

Gravity waves in the Southern Hemisphere derived from balloon observations and the ECMWF analyses

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Outline

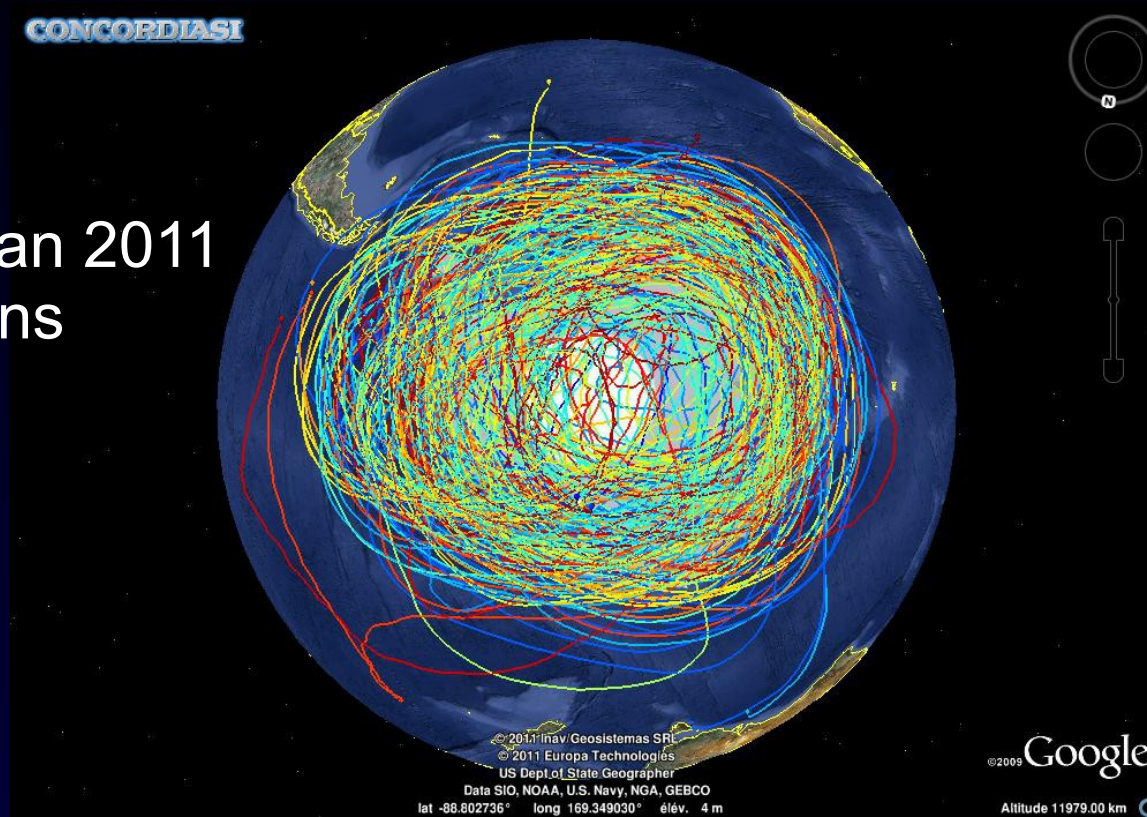
- Motivations
- Comparison between ECMWF and Concordiasi
- Discussion
- Conclusion

Motivation

- ECMWF operational analyses now have high-resolution (T1279)
- How well are the GWs resolved in the ECMWF?

Concordiasi (*Rabier et al 2010*)

Sept 2010 to Jan 2011
18 balloons



- Use for comparison
- Revisit the issue of the missing drag at 60°S

ECMWF operational analyses

- T1279 → 0.125° horizontal grid spacing
- 91 model levels from surface up to 0.01 hPa
- Available at 00, 06, 12, 18 UTC
- Satellite and conventional observations assimilated with 4DVar

Methodology

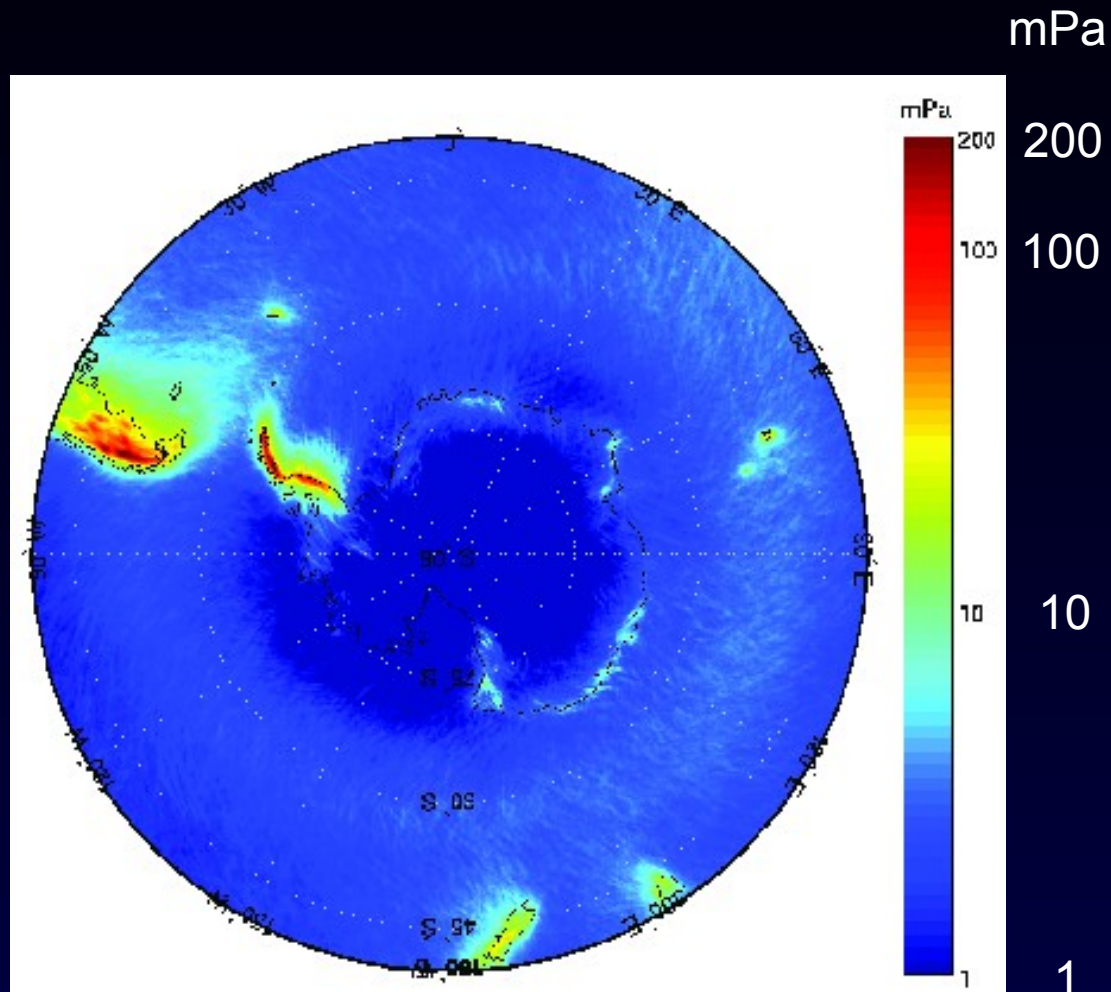
- Calculation of momentum flux:
 - Concordiasi:
 - based on *Boccara et al 2008*
 - ECMWF:
 - Resolved GWs in ECMWF
 - Correlation $u'w'$
 - base state: 15 first zonal modes

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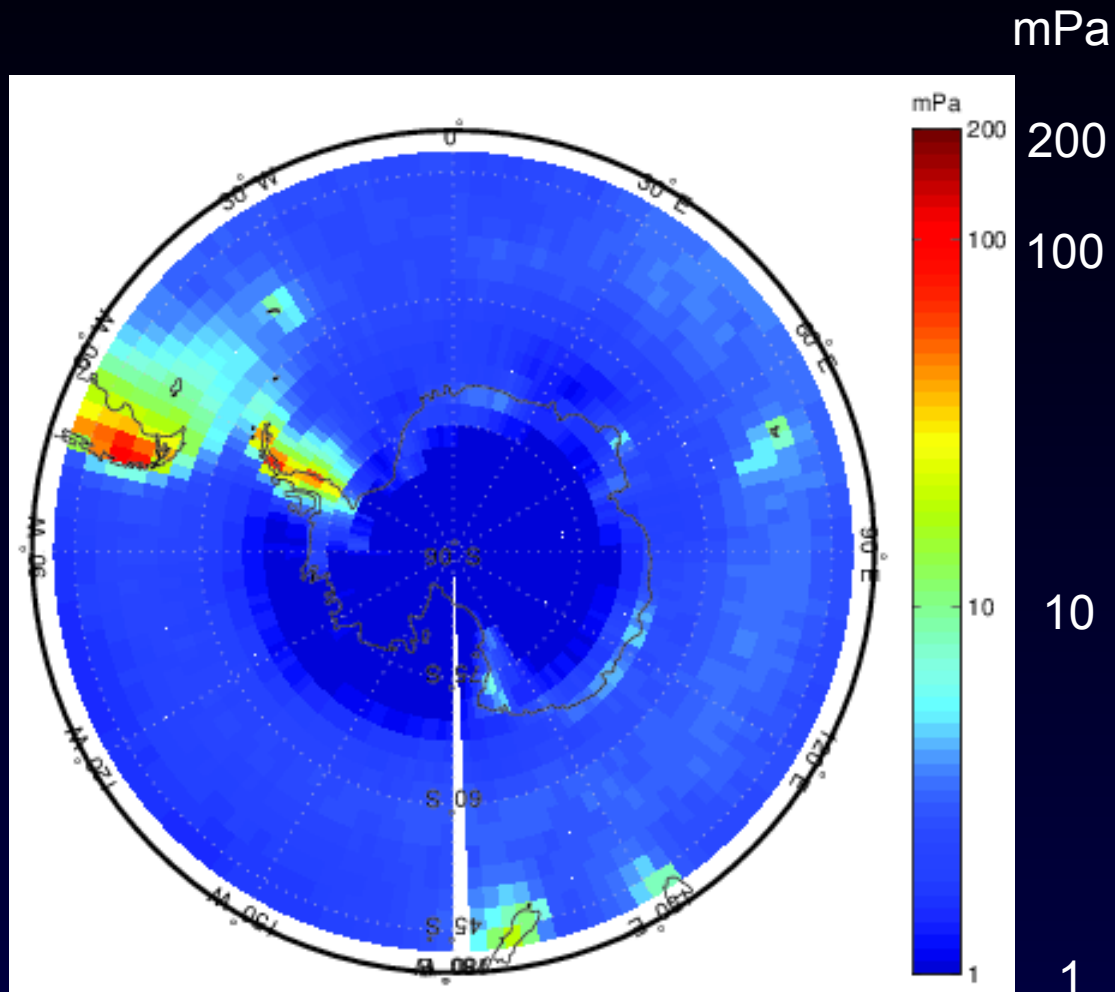
Momentum flux

ECMWF
0.125°



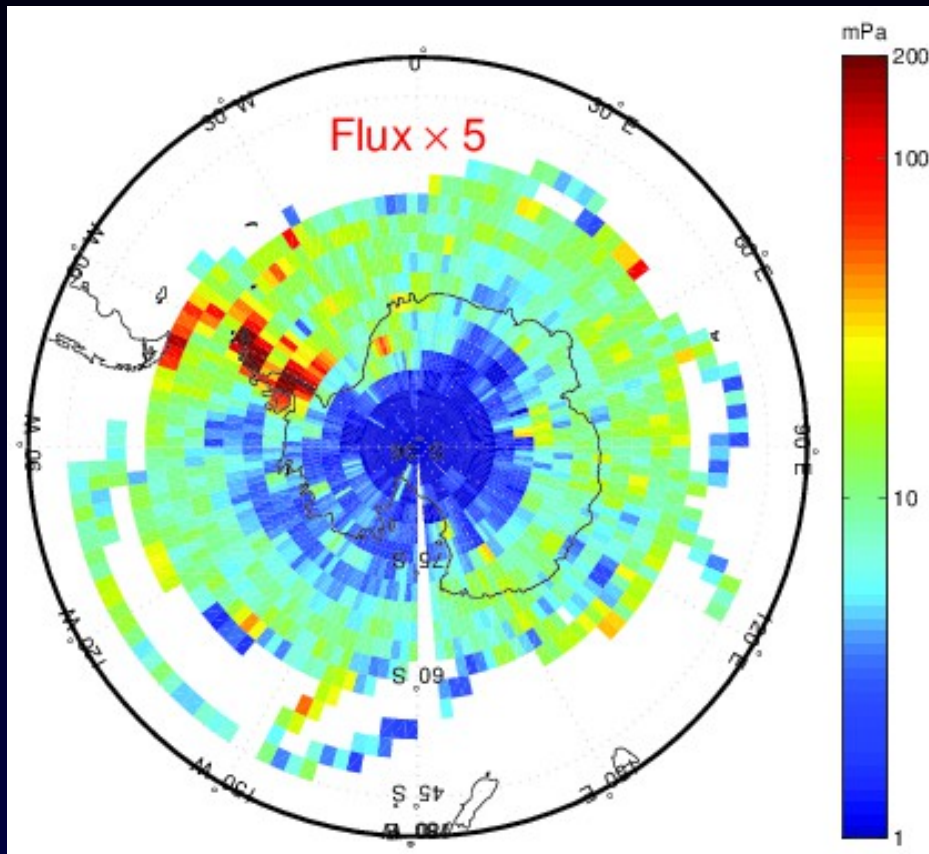
Momentum flux

ECMWF
2.5°

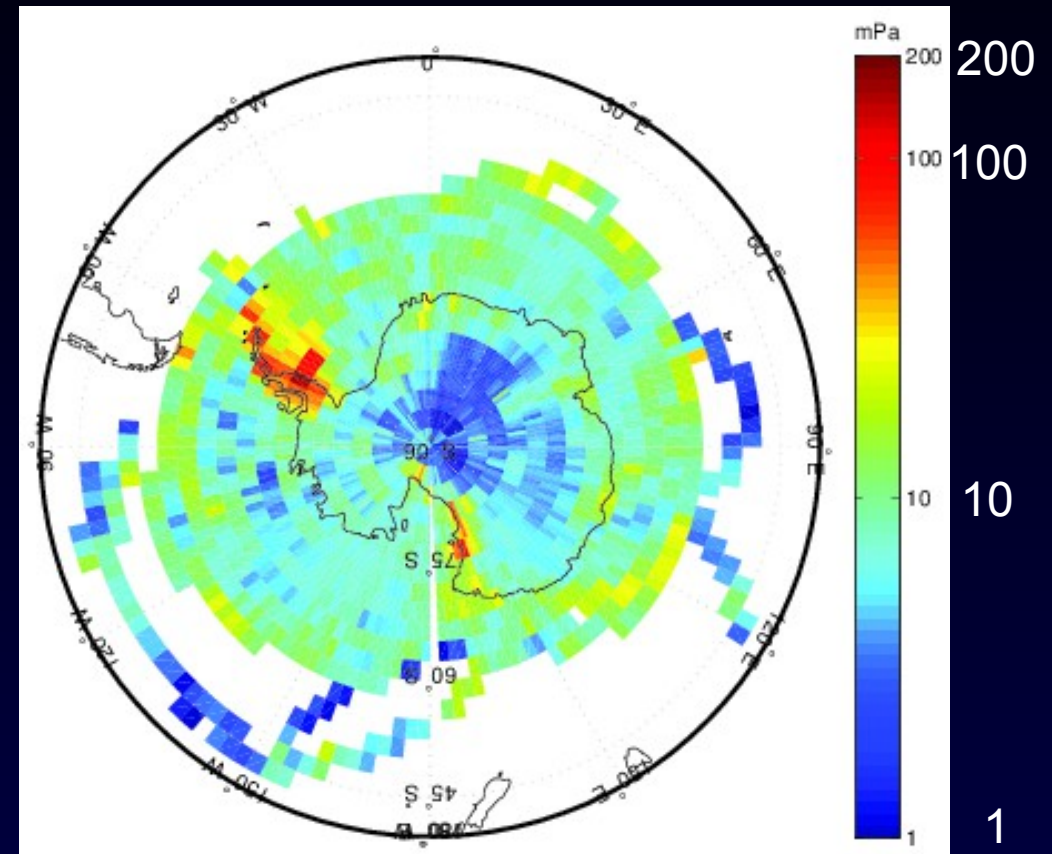


Momentum flux

ECMWF
F=1.8mPa

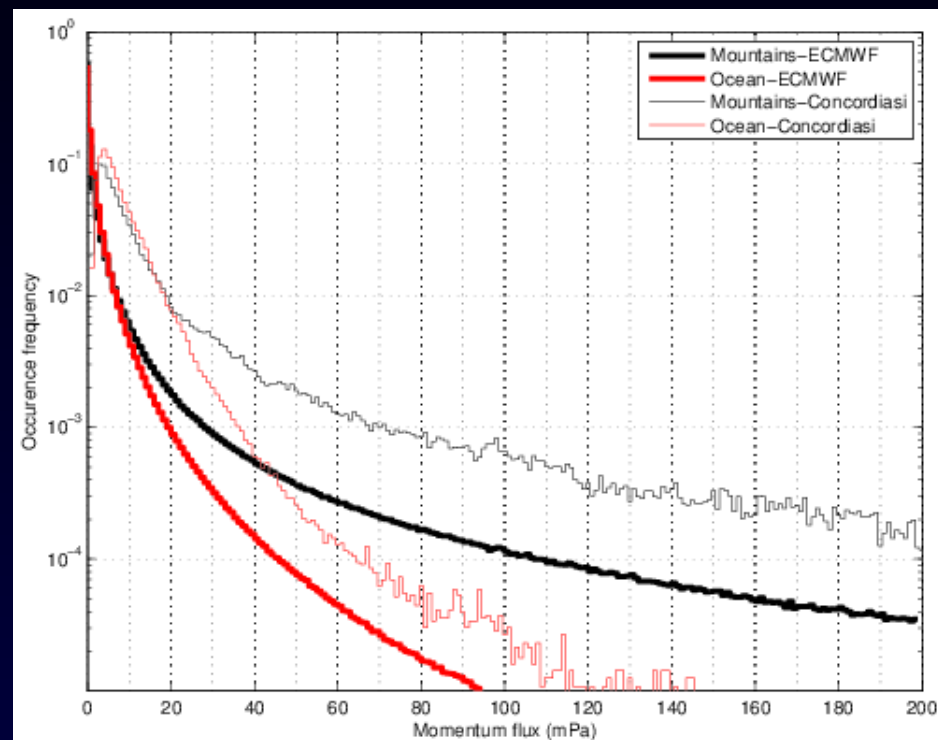
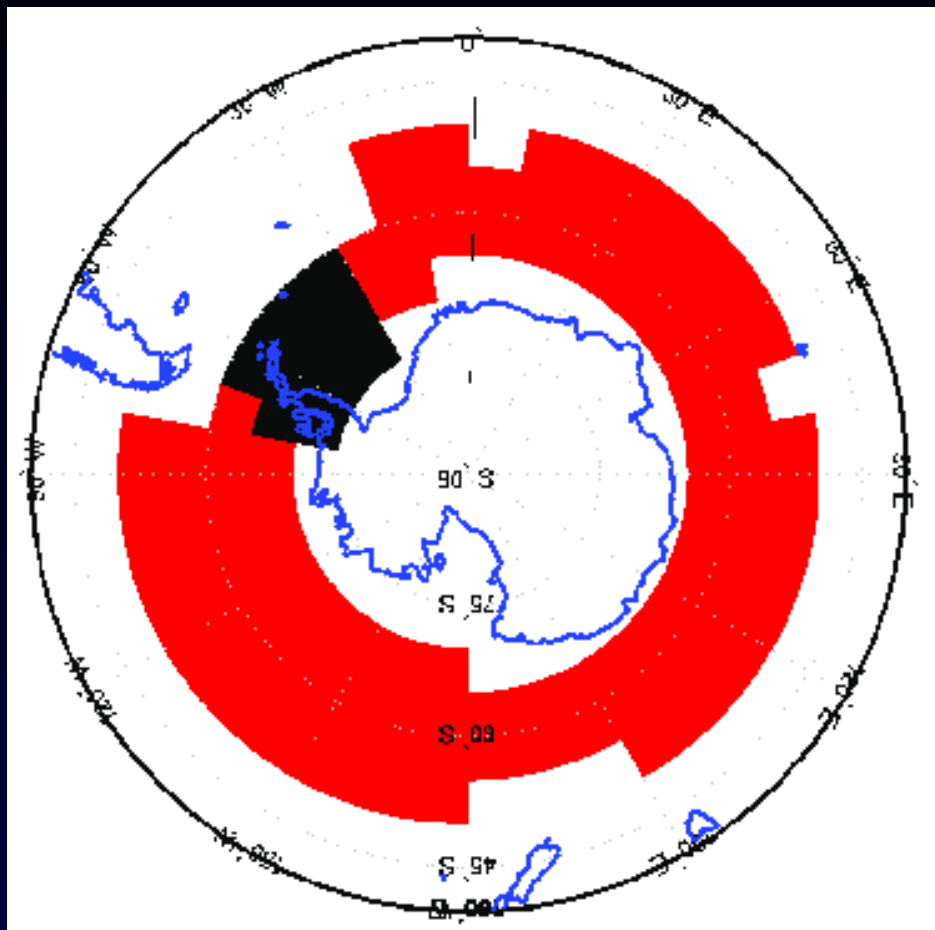


Concordiasi
F=9mPa



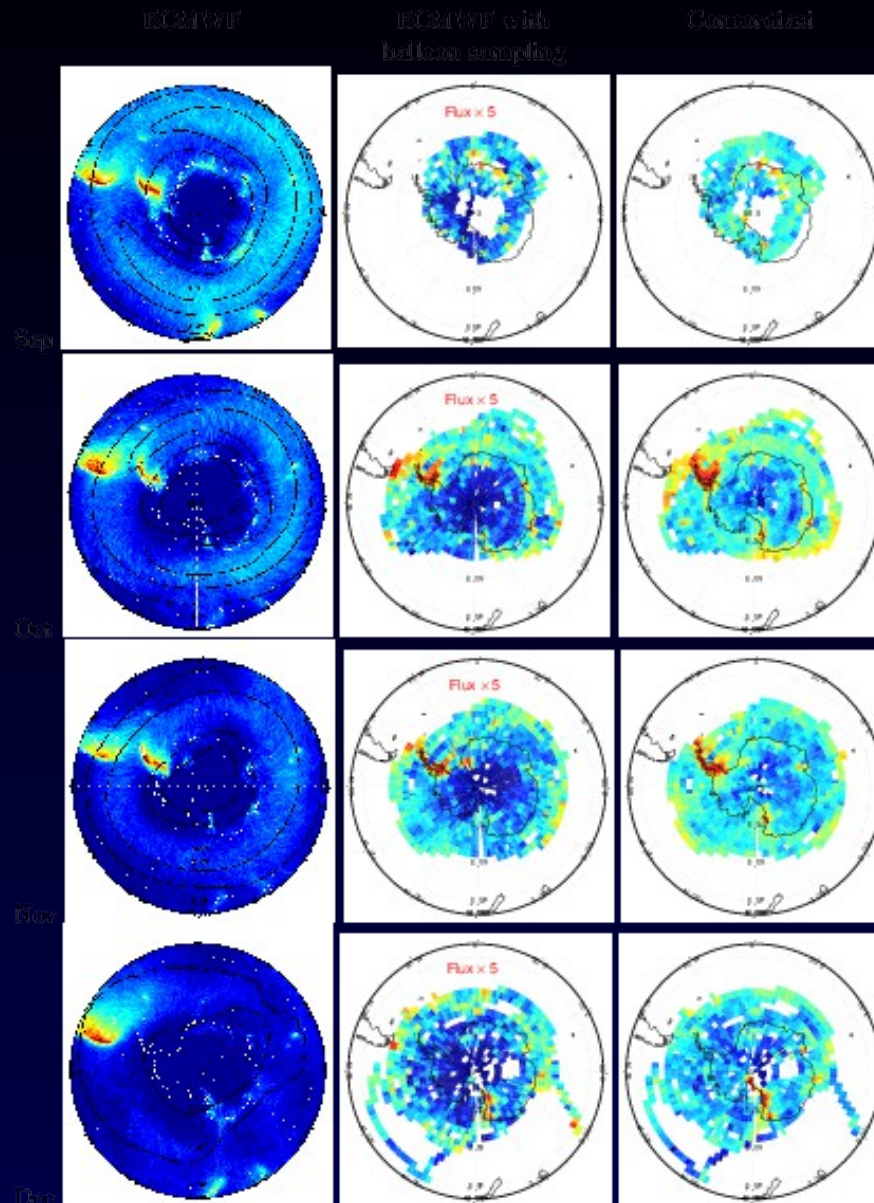
- Good geographical agreement, but factor 5 in amplitude
- Higher contrast between Plateau and the rest in ECMWF

Intermittency

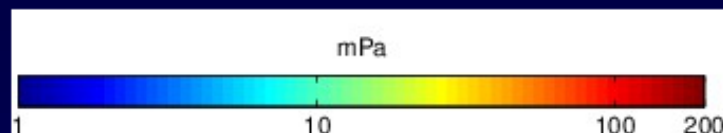


- More intermittency over mountains (consistent with *Hertzog et al. 2012*)
- Mountains: 64-86% of total flux due to the 10% largest wave events
- Ocean: 29-55% 10%

Seasonal variations



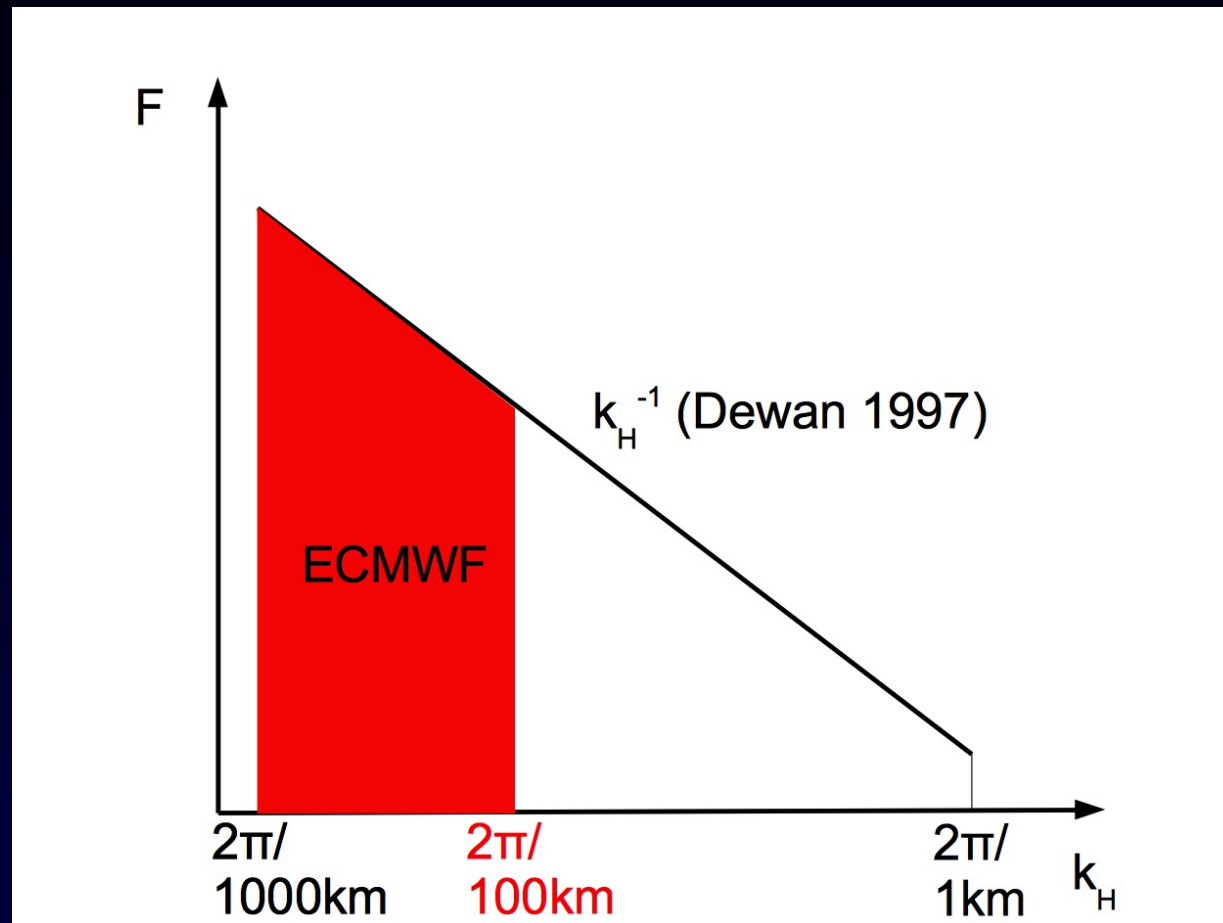
Filtering of the low
phasespeed GW
after Nov



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Discussion

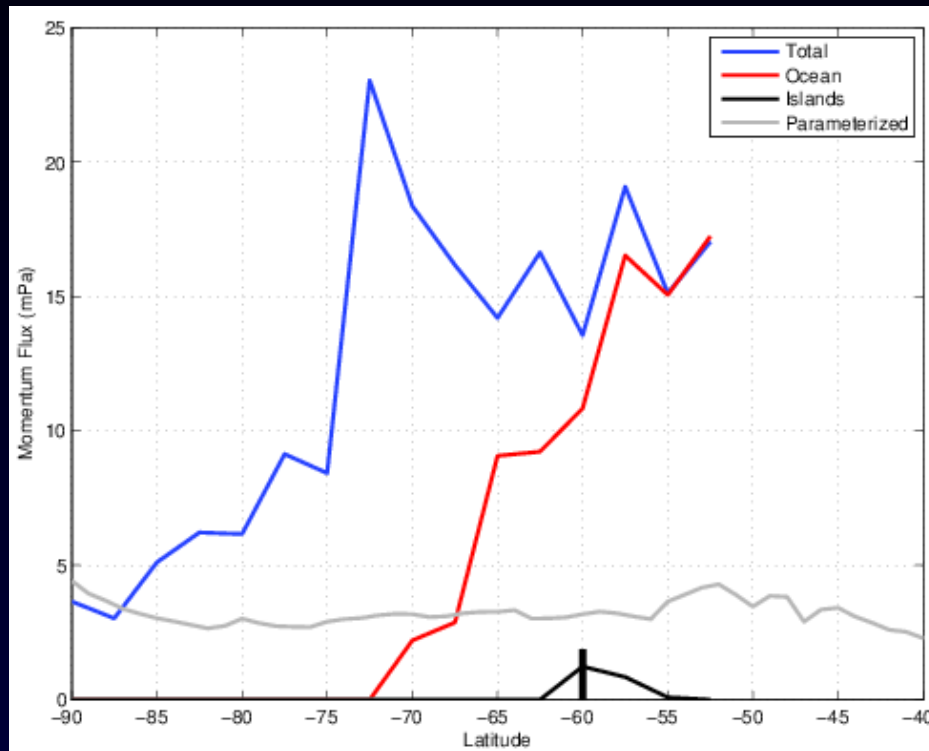


- Factor 5 in ECMWF: resolution explains a factor 3 + numerical diffusion

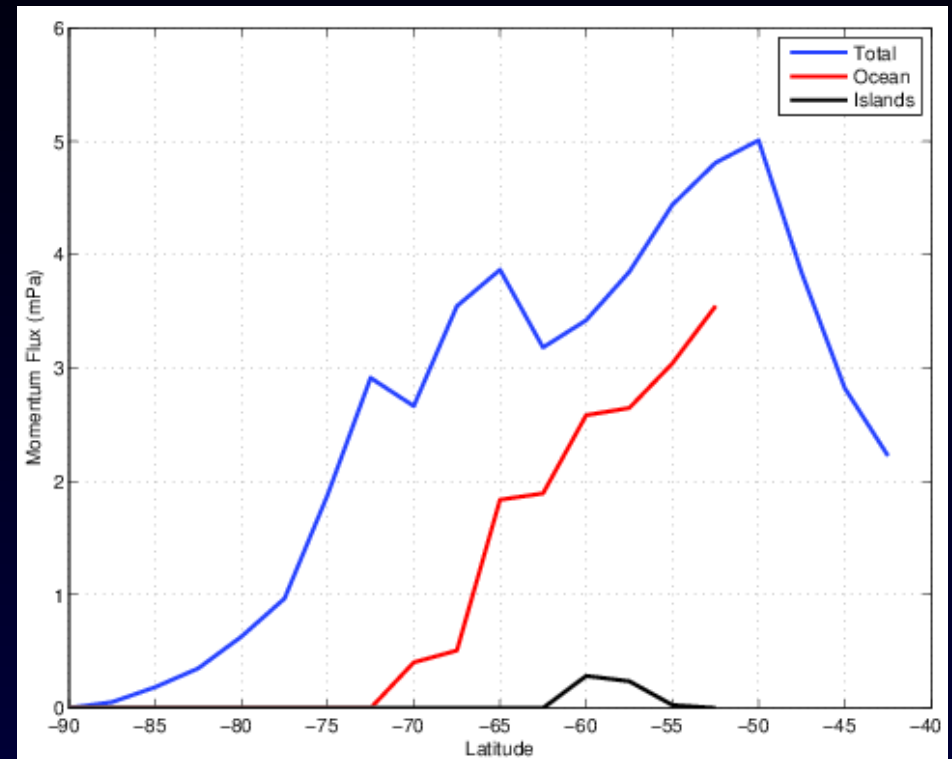
Source of missing drag at 60°S

October

Concordiasi



ECMWF



- NGWs at 60°S: same order of magnitude as the Peninsula
- OGWs at 60°S: not more than 2.5mPa
- Suggests that the missing drag comes from NGW (consistent with *Hendricks et al 2014*)

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Conclusion

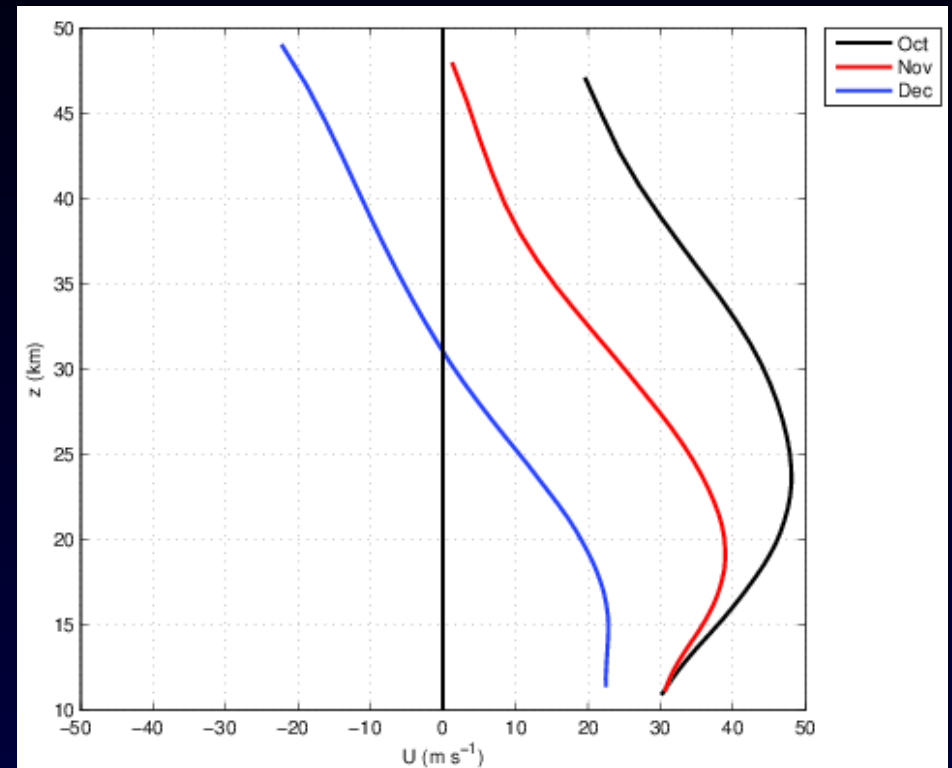
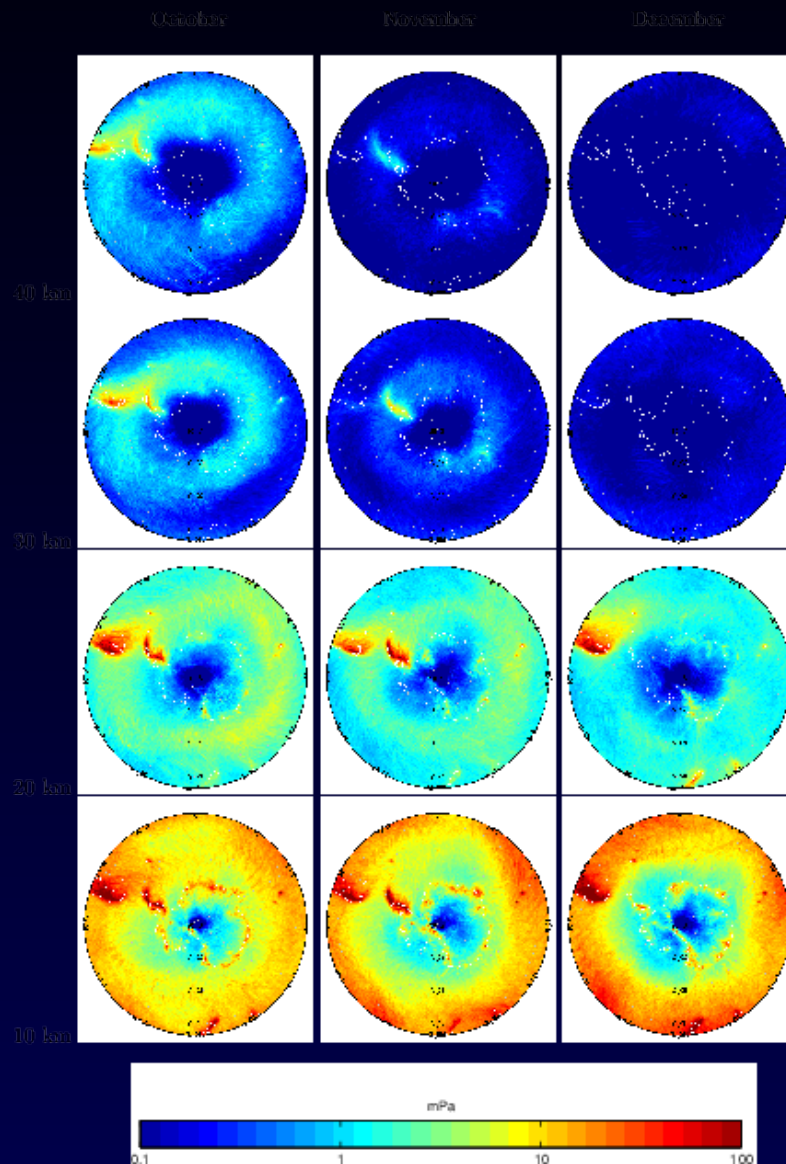
- ECMWF can be used to study the spatial, seasonal and interannual variability of GW
- Factor 5 on the amplitude mostly due to the resolution
- Contrast 3X greater in ECMWF
- Missing drag at 60°S probably related to NGWs

Jewtougoff, Hertzog, Plougonven, de la Camara, Lott, 2015, in revision for JAS

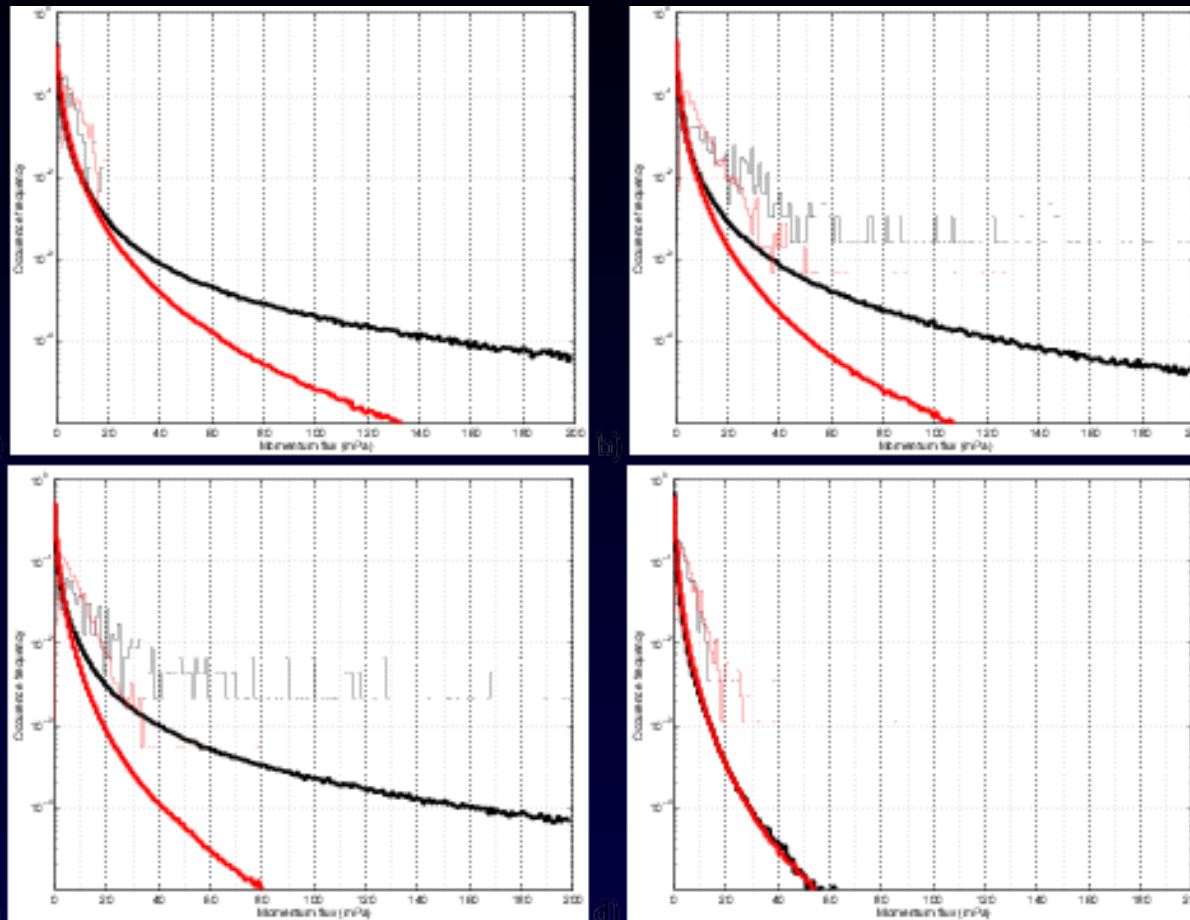
Thank you



Filtering by the wind



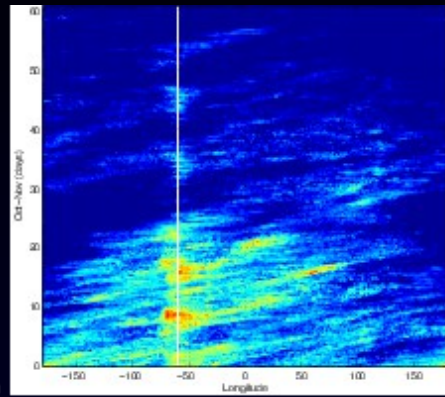
Seasonal variations



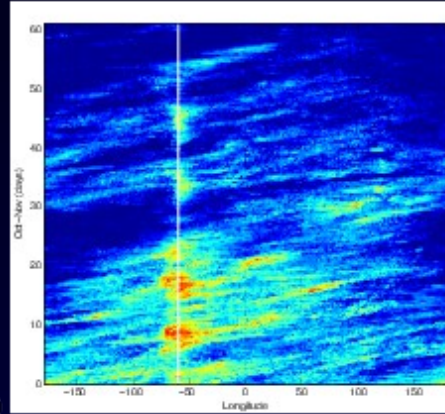
— Mountains-ECMWF
— Ocean-ECMWF
— Mountains-Concordiasi
— Ocean-Concordiasi

Effect of lateral propagation

30 km



20 km



10 km

