A model-based climatology of low-level jets in the Antarctic

Günther Heinemann, Rolf Zentek
Environmental Meteorology, University of Trier, Germany

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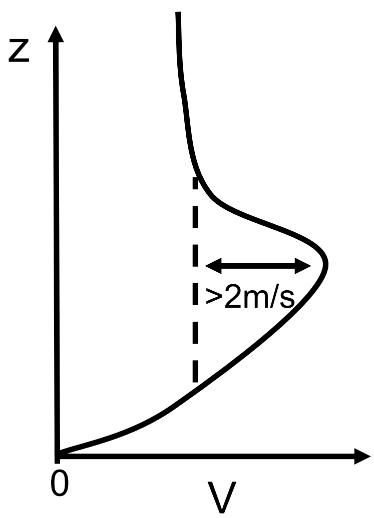
Low-level jets in polar regions



Definition LLJ

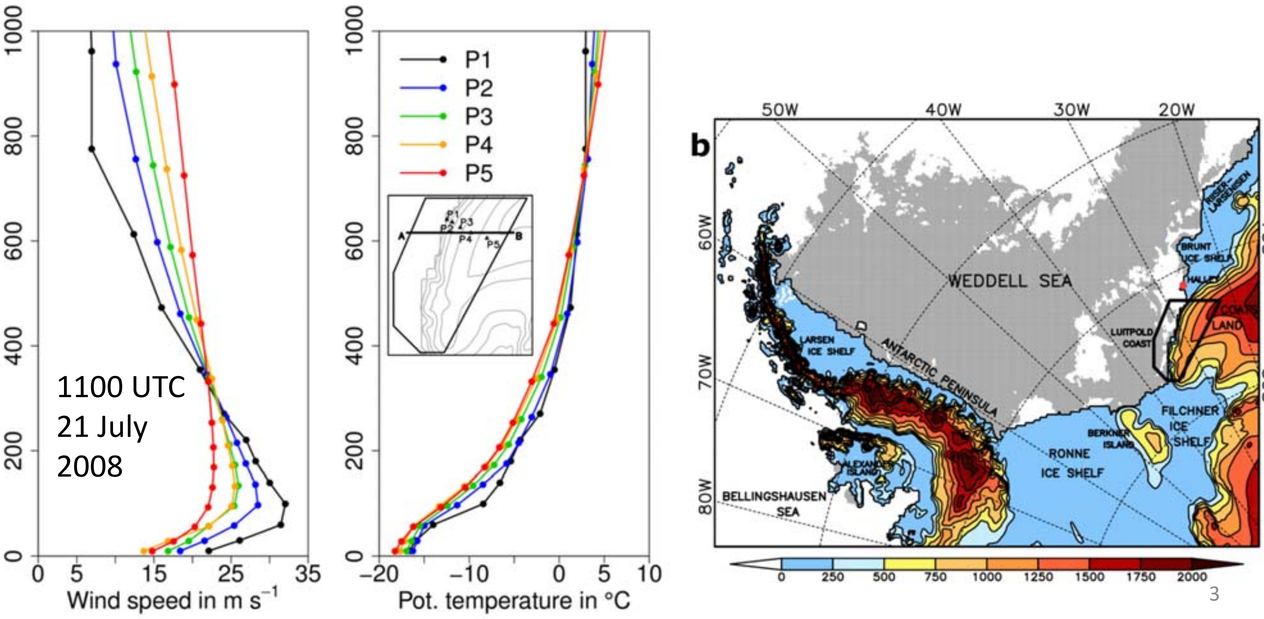
- Wind maximum in the lower troposphere
- anomaly >2 m/s
- Windmax. V > 10m/s

LLJs are

- Climatological features in polar regions (and mid-latitudes)
- Relevant for air pollution transport
- Relevant for wind power
- Relevant for turbulence production

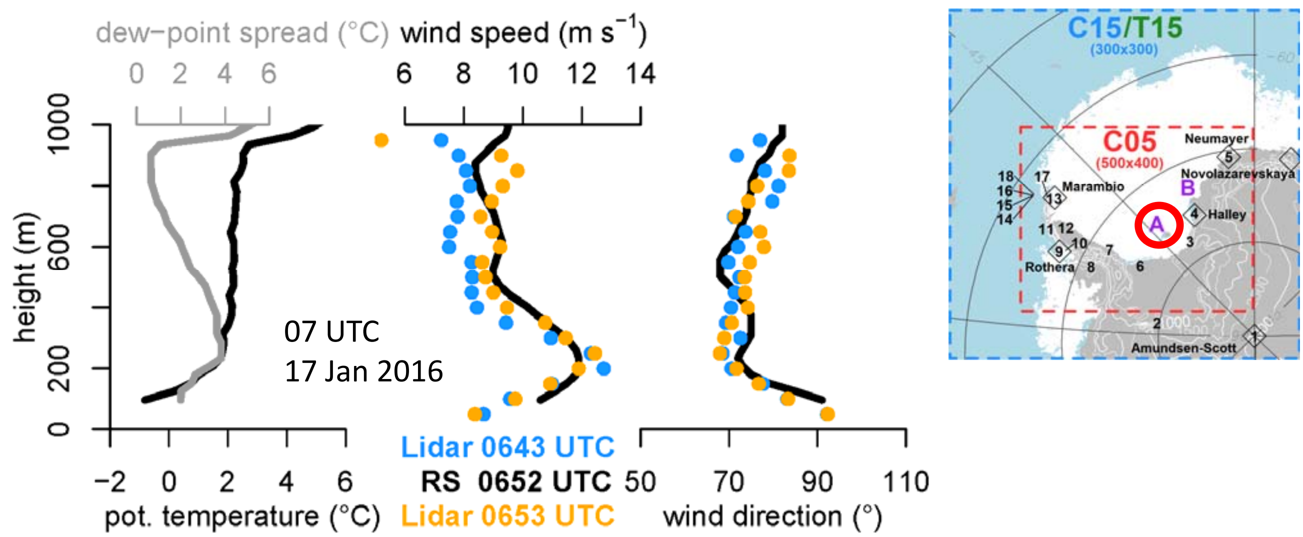
Katabatic low-level jets

Ebner et al. (2013) Antarctica, CCLM simulations 5km



Baroclinic low-level jets

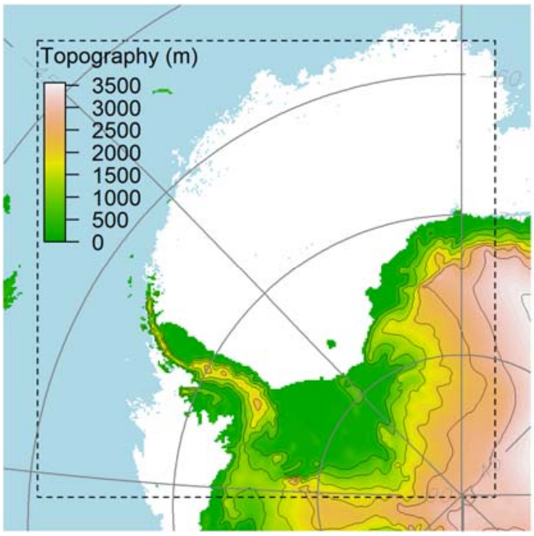
Zentek et al. (2018) sea ice Weddell Sea, Antarctica, LIDAR/RS measurements



Atmospheric modelling: CCLM

COSMO-CLM or **CCLM (**non-hydrostatic):
http://www.clm-community.eu

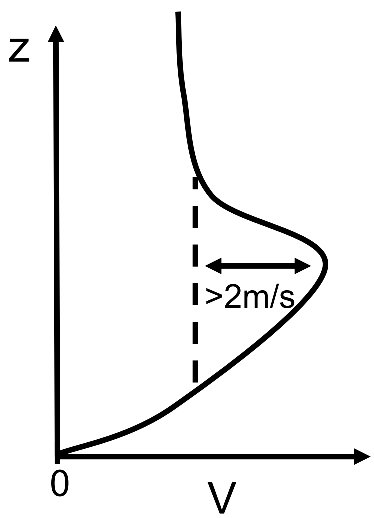
CCLM nested runs ERA-Interim ->
15km (T15), 300x300 grid points
2002 – 2016
Hourly data
60 layers (14 below 500m, lowest level at 5m)
(see Zentek and Heinemann 2020)



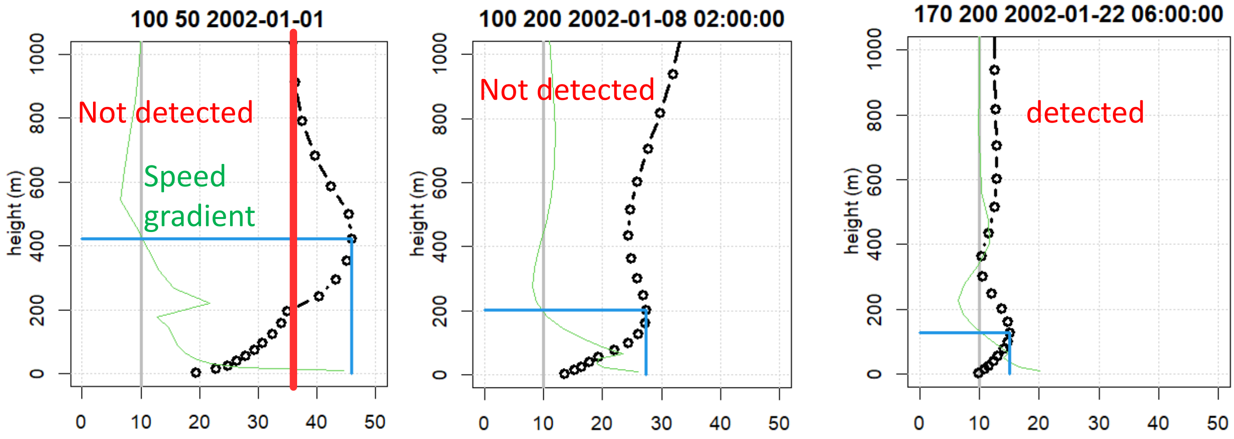
Climate Limited-area Modelling Community

Low-level jet criteria

- Height of the wind maximum (vmax) below 1000m (hmax)
- Absolute anomaly >2 m/s, search within 1.5*hmax (maximum 500m radius)
- Relative anomaly >xx% of vmax (25% in Tuononen et al. 2015)



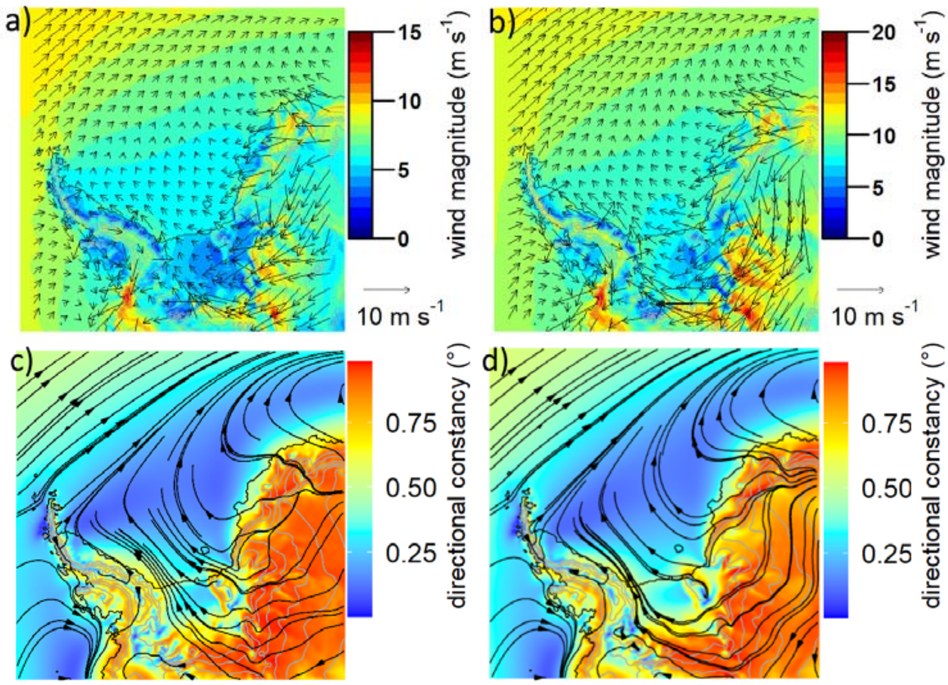
Vmax=46m/s
Hmax=400m
Search for anomaly up to 1000m



Relative anomaly 25% = 11.5m/s

Wind climatology 2002 – 2016

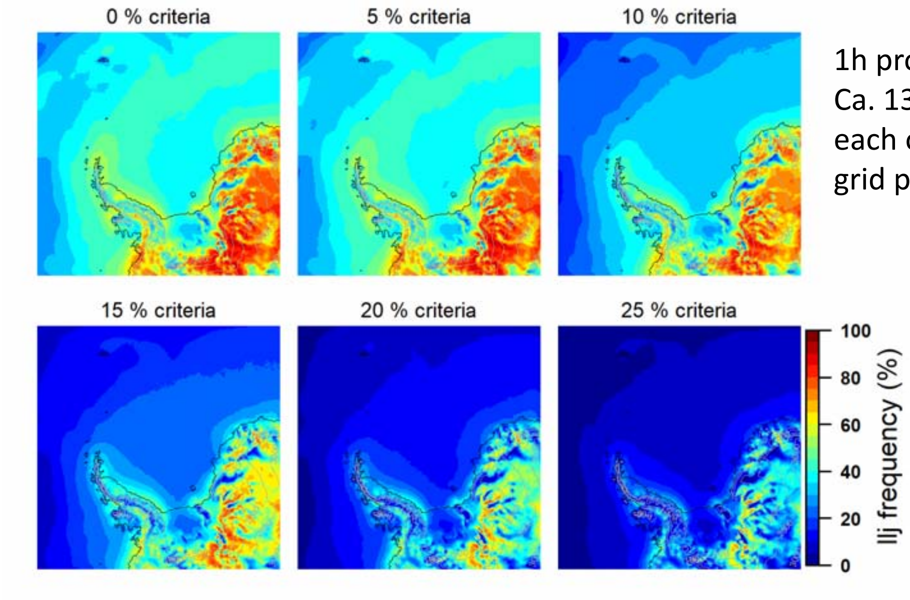
10m



100m

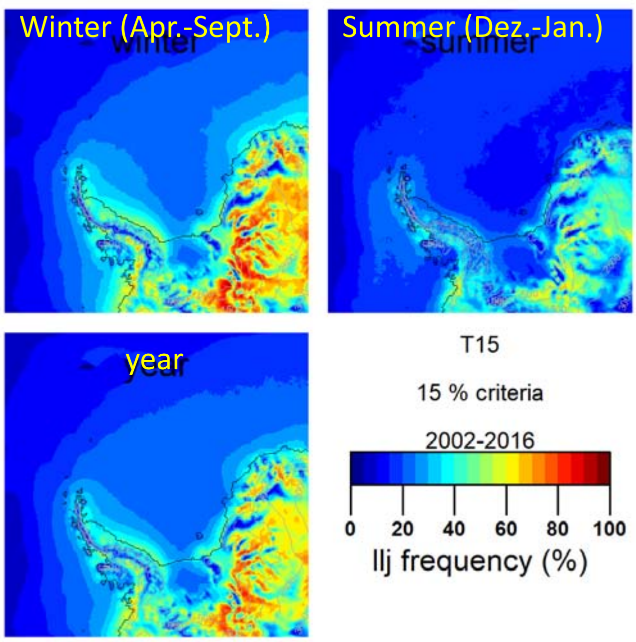
LLJ climatology 2002-2016

LLJ frequency for different relative criteria, all with 2m/s absolute criteria

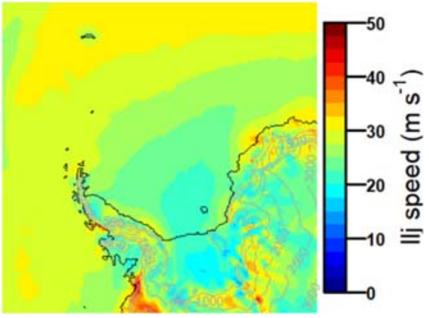


1h profiles
Ca. 130000 profiles at each of the 90000 grid points

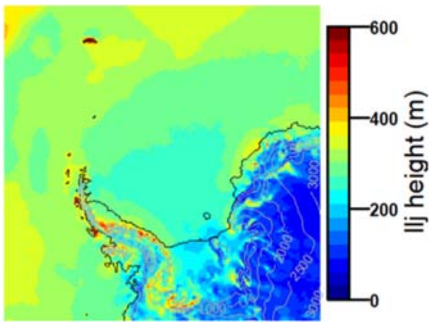
LLJ frequency for 15% relative criteria and for seasons

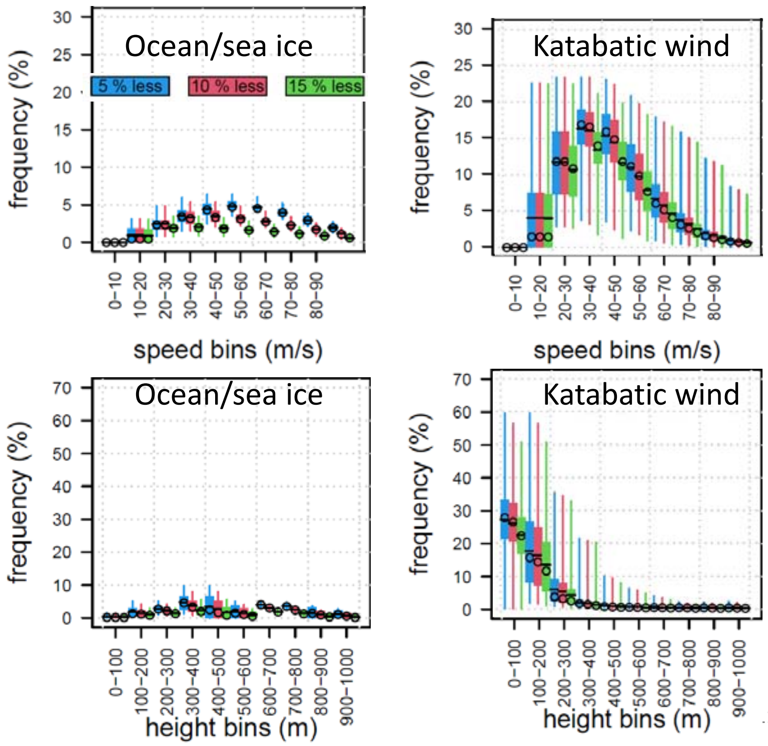


LLJ speed, 15% criteria



LLJ height





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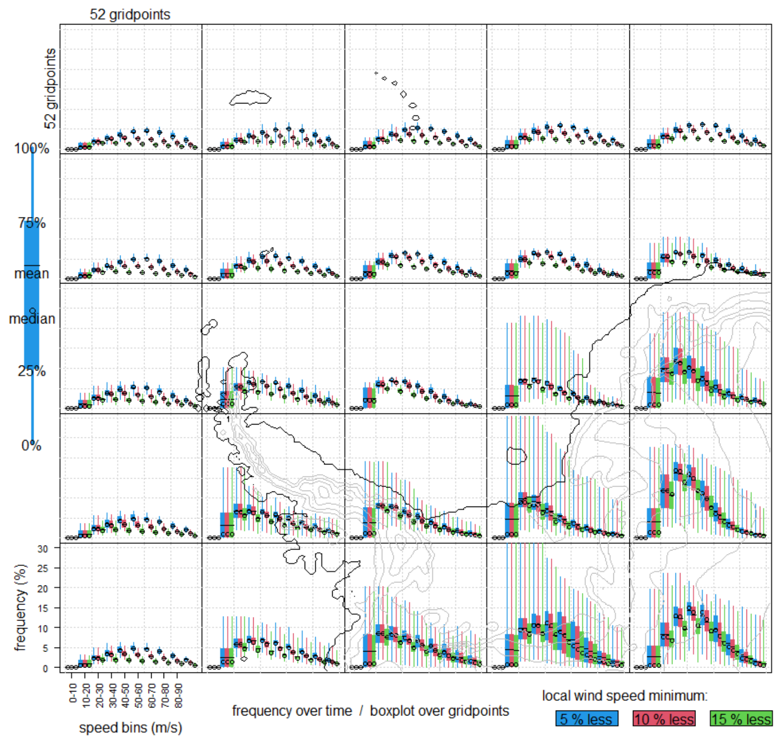
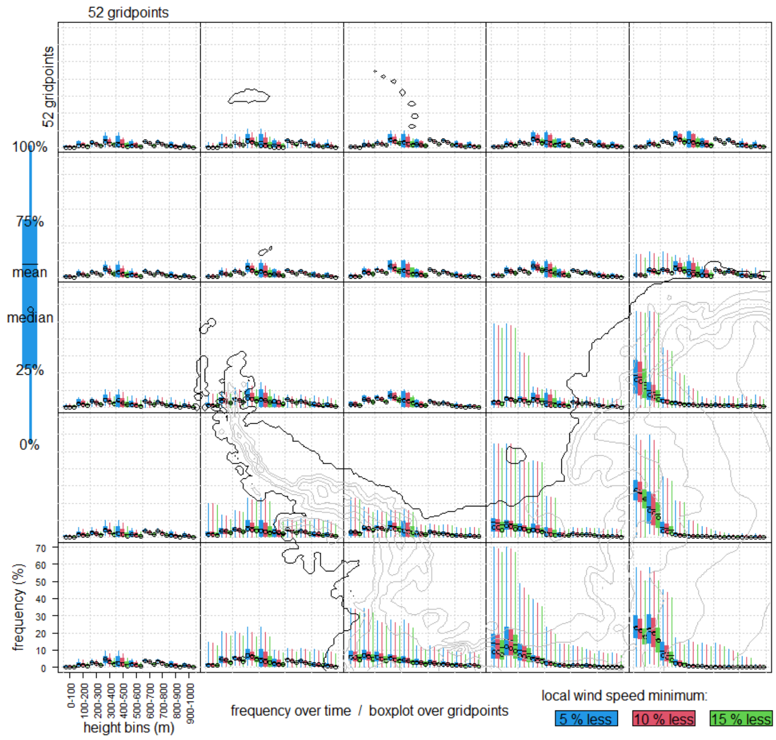


LLJ speed



LLJ height

Summary and outlook

C15 simulations 2002-2016

Wind climatology reflects katabatic and barrier winds

LLJ detection sensitivity to criteria: strong for ocean and sea ice, weak for katabatic wind

Some references

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Observations and model data published on PANGAEA and Zenodo