

Ozone recovery effects in the SH stratosphere influence the dynamics in MLT via GW coupling. This is fairly reproduced in GAIA and WACCMX-SD.

Long-term changes in mesospheric wind and wave estimates based on radar observations in both hemispheres

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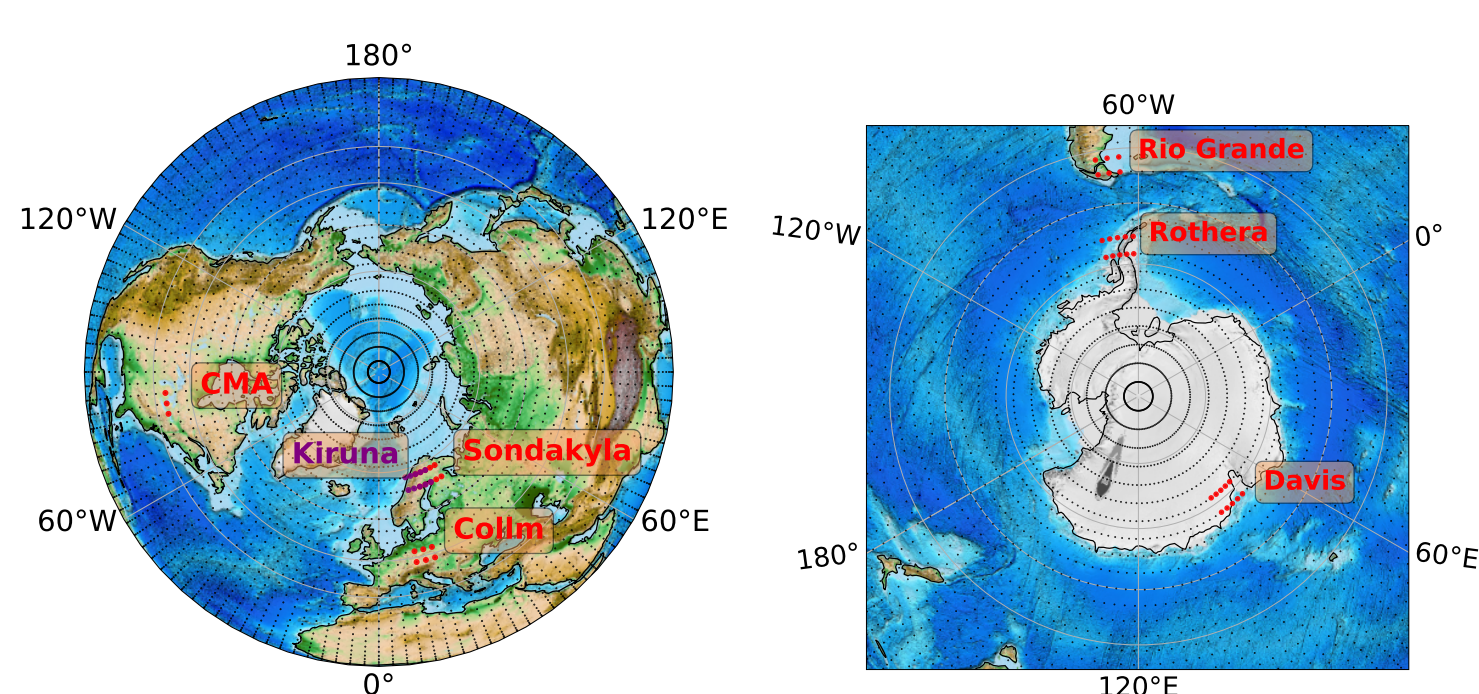
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Introduction

Several studies [1, 9] found a trend reversal between winter and summer circulation in the southern hemisphere around 2000 in the middle atmosphere. The analysis of WACCM6 simulation confirmed that \ominus trend in the stratosphere after 2000 can be attributed to ozone recovery [6]. Here we investigate how stratospheric trends relate to trends in the mesosphere and lower thermosphere (MLT) dynamics.

Datasets

- Meteor radar (MR) zonal and meridional wind (ZW, MW) measurements for 7 stations (2005–2019)
- MERRA2 reanalysis [5]
- models nudged in the stratosphere
 - WACCMX-SD (1980–2017) [2]
 - GAIA (1996–2017) [4]



Methods

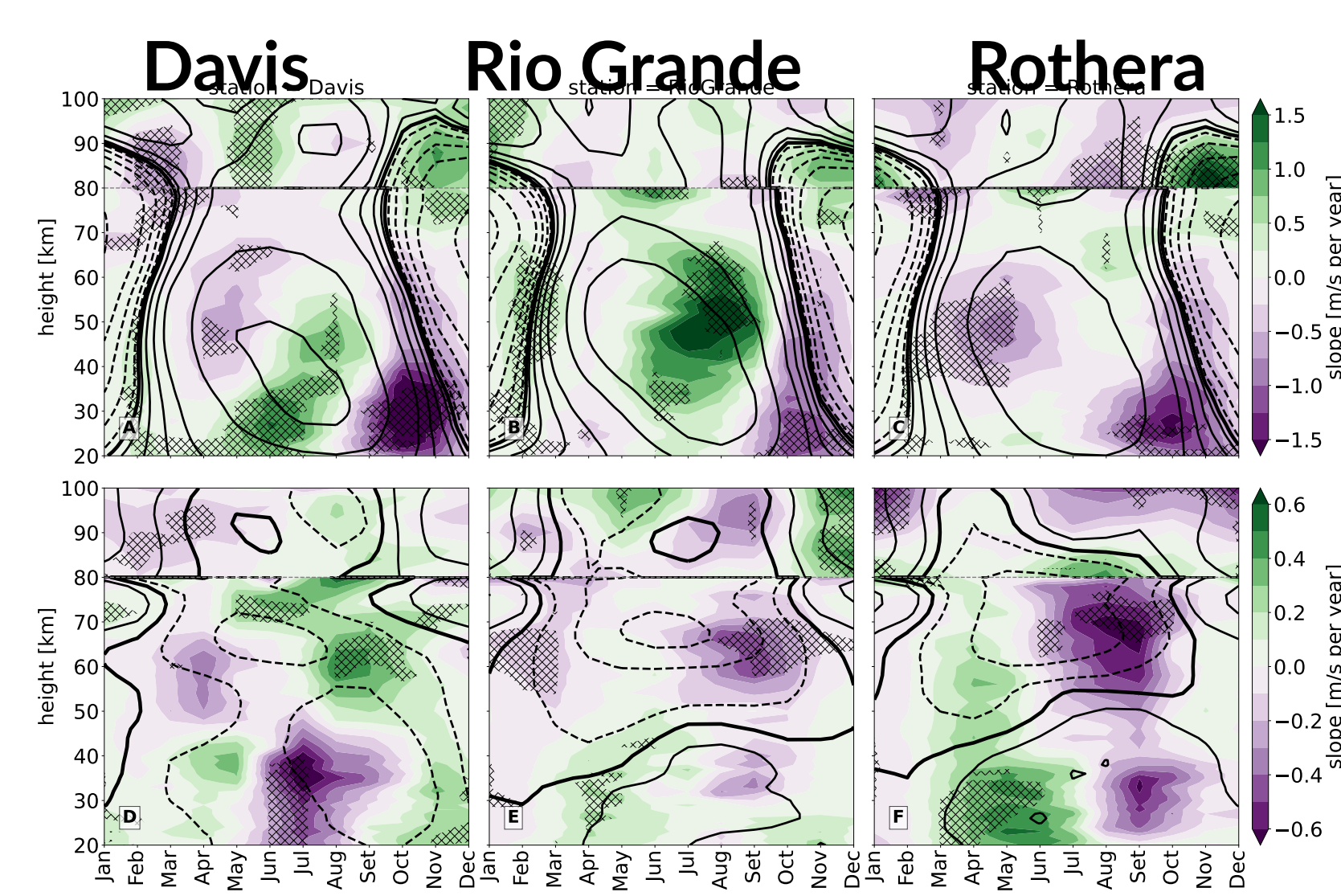
- adaptive spectral filtering [8] to decompose winds in daily means, diurnal and semidiurnal tides etc.
- trend analysis based on Theil–Sen estimator using the modified Mann-Kendall test [10, 7]
 - compared with OLS (t-test, bootstrap), GLSAR, and GLS using measurement error so far

Future outlook

Use of the FDR methodology [11]. Comparison with ERA5. Suggestions?

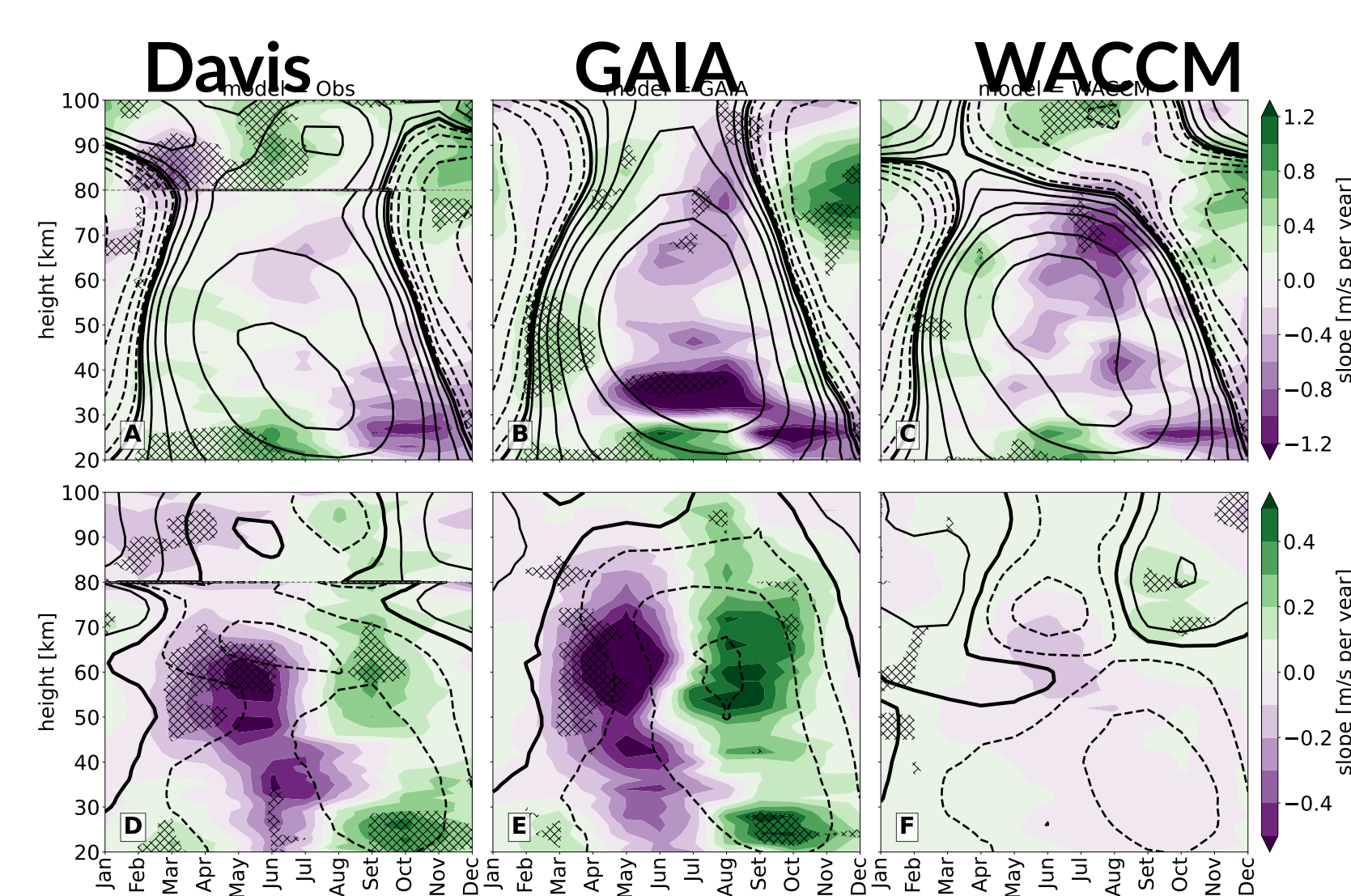
Comparison among SH stations

Trends in MERRA2 (70–80 km) compatible with trends reveal above by MRs. The common \ominus trend in ZW starting in Sep switches to \oplus trend weakening easterlies (70–90 km).

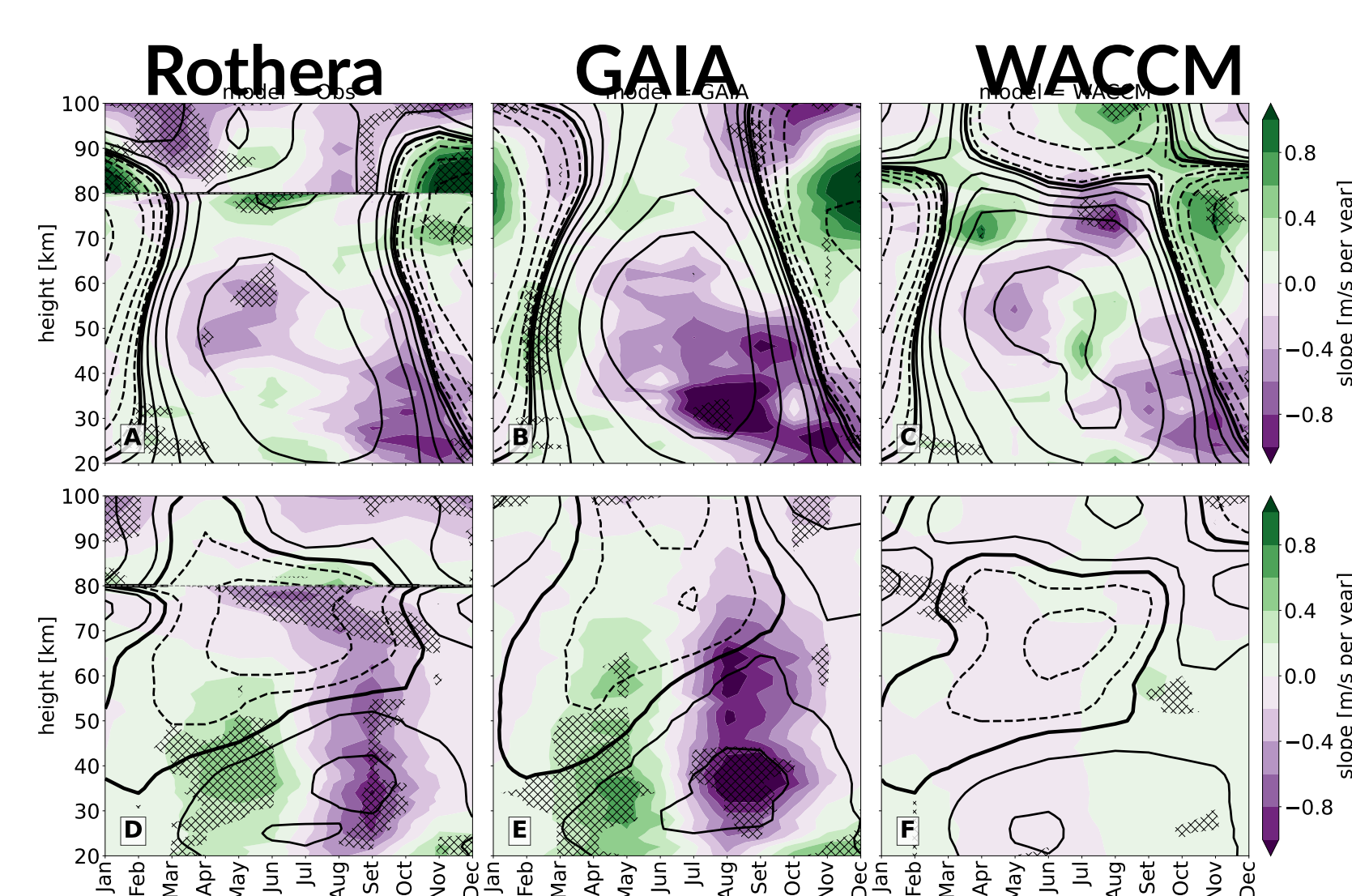


Comparison w. reanalysis & models

Both models are able to reproduce \oplus ZW trend in Nov/Dec around 80 km.

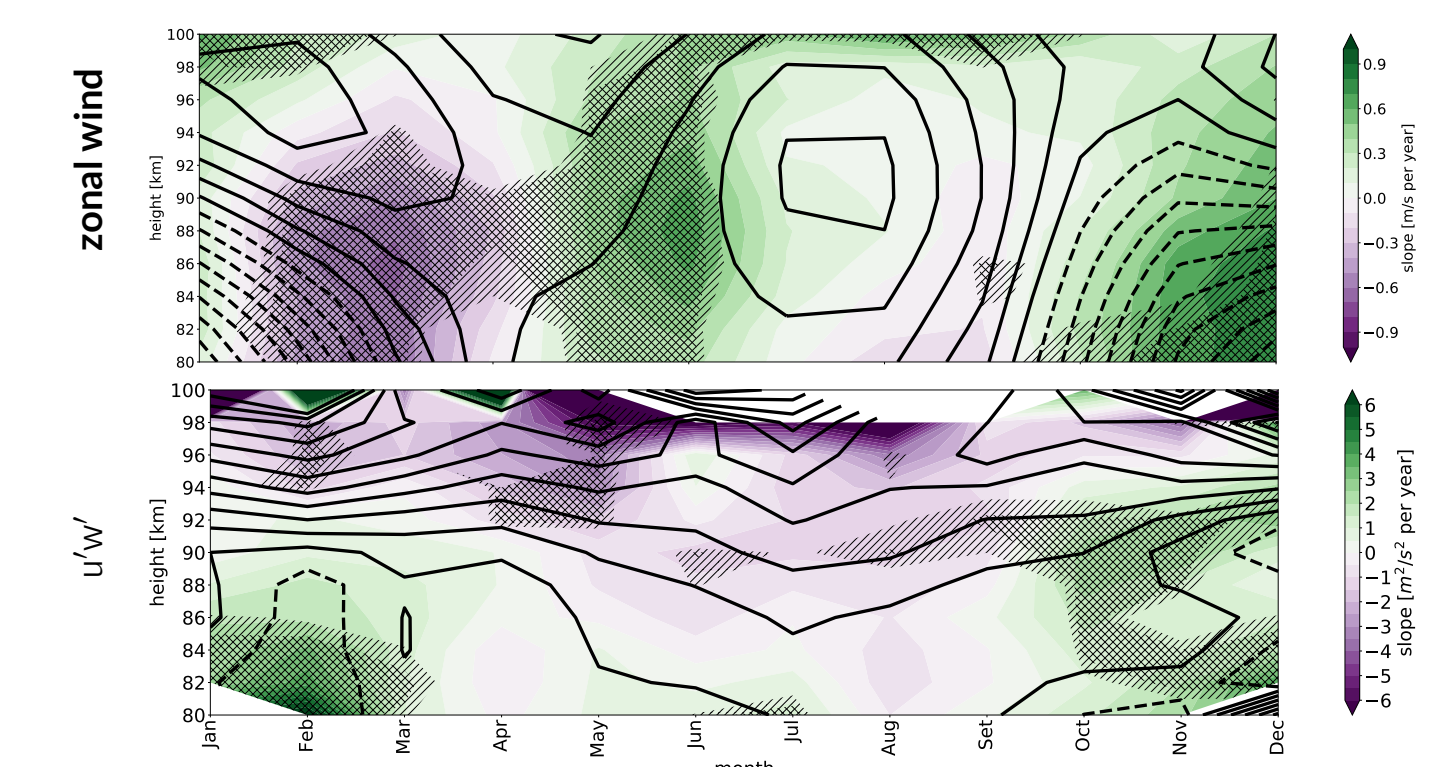


Too weak trends in MW reproduced by WACCM. Not even stratospheric trends not comparable with MERRA2.

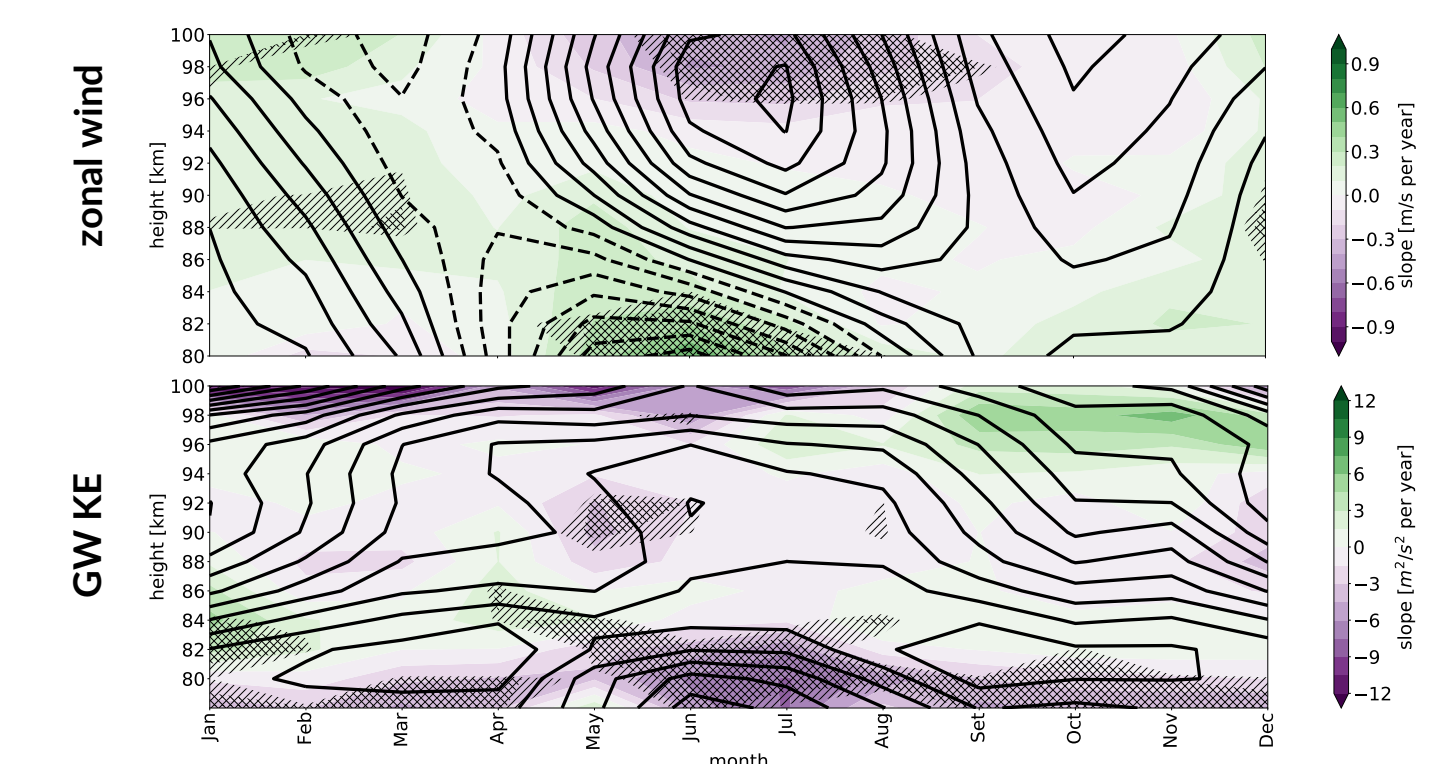


Trends related to GWs

Strengthening of easterly winds in Oct/Nov/Dec connected with a weaker westward drag in the same months as documented at Davis.

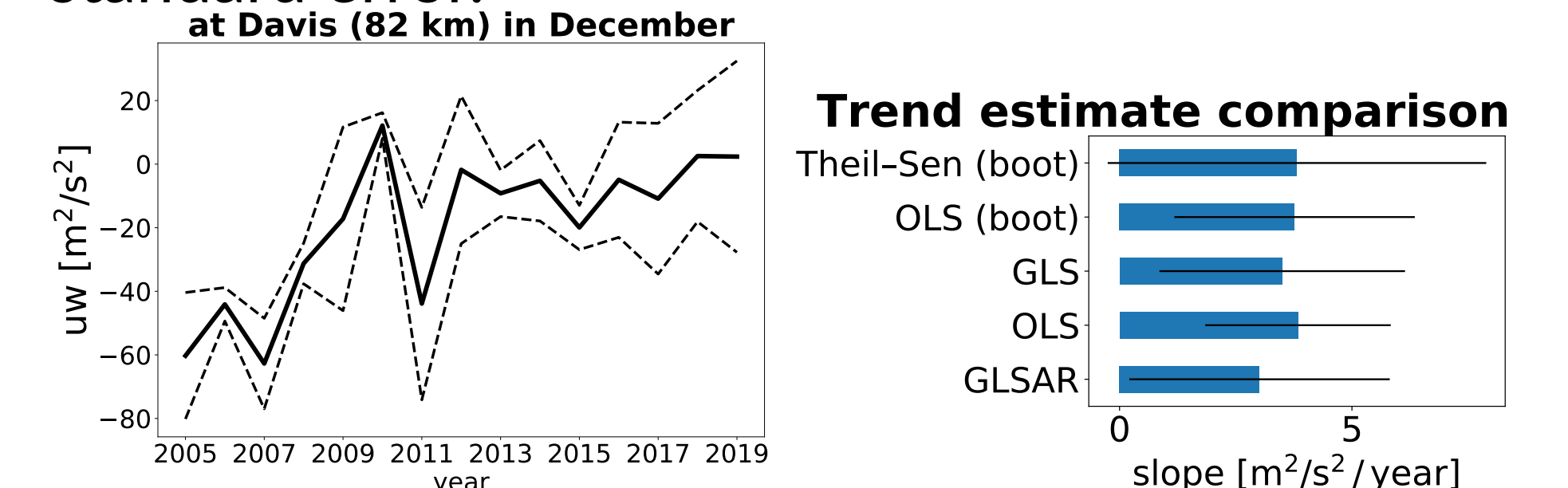


At Collm summer trends in ZW as opposed to previous studies [3], associated with decreased GW kinetic energy. No significant signal in u/w'.



Robustness of fitting method

Alternative methods offer a substantially lower standard error.

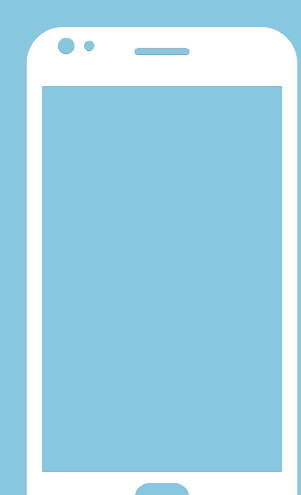


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