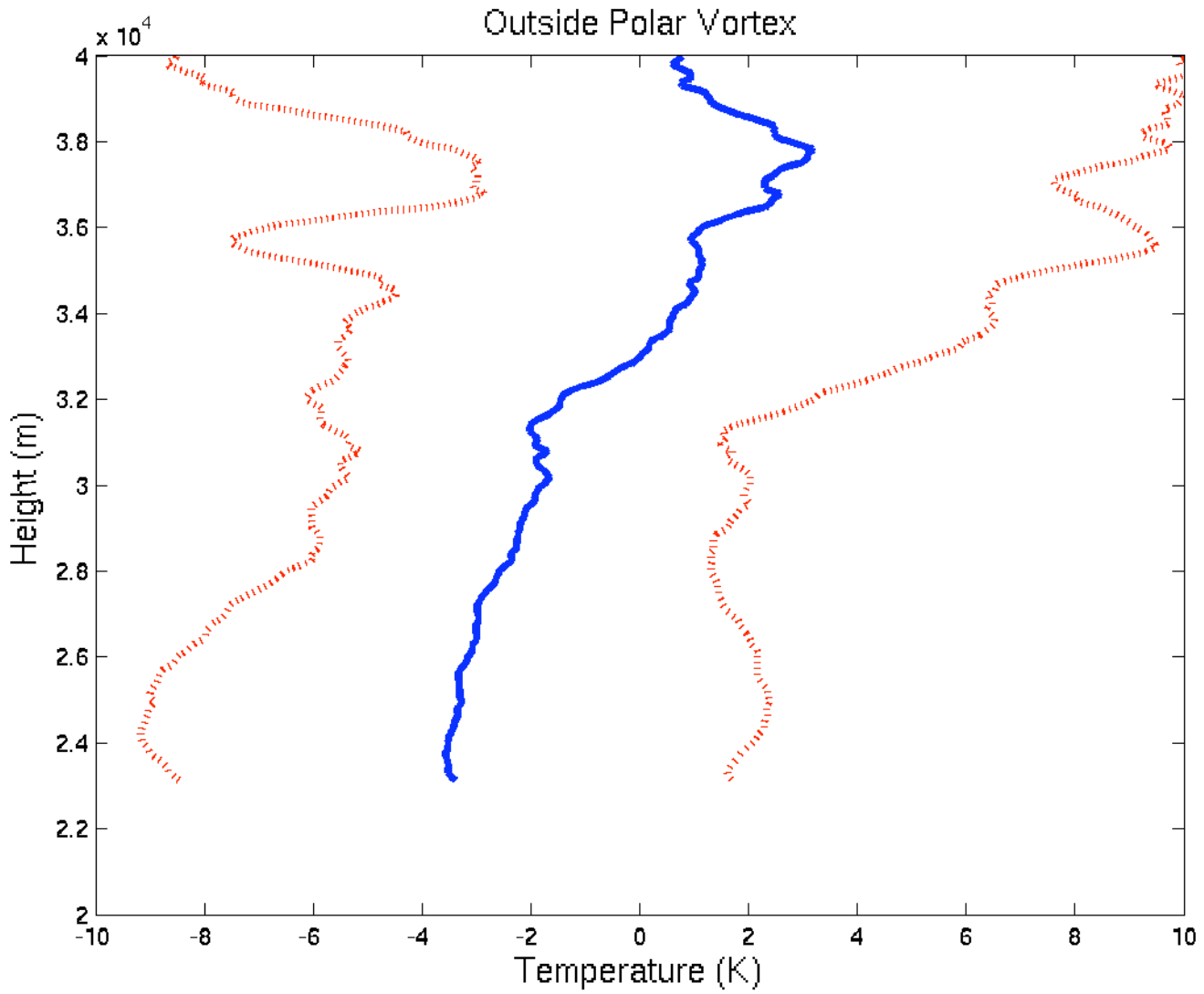


Mean and STD bias for events outside the vortex (case B)



Mean and STD bias for events outside the vortex (case B)



On the border of The Polar Vortex (case C)

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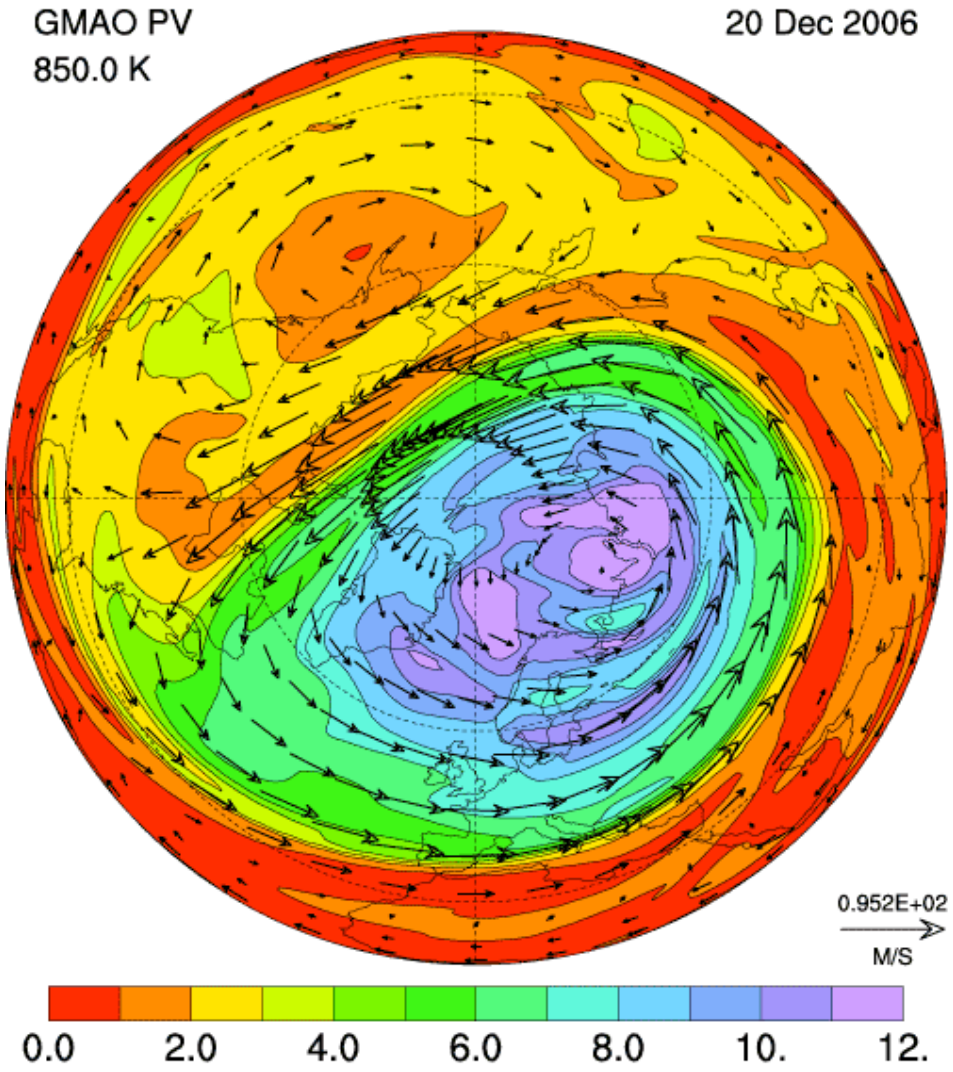
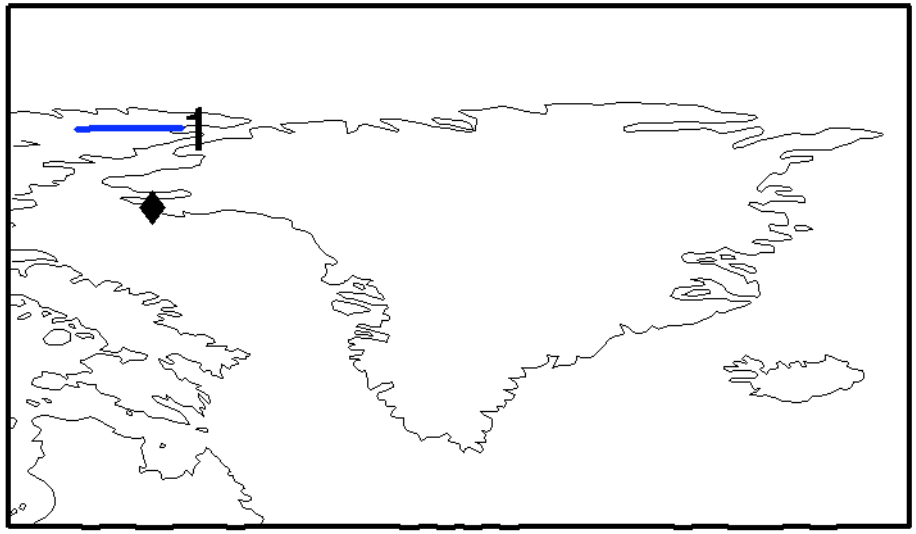
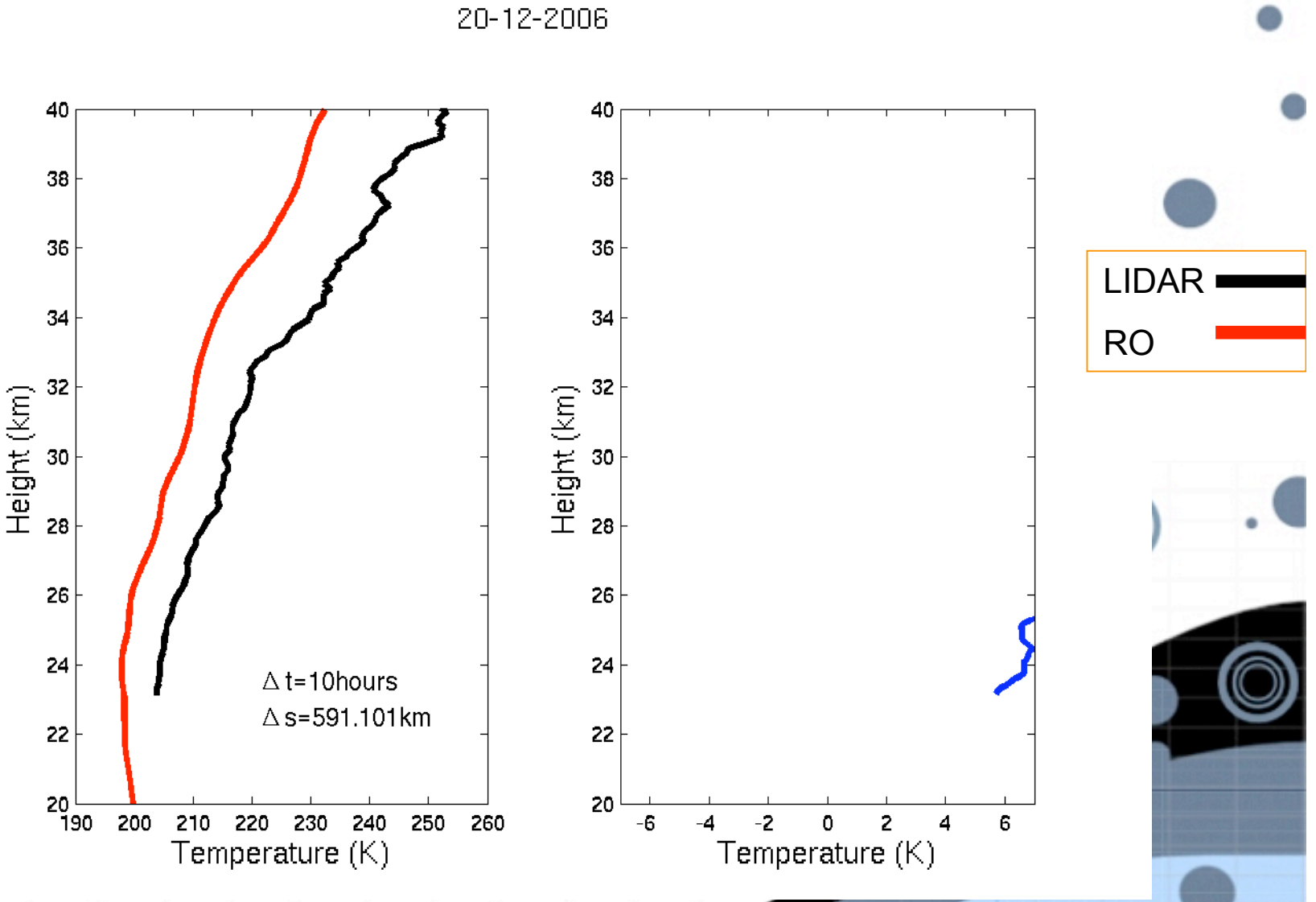


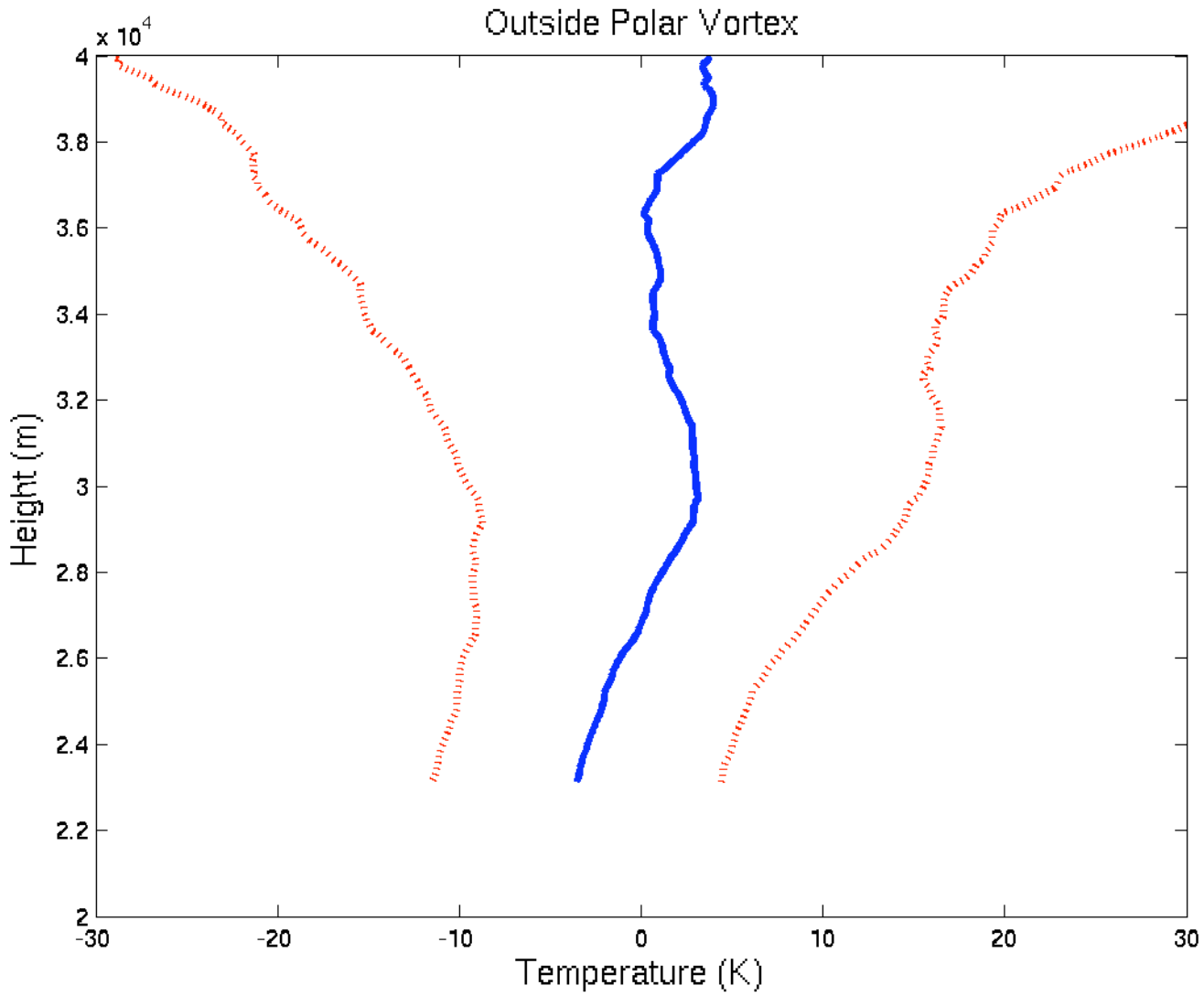


850 K

On the border of The Polar Vortex (case C)



Mean and STD bias for events outside the vortex (case C)



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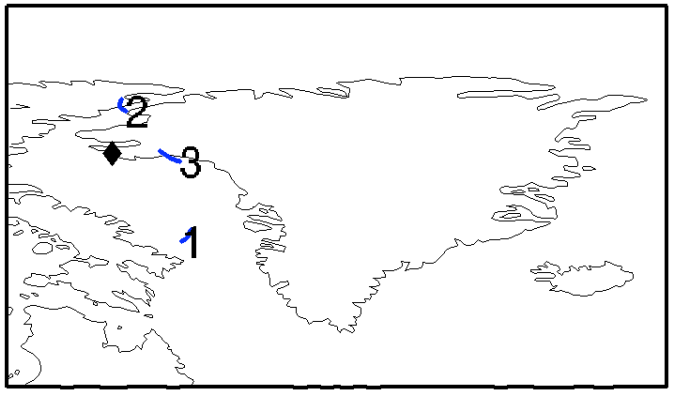
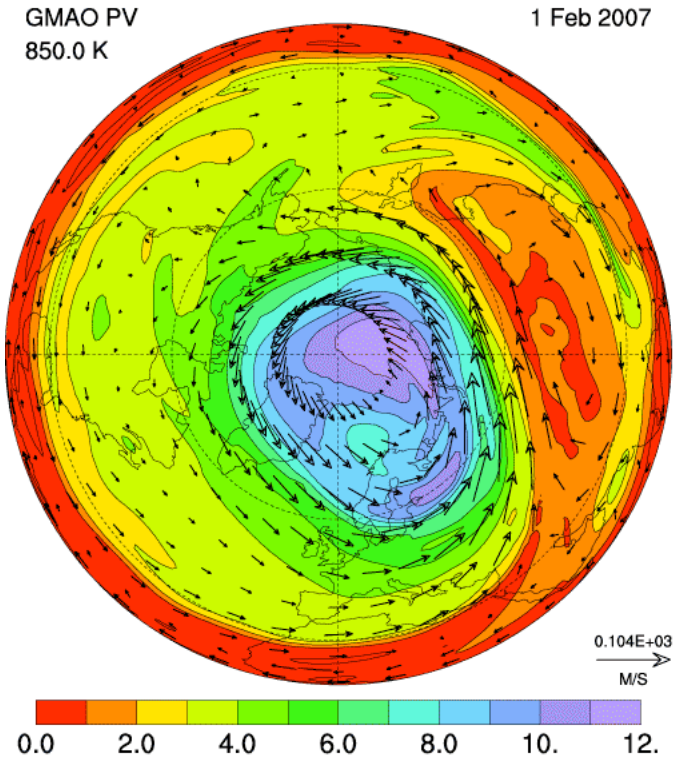
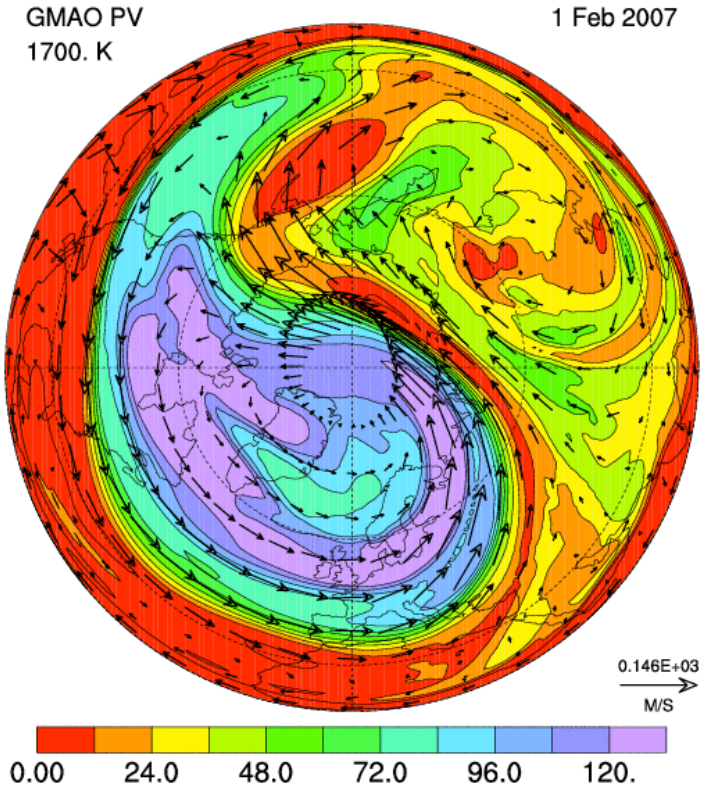
Tilted Polar Vortex



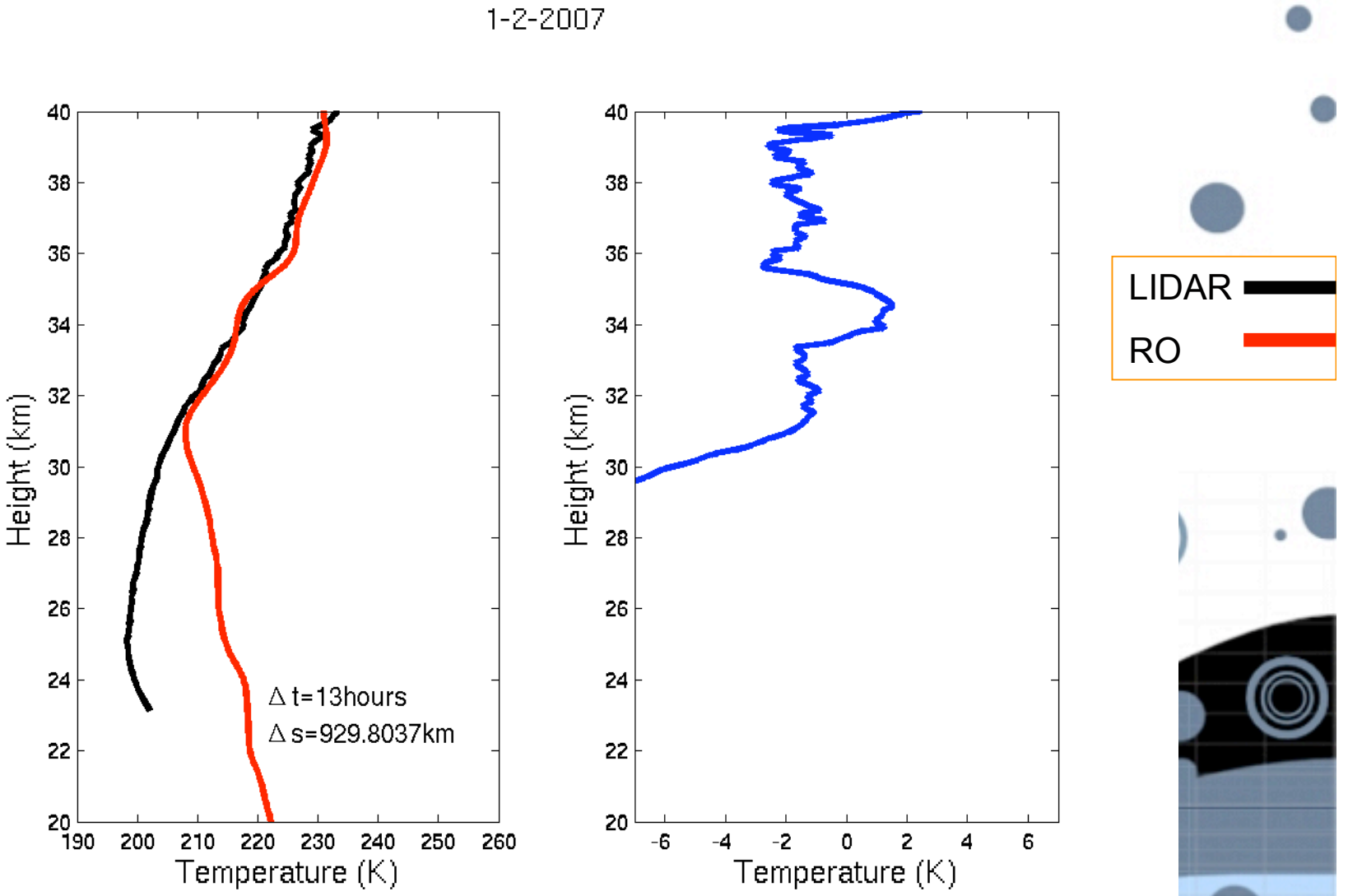


850 K

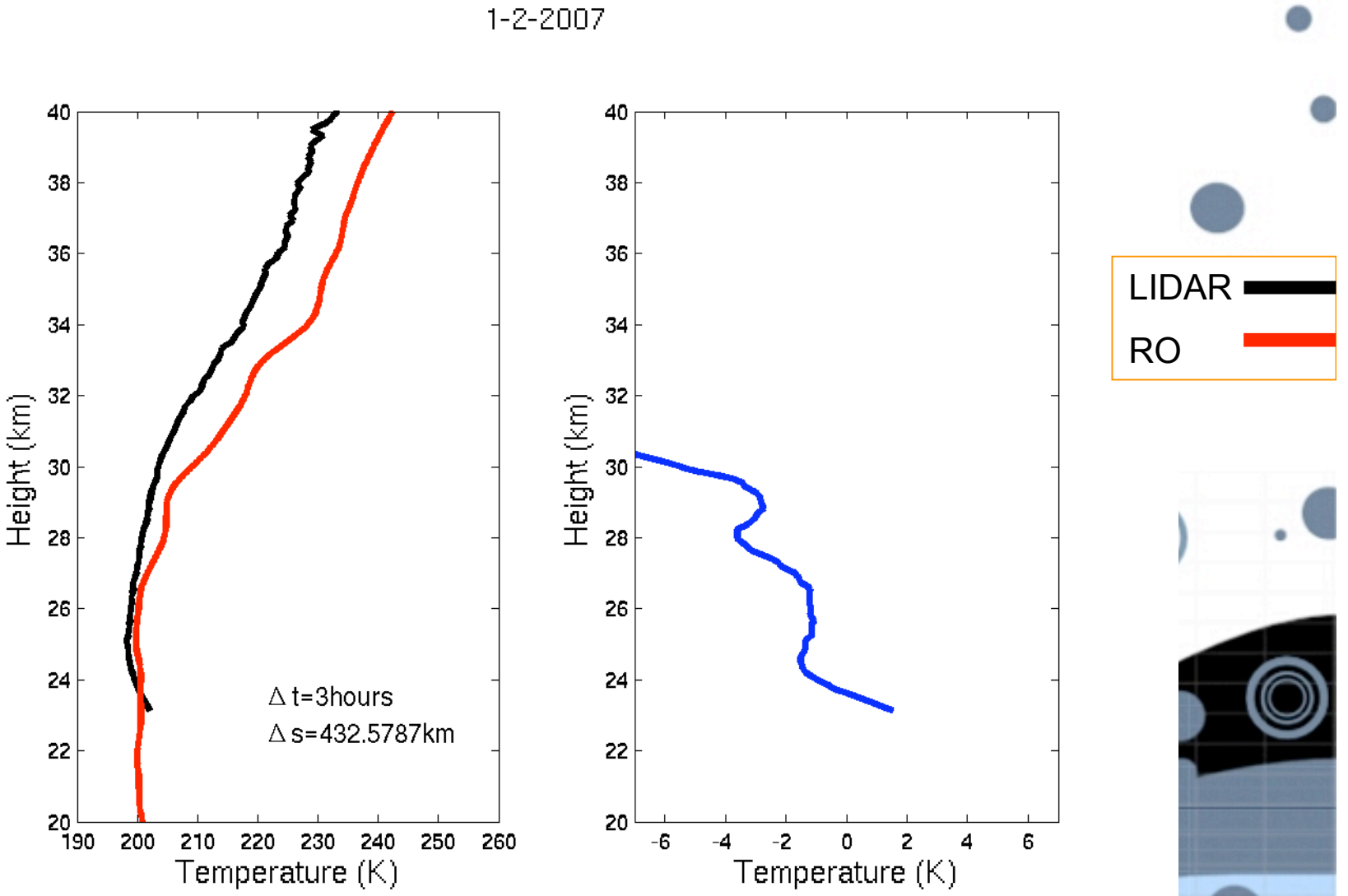


1700 K

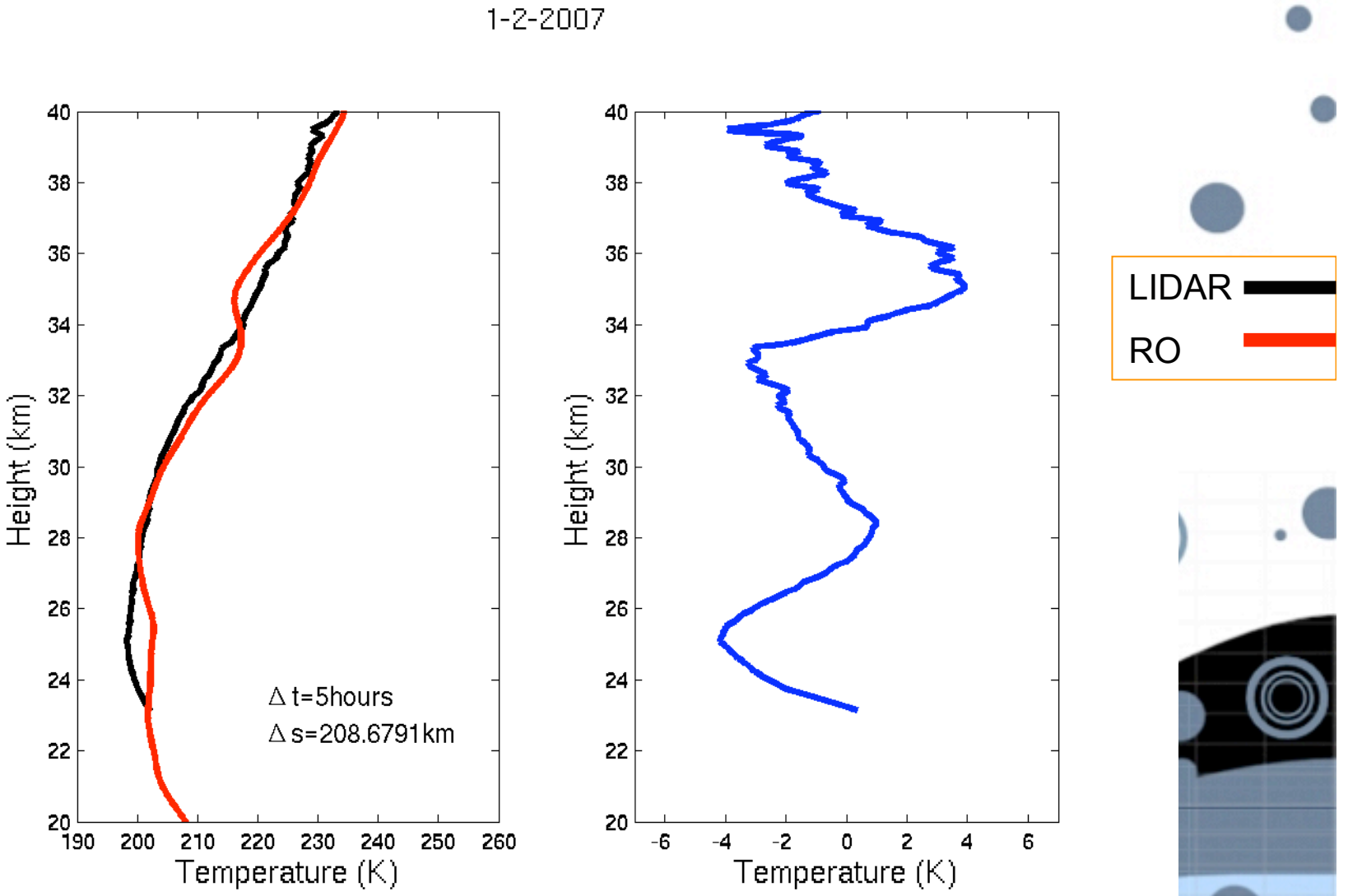
Tilted Polar Vortex



Tilted Polar Vortex



Tilted Polar Vortex



Conclusion

From comparisons 4 cases can be cassified:

1. Lidar and RO inside the vortex: excellent agreement
2. Lidar and RO on the border or outside but within 250km distance: excellent agreement
3. Lidar and RO on the border or outside, but far: poor agreement
4. Tilted Polar Vortex: depending on the position of the RO, the agreement is good in the part of the profile inside the vortex.

Conclusion

From the analysis of all the measurements:

- The mean of all the measure in the entire selected region has a wide error.
- When the analysis is restricted to a circle of 100km and 6 hours of difference, the results are comparable with the one obtained in literature;

Future Work

- Analysis of the polar vortex variability with RO measurements;
- Integration with the other measurements (CHAMP);
- Test of stratospheric initialization using Lidar data

Acknowledgement

- ROSA Project, ASI Italian Space Agency
- Radio Occultation data from COSMIC/UCAR dataset
- Daily maps of potential vorticity (PV) and temperature from NASA's Global Modeling and Assimilation Office (GMAO) Goddard Earth Observing System (GEOS) Versions 4.03 (GEOS-4) analyses (Bloom et al., 2005).
- DMI for logistic and scientific support in Thule
- Discussions and contributions: Prof. A. Sutera and Dr. I. Bordi.