

# Global gravity wave distributions from limb-sounding satellites, ECMWF and ray-tracing modelling

Peter Preusse

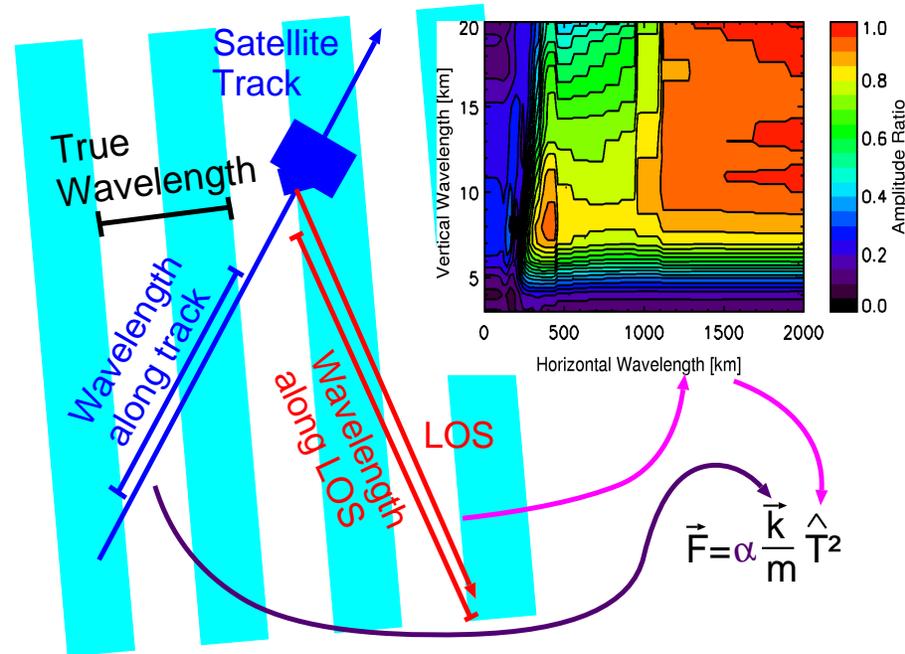
Manfred Ern, Isabell Krisch, Cornelia Strube

Peter Bechtold (ECMWF)

Byeong-Gwon Song (Yonsei), Hye-Yeong Chun (Yonsei)



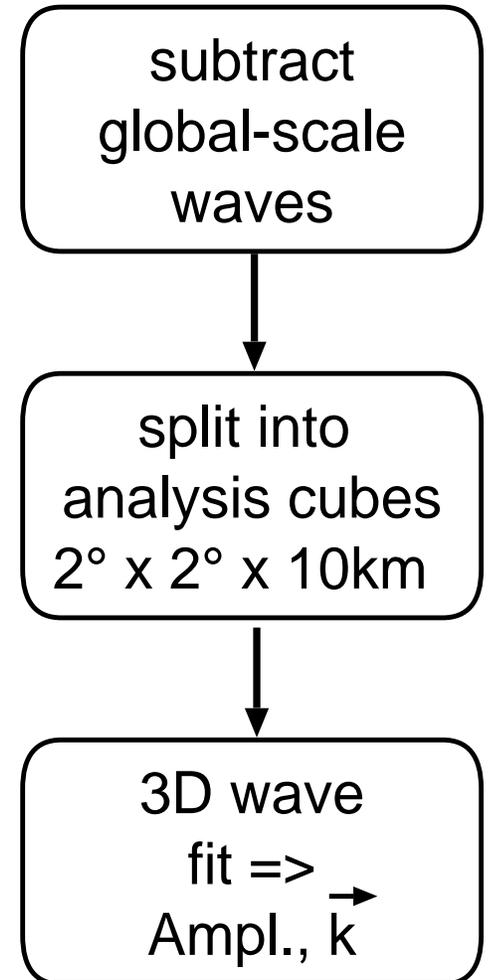
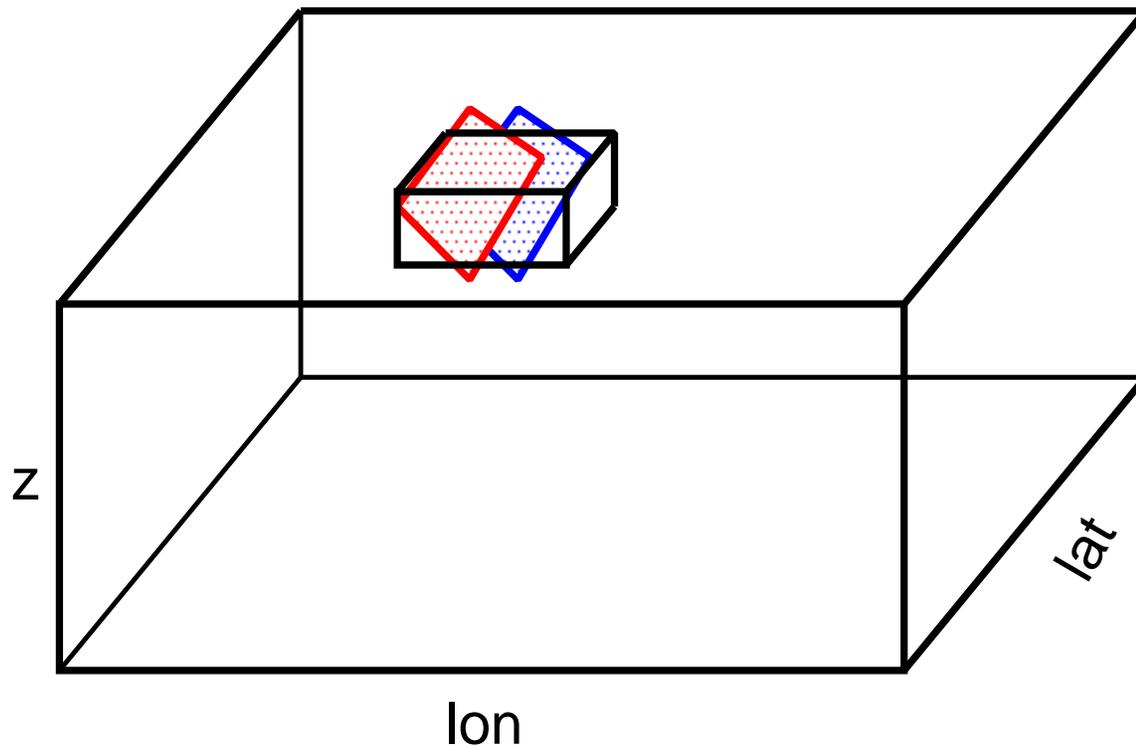
# Momentum flux errors



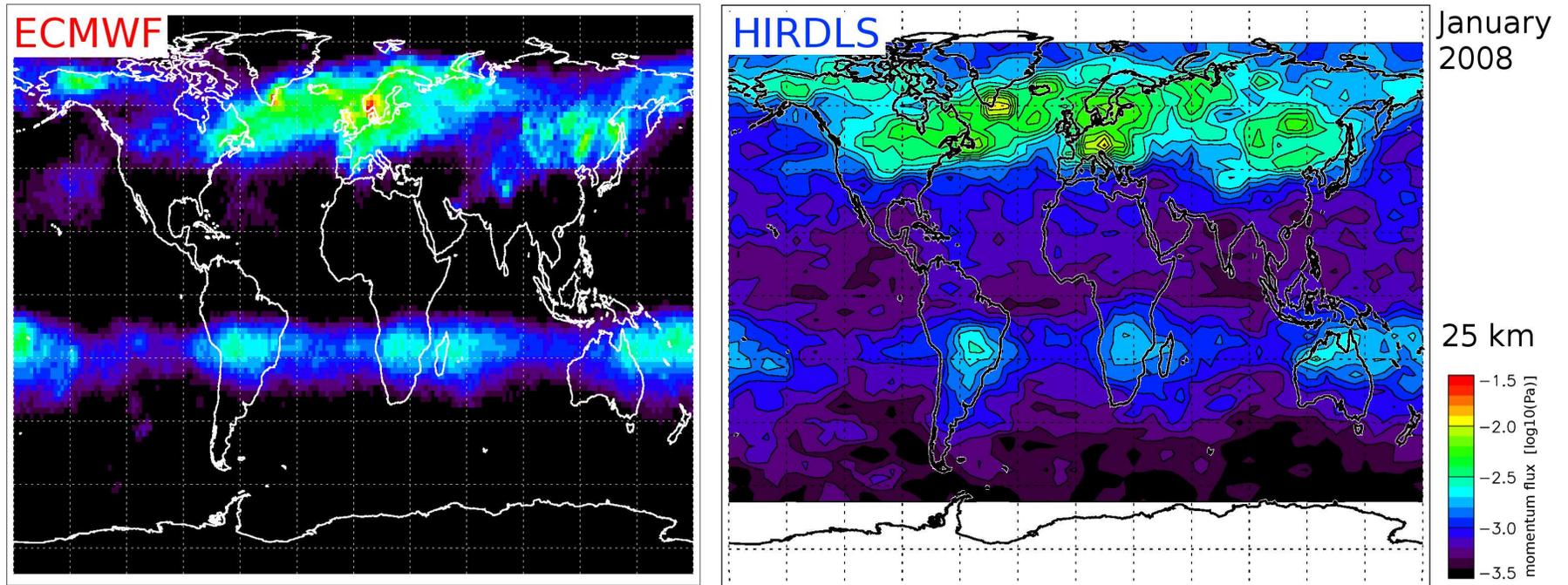
- Expect HIRDLS GWMF to be lower than ECMWF (~factor 2-3)
- Statistical errors HIRDLS small
- In future: comparison including observational filter

# ECMWF: GWMF and direction

## Analysis of ECMWF data

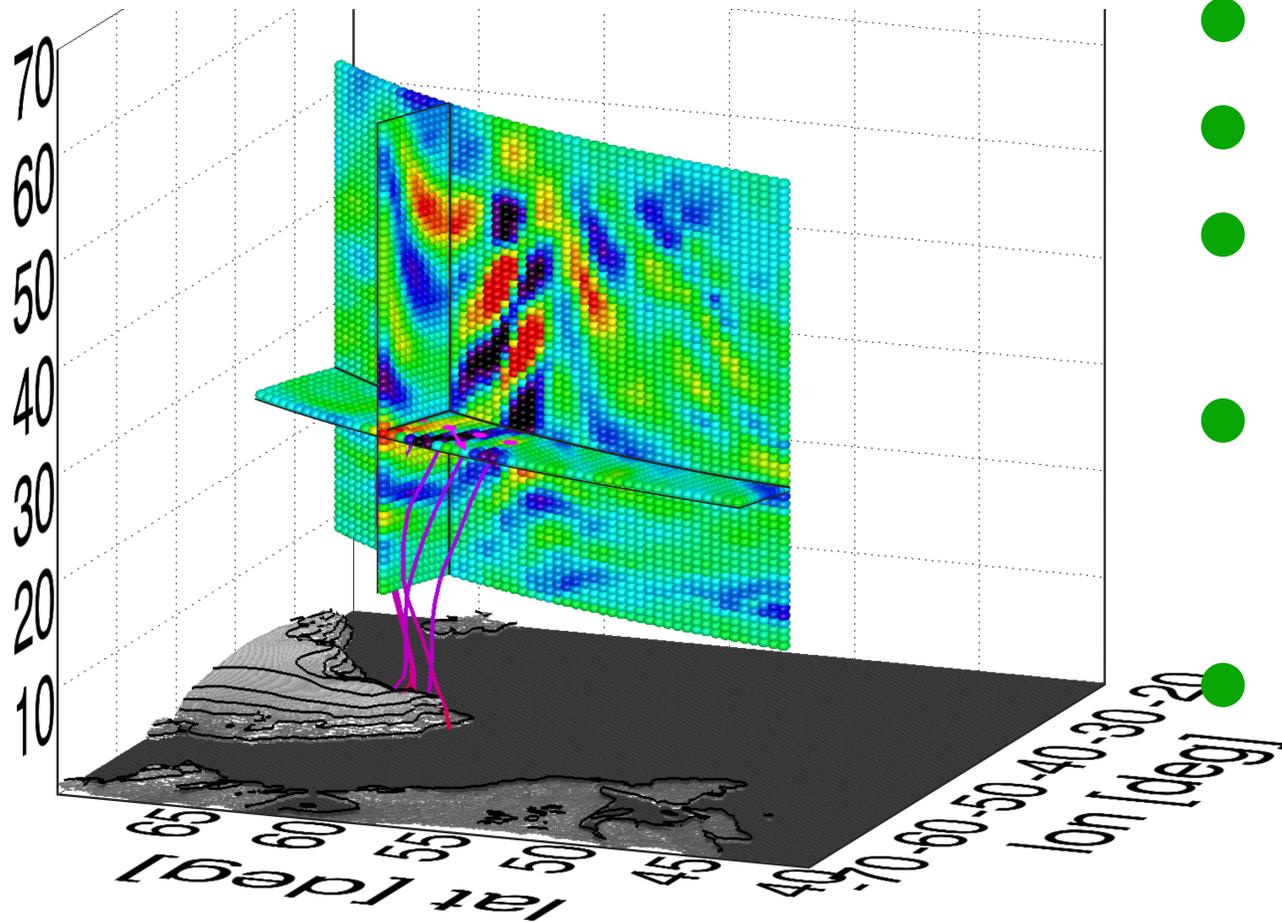


# ECMWF global data and HIRDLS



- Very good match at winter mid and high latitude
- Subtropics in ECMWF follow wind rather than convection
- ECMWF: No wave background in tropics, summer hemisphere  
in HIRDLS this is real, not noise!

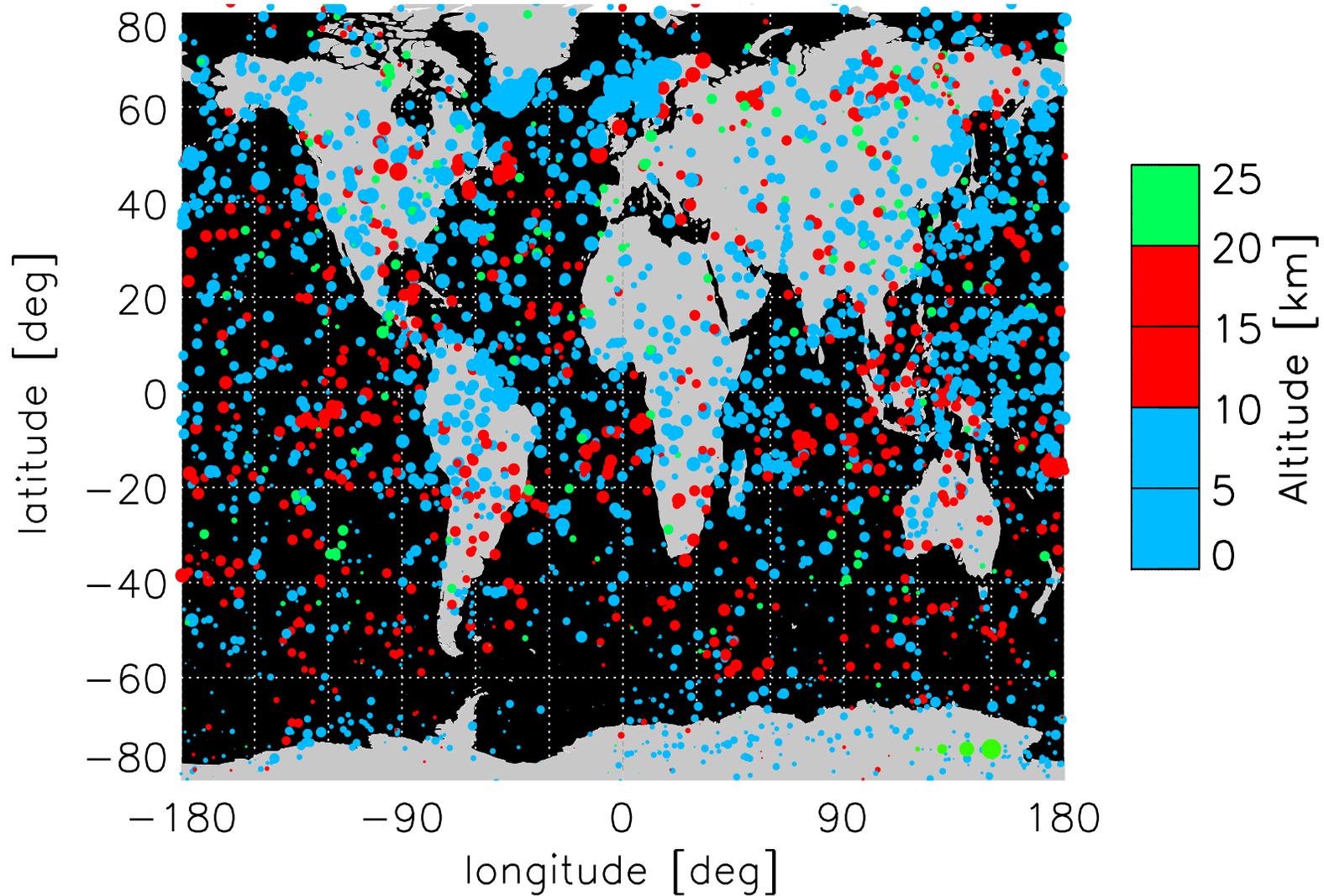
# Raytracing from S3D



- Full 3D data  $\Rightarrow$
- Full 3D wave vector
- allows for launching rays
- Back-tracing: source at **or** above lowest point
- Forward-tracing: upward propagation, dissipation incl.

# Global backtraces

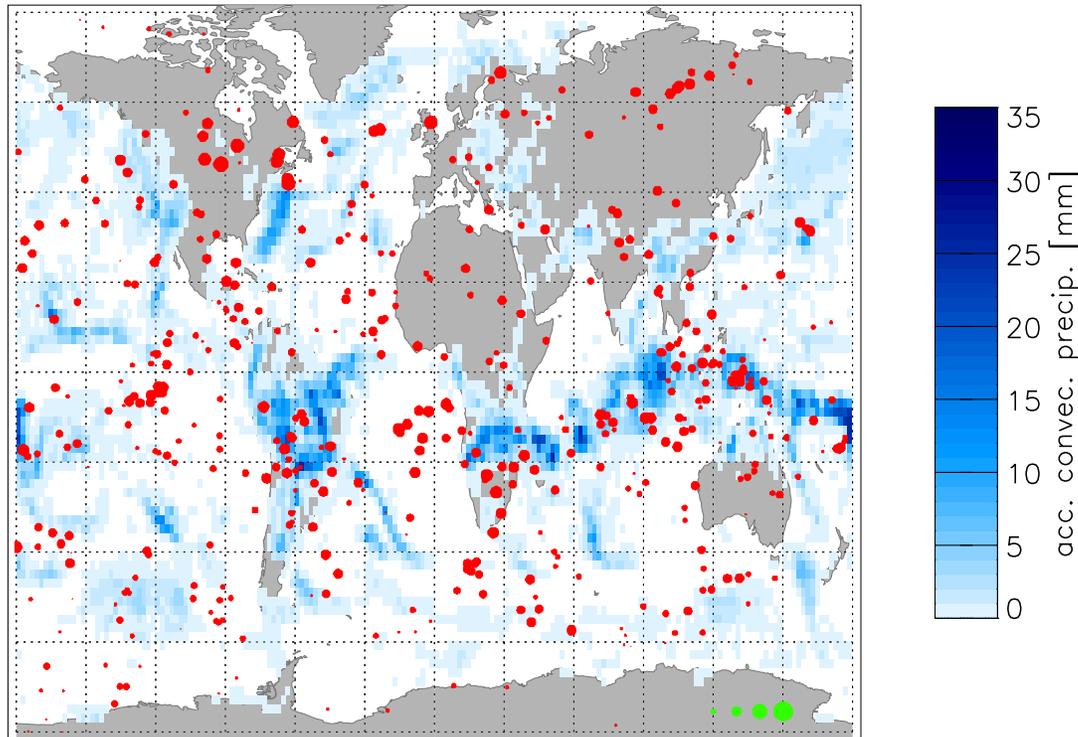
29 Jan 2008 ; 12 GMT



*Preusse, ACP, 2014*

# RT stop 12-18km

27-Jan-2008 12 GMT



- Almost all ECMWF convective GWs from tropopause
- Convection is parameterized in ECMWF
- Updrafts not represented in GCM core (only net effects couple to core)

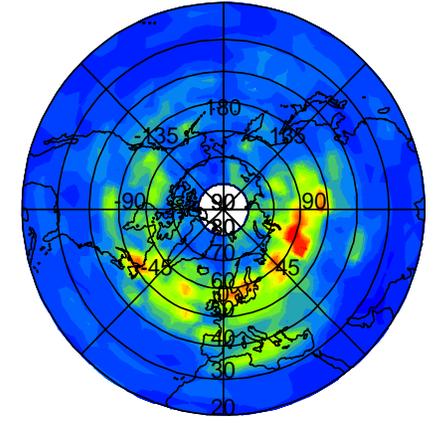
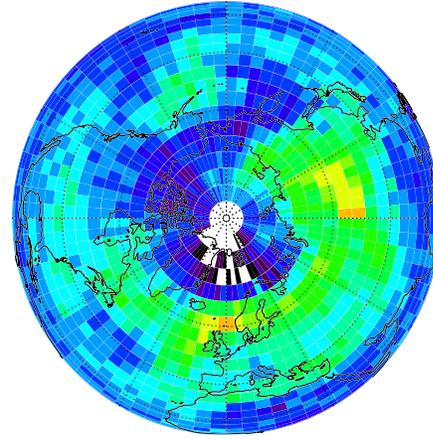
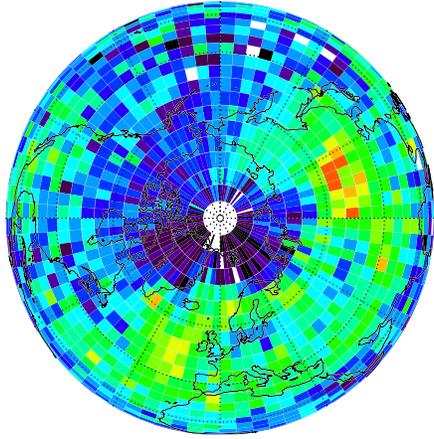
# Propagate ECMWF upward

GW 30km; Launch 12km

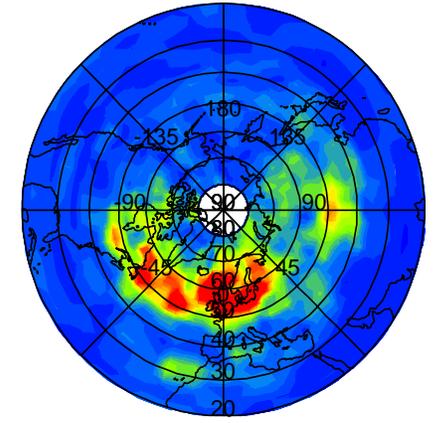
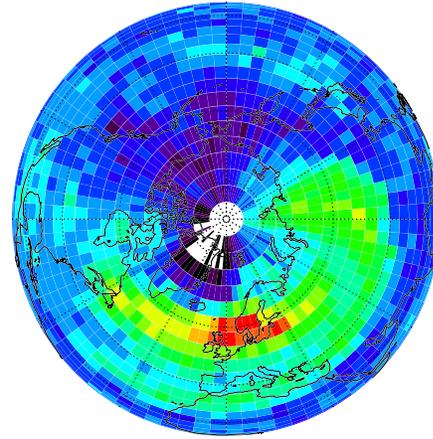
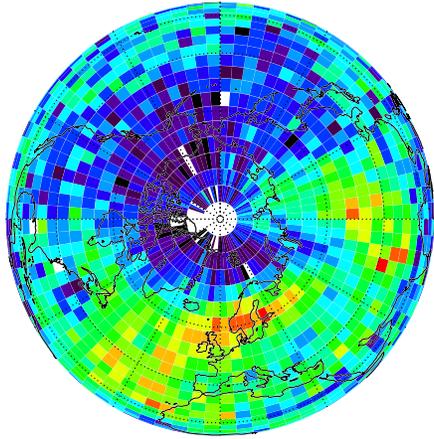
GW 30km; Launch 25km

HIRDLS

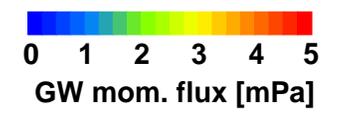
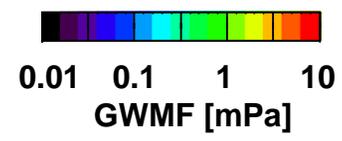
03-07



08-12



Jan 2006



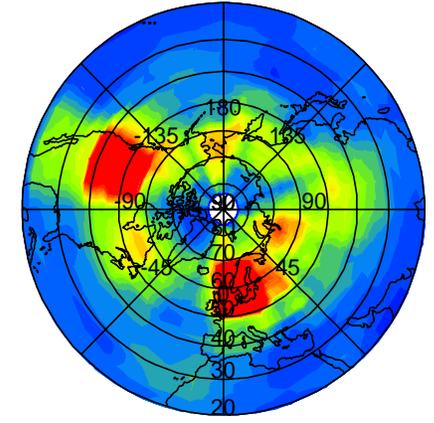
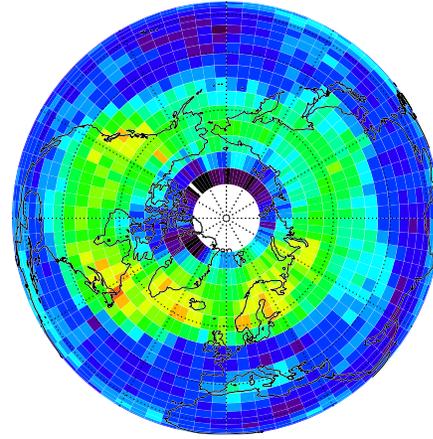
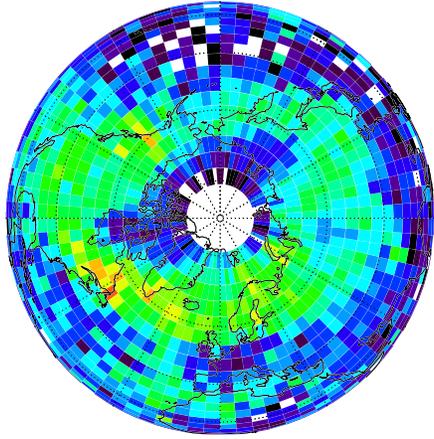
# Propagate ECMWF upward

GW 30km; Launch 12km

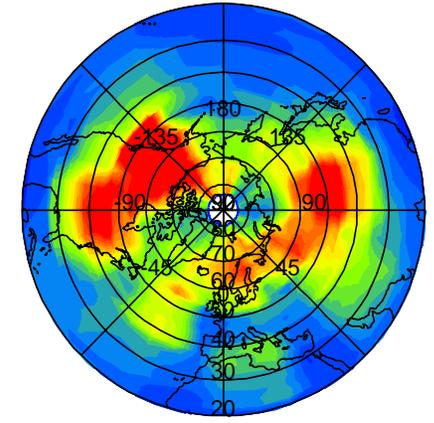
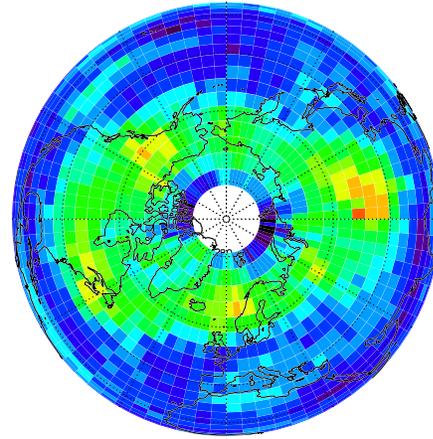
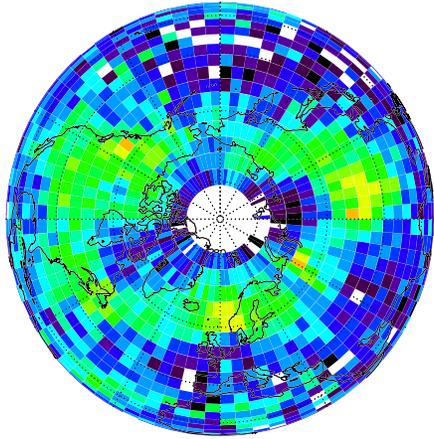
GW 30km; Launch 25km

SABER

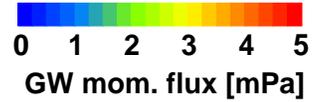
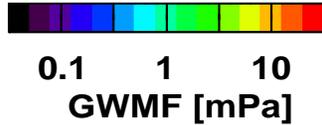
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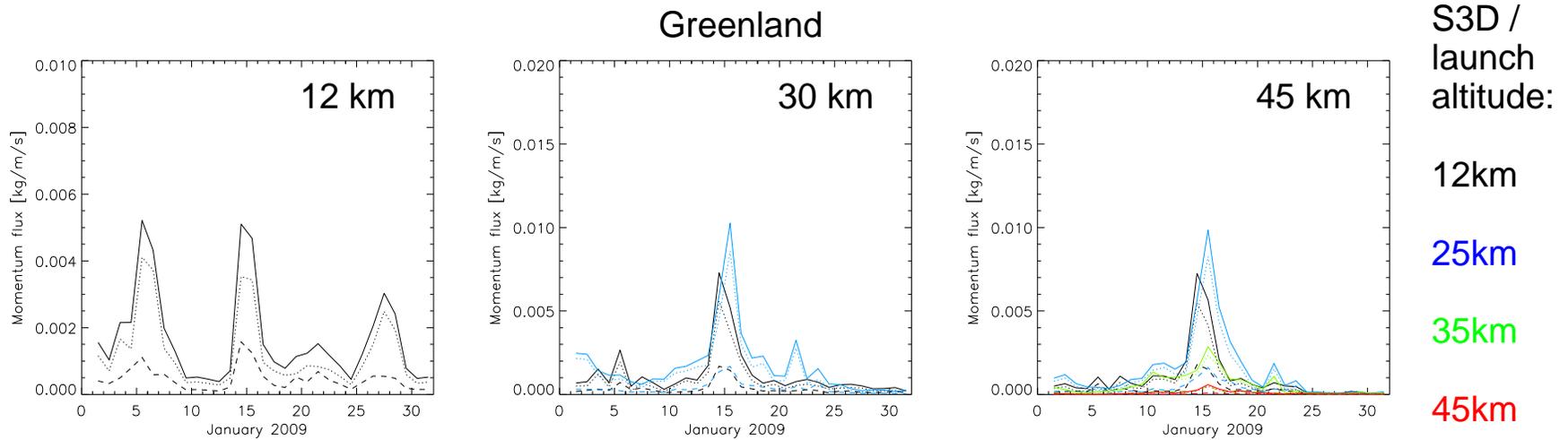
17-21



Jan 2009

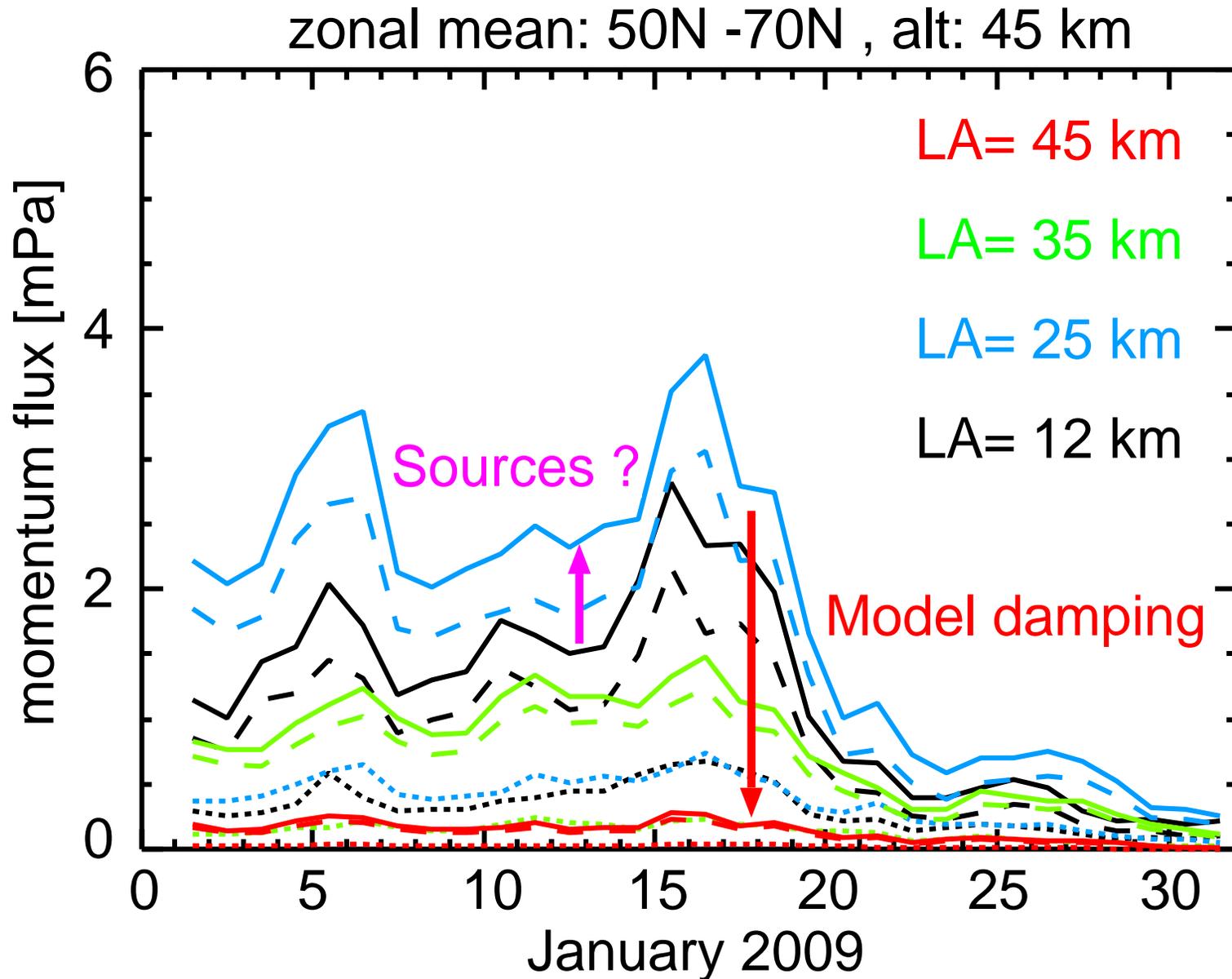


# Sources, filtering and dissipation

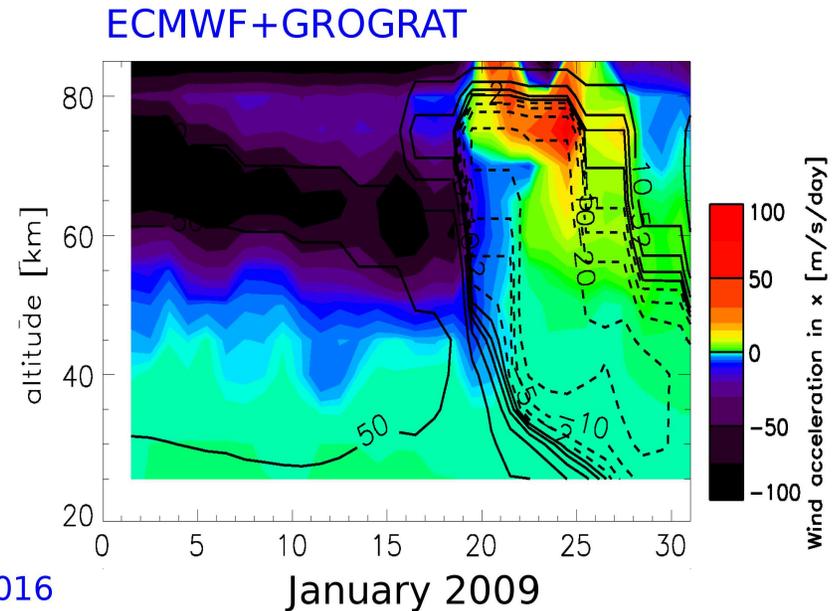
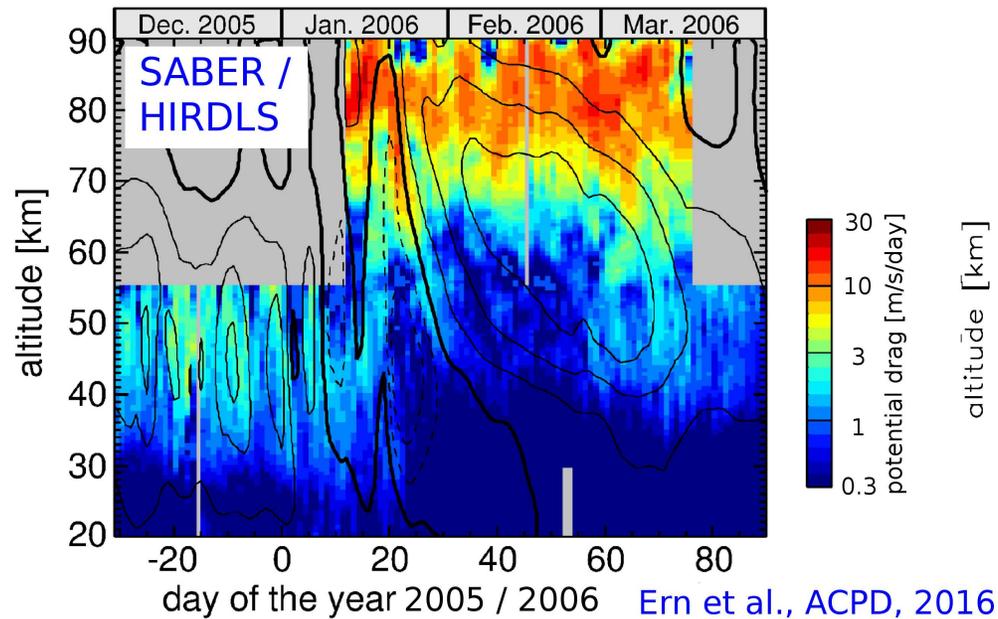


- Wind filtering in lower stratosphere removes 1st and 3rd peak
- 12km, 25km launch consistent, 45km strongly reduced

# Processes responsible?



# General features reproduced



- Stable vortex:
  - Upper edge of jet →
  - Max. of neg. acceleration
- Rebuild Phase:
  - short peak of positive acceleration

# Summary

- ECMWF good representation
  - for orographic GWs, GWs from jets
  - for altitudes  $< 40\text{km}$
- Upward projection by ray-tracing
- Still we need better global observations
- GLORIA demonstrates abilities in Polstracc/GW-LCycle/Salsa (PGS) campaign ( → **Poster 10** )