Some results on stratospheric dynamics obtained with the pre-VORCORE observations

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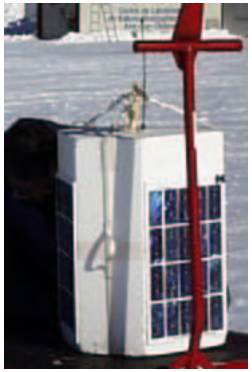


Presentation plan

Superpressure balloons (global, nice resolution, isopycnic) to get information:

1. on stratospheric dynamics over a large range of scales
2. to assess temperature fluctuations for microphysical studies
3. to quantify how reliable are various (re)analyses
4. to study transport and mixing

Framework of studies

3 technological campaigns aimed at preparing the Vorcore campaign:

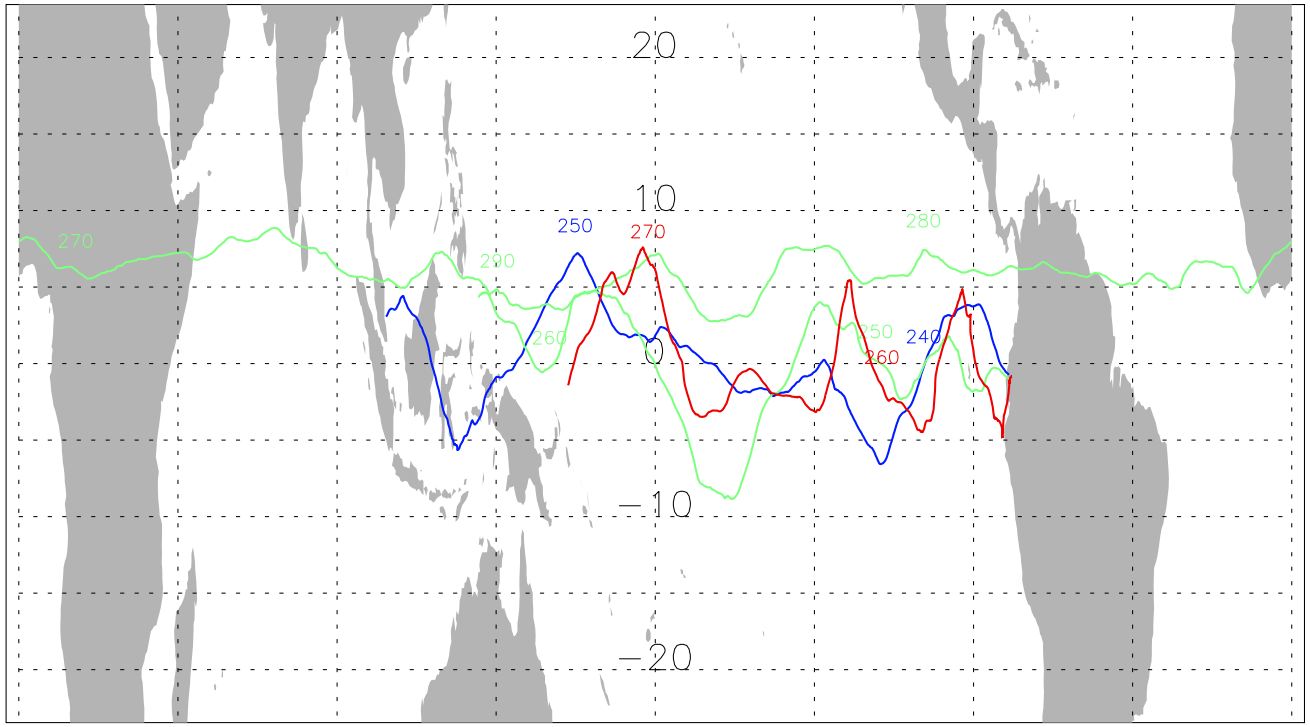
- Ecuador 1998: 3 LD flights (21, 47, 24 days)
- Kiruna 2001: 3 LD flights (24, 70(?), 19 days)
- Kiruna 2002: 6 LD flights (11, 29, 14, 8, 11, 43 days)

with meteorological gondolas:

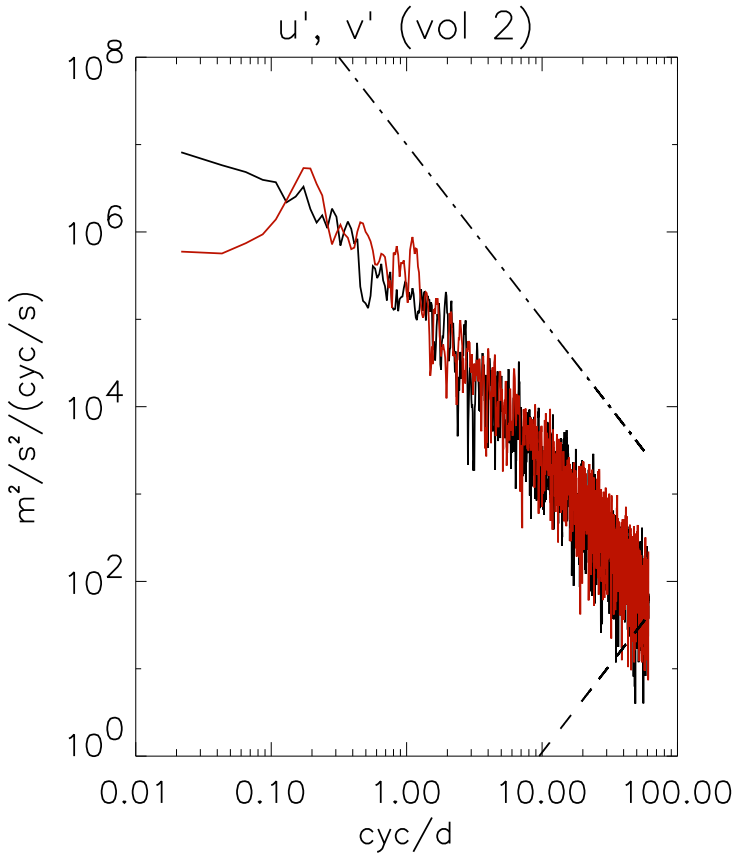
- temperature, pressure, wind
- 12/15 minutes

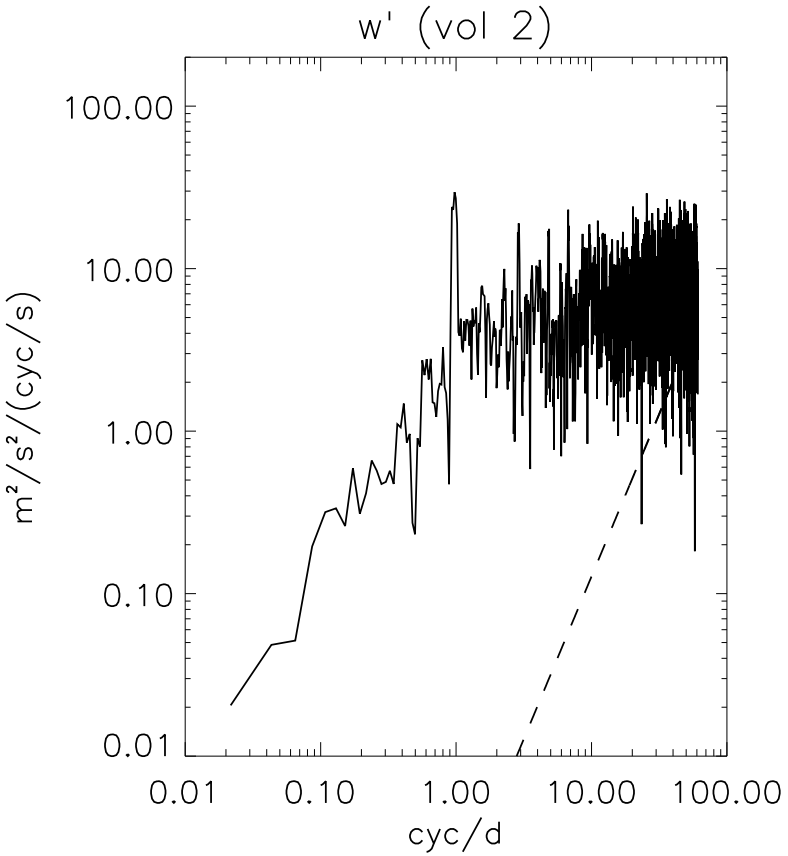
Ecuador campaign: trajectories

September-October 1998, 60 hPa, 20 km

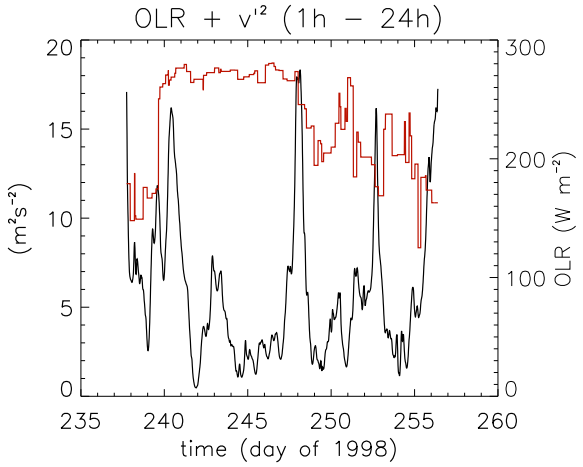


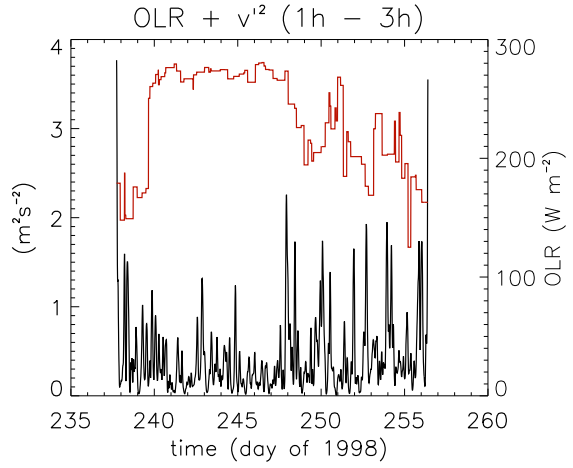
Wind Spectra





Gravity-wave variability





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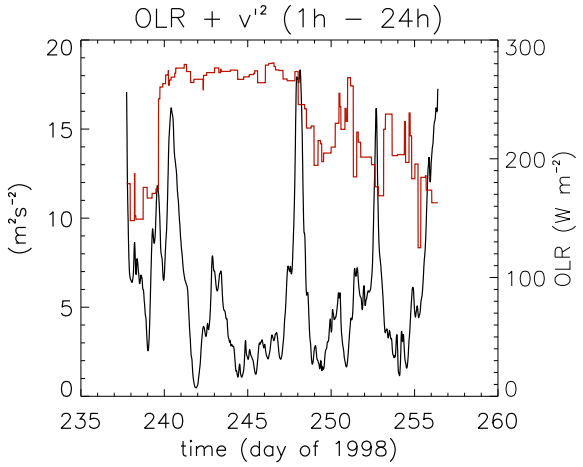

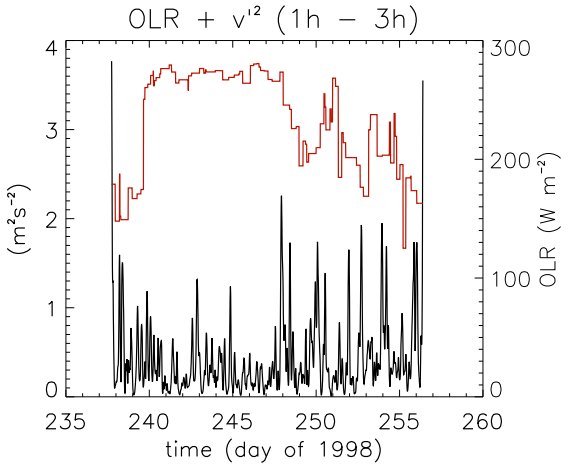

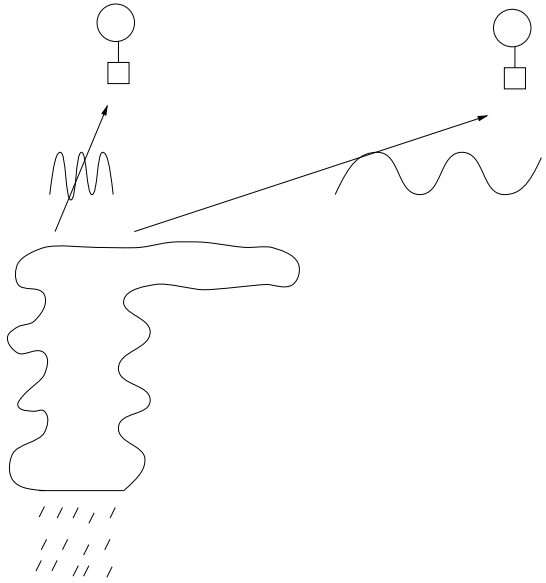

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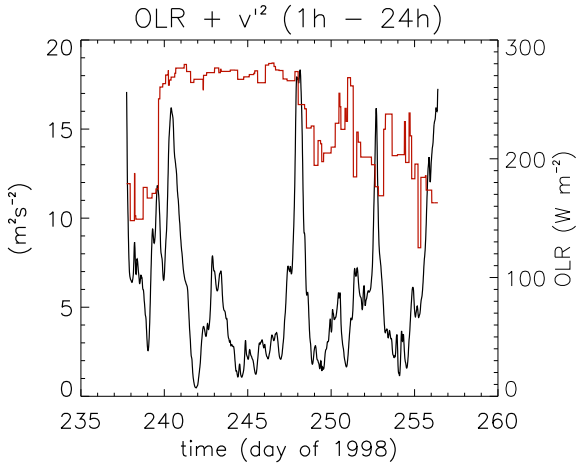
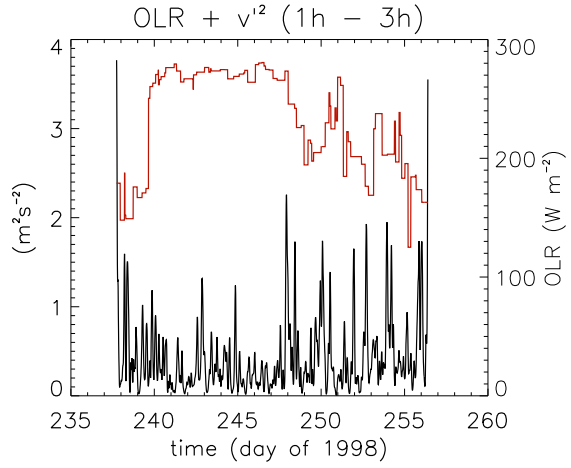




All waves: [1 h; 24 h[

OLR	$< 250\,\mathrm{W\,m^{-2}}$	$> 250\,\mathrm{W\,m^{-2}}$
Flight 1	8.2	7.0
Flight 2	6.7	8.1

Short waves: [1 h; 3 h[

OLR	$< 250\,\mathrm{W\,m^{-2}}$	$> 250\,\mathrm{W\,m^{-2}}$
Flight 1	0.78	0.44
Flight 2	0.66	0.38

Eliassen-Palm flux

Gravity Waves [1 h; 24 h[

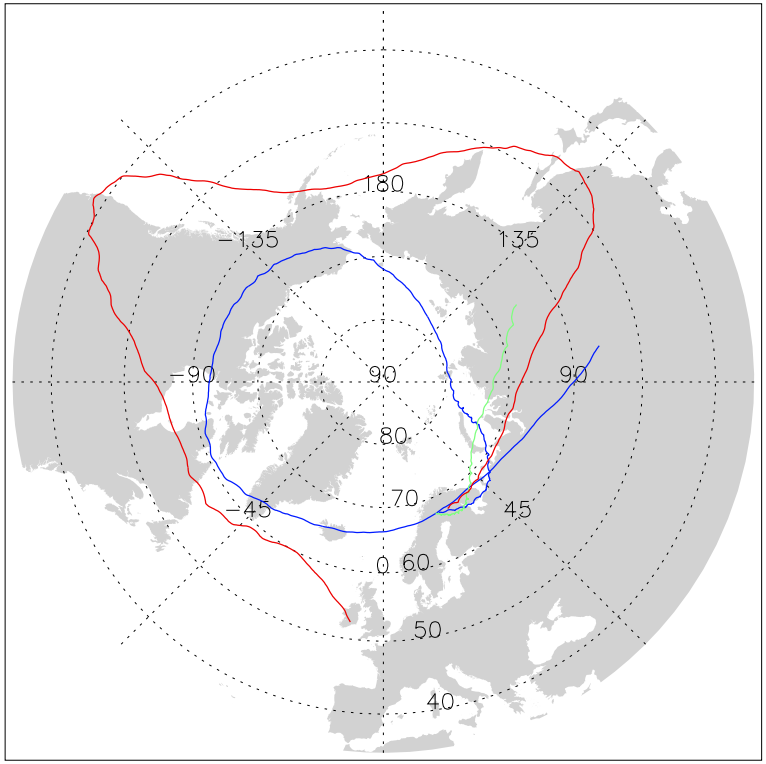
10^{-3} J/kg	$\overline{u'w'}^{+}$	$\overline{u'w'}^{-}$	$\overline{u'w'}$	$\overline{u'w'}^{+} - \overline{u'w'}^{-}$
whole flight	7	– 6	1	12
Pacific Ocean	5	– 5	– 1	10
Indonesia	15	– 10	5	26

Rossby-gravity waves

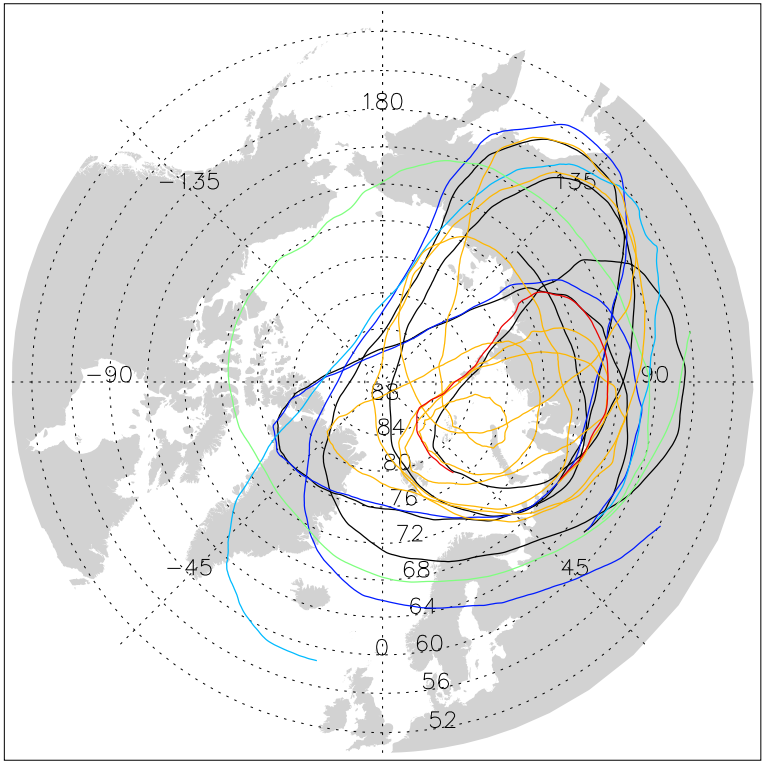
$$f\overline{v'\theta'}/\bar{\theta}_z - \overline{u'w'} = 1 - 2\ 10^{-3}\ \text{J/kg}$$

Kiruna trajectories

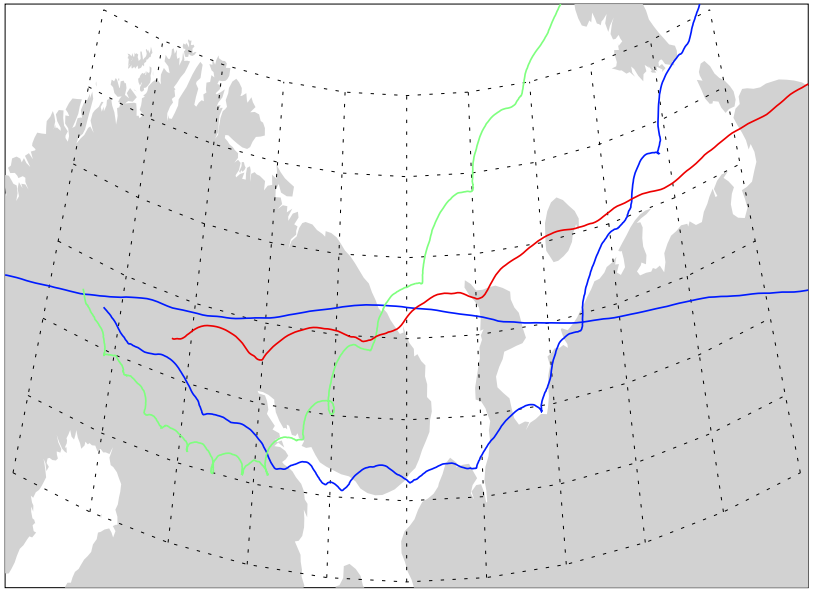
Winter 2001, 3 flights

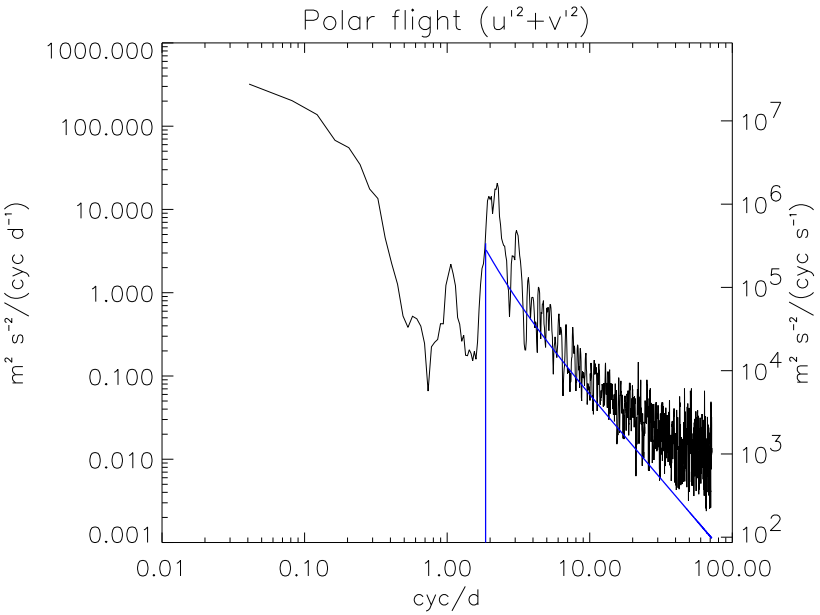


Winter 2002, 6 flights

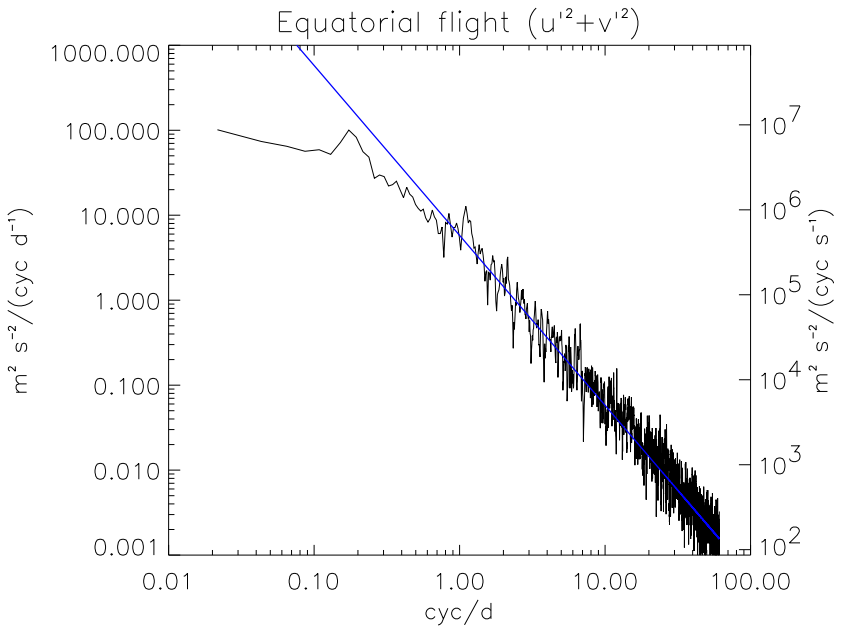


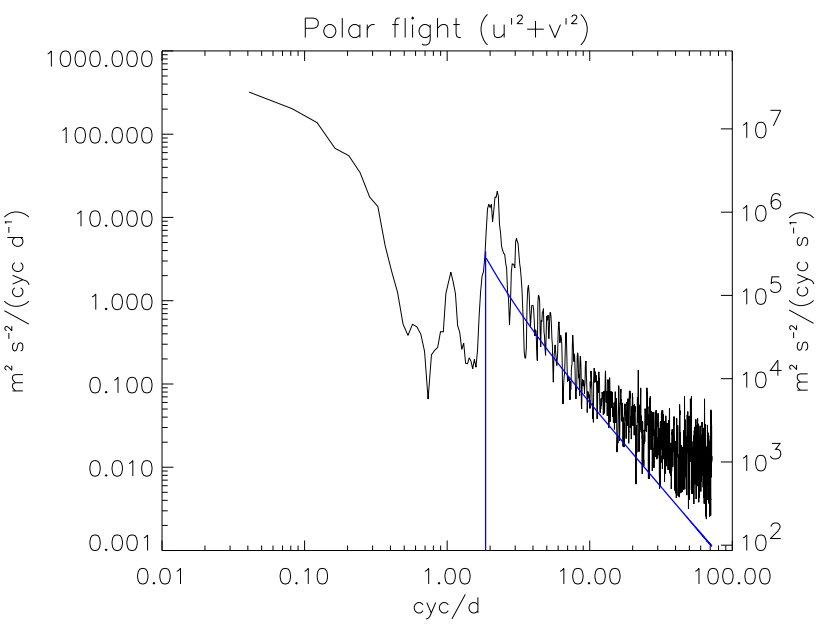
Inertia-gravity waves



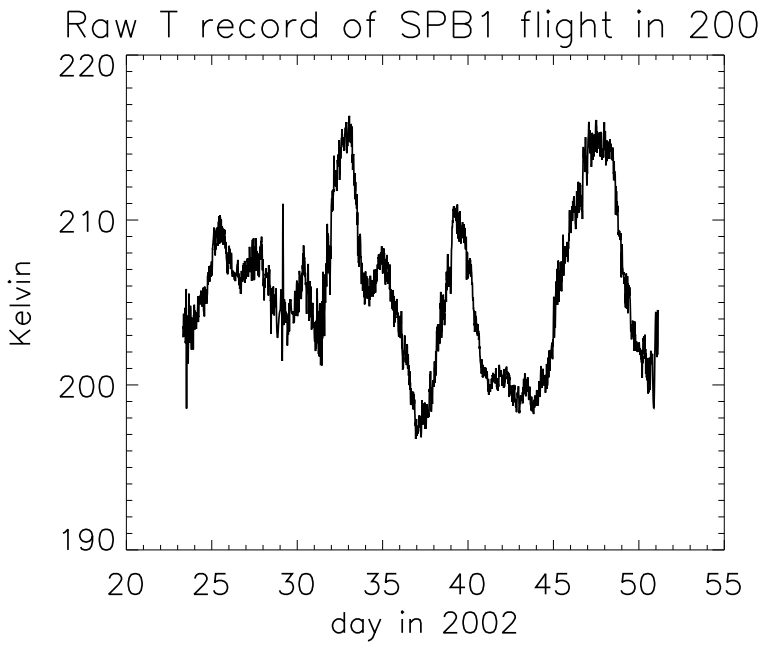


Inertia-gravity waves





Temperature fluctuations



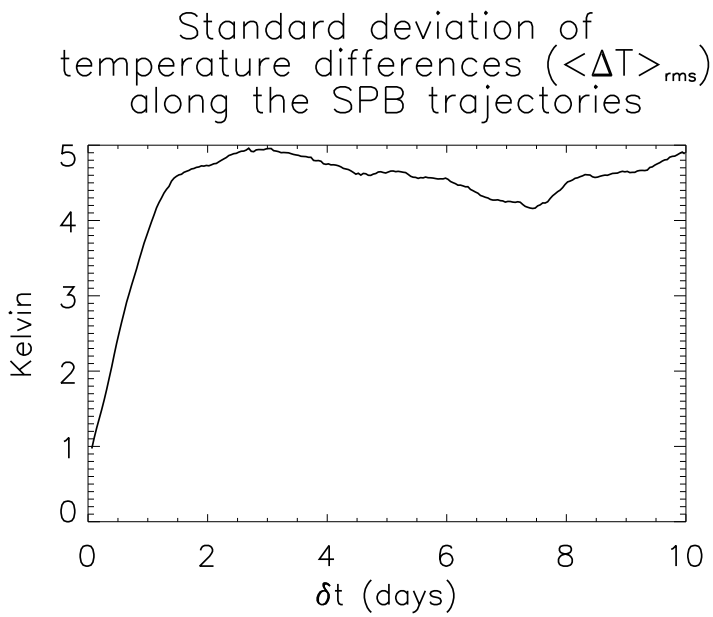
Temperature differences along SPB flights:

$\Delta T(\delta t) = \langle T(t+\delta t) - T(t) \rangle$

with δt varying between 1 hour and 10 days.

Temperature fluctuations

Temperature differences



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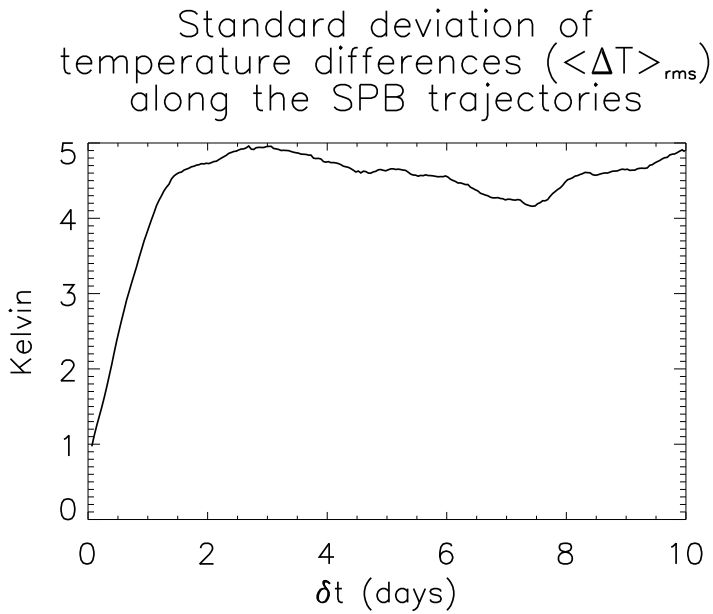
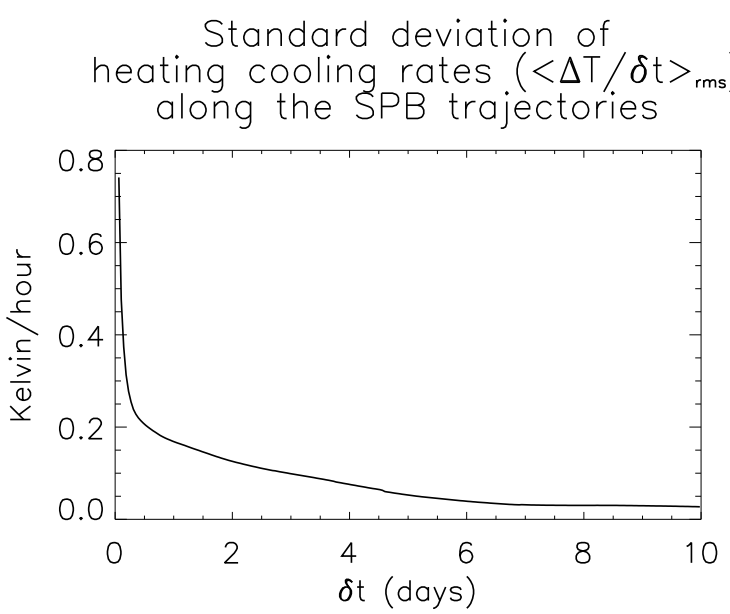
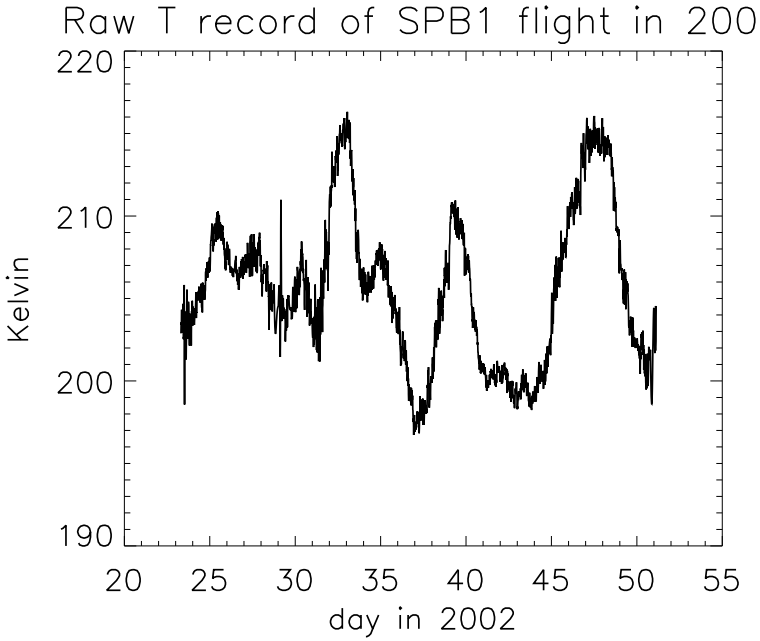
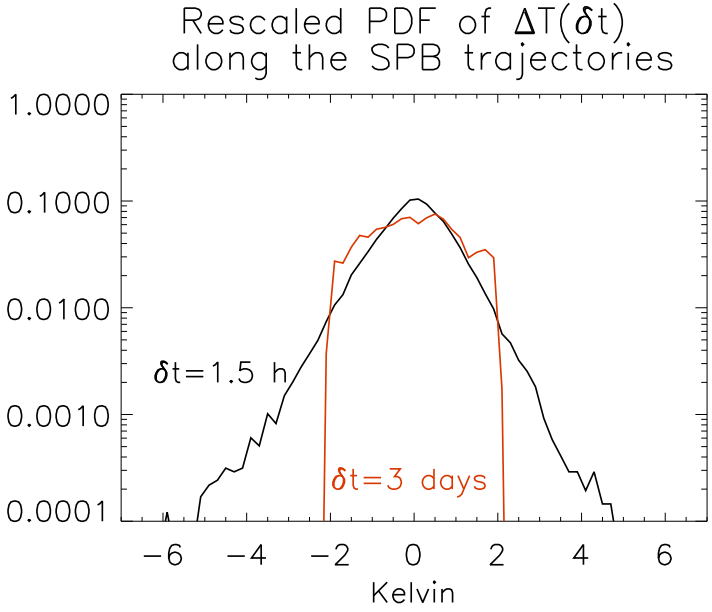


Heating/cooling rates



Temperature fluctuations

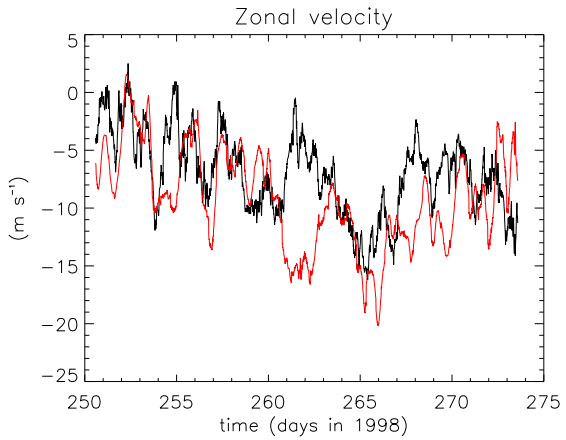


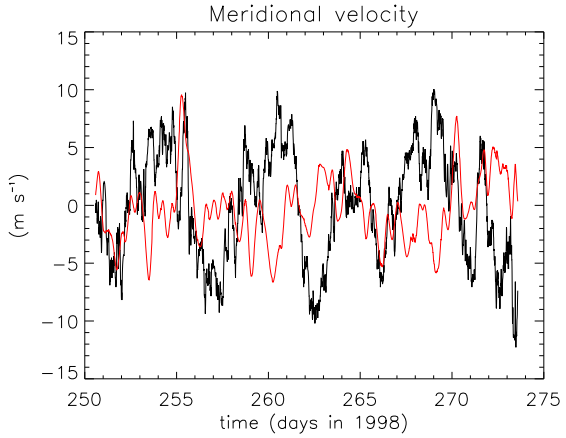


Accuracy of stratospheric analyses

Equatorial Flight

Observations/ECMWF





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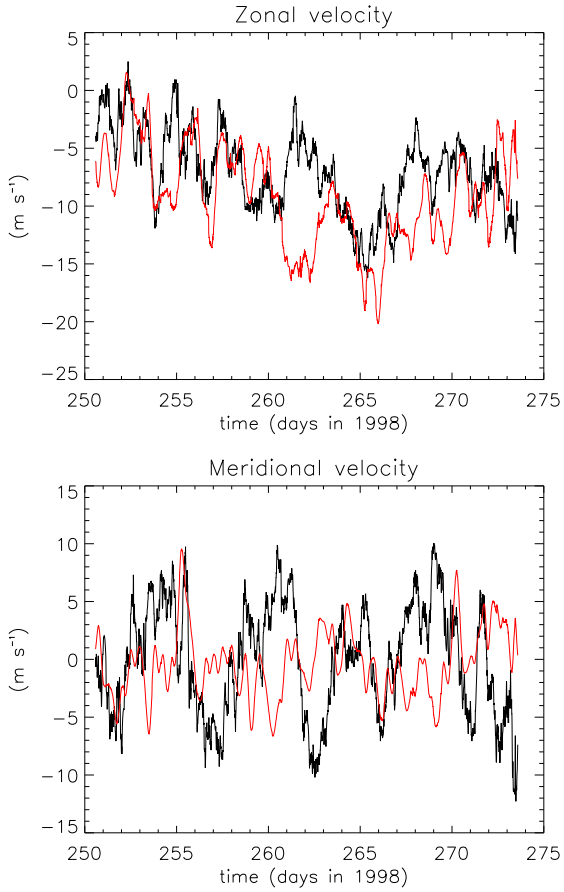
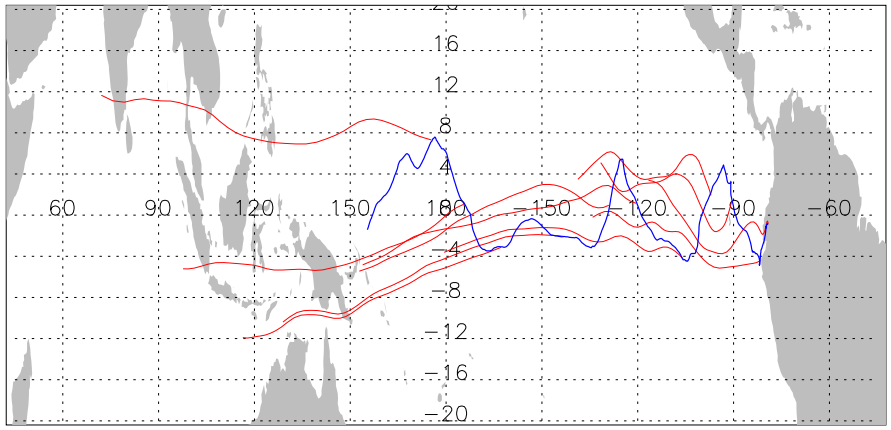


Observations/NCEP



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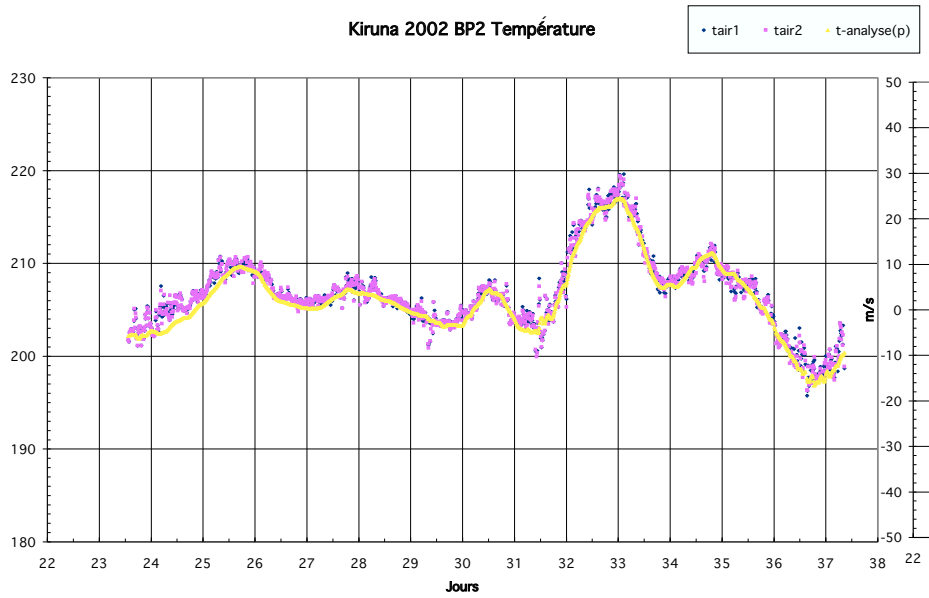
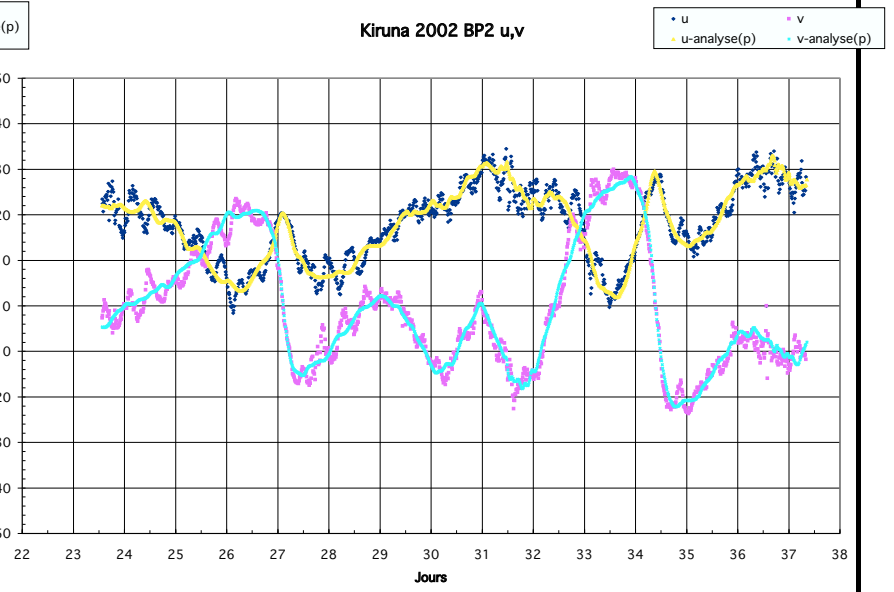
Polar Flight

Observations/ECMWF





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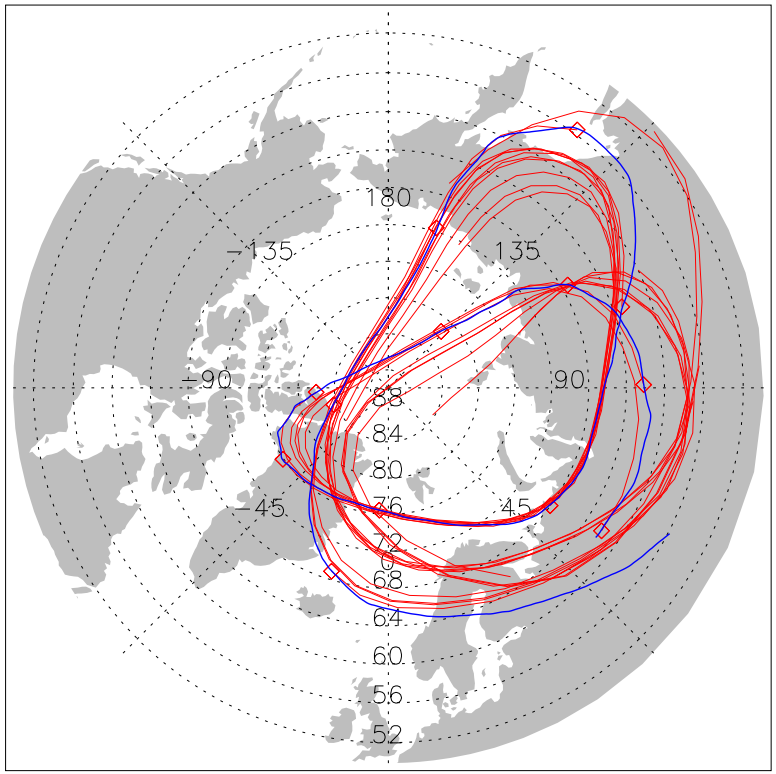

Conclusions

Super-pressure balloons

- global, high accuracy
- wave activity, model validation, microphysical studies
- quasi-lagrangian: transport, mixing (tracer: water vapor, methane)