A model-based study of foehn effect impacts on the near-surface climate over the Larsen ice shelf at the Antarctic Peninsula

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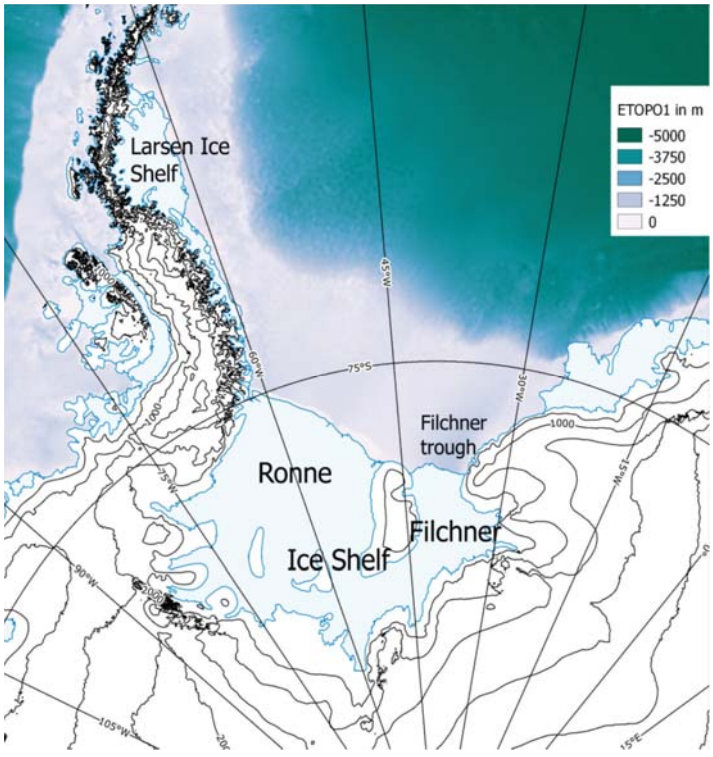
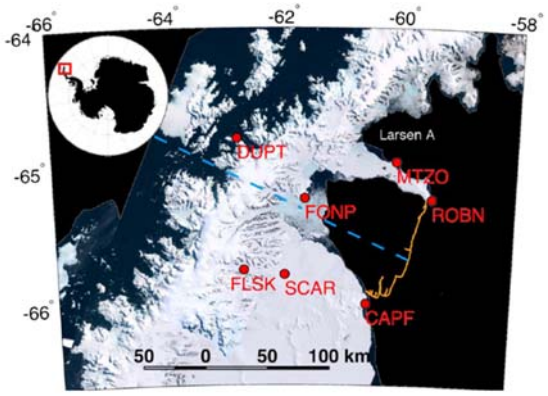




Cape et al. (2015)

Table 1. Weather Station Information[a]

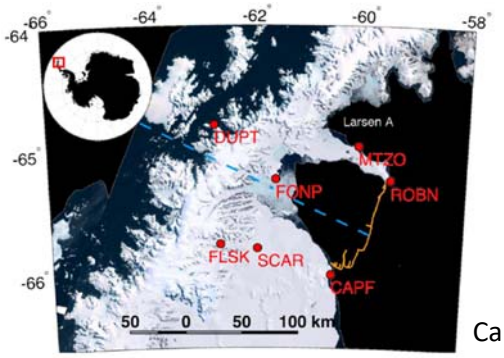
ID	Sensor Platform	Instrument	Name	Latitude	Longitude	Elevation (m)	Earliest Data	Latest Data
DUPT	cGPS	WXT520	Duthiers Point	−64.80	−62.82	40	2009 Apr 03	2014 Aug 28
ROBN	cGPS	WXT520	Robertson Island	−65.25	−59.44	58	2010 Feb 06	2014 Aug 28
CAPF	cGPS	WXT520	Cape Framnes	−66.01	−60.56	100	2010 Feb 18	2014 Aug 28
FONP	cGPS	WXT520	Foyn Point	−65.25	−61.65	65	2010 Feb 07	2014 Aug 28
FLSK	AMIGOS	WXT520	Flask Glacier	−65.77	−62.72	450	2010 Feb 06	2014 Jul 11
SCAR	AMIGOS	WXT520	SCAR Inlet	−65.80	−62.00	54	2010 Feb 16	2014 Aug 28
MTZO	**station**	**Hg / HMP45C**	**Matienzo**	**−64.98**	**−60.07**	**25**	**1962 Jan 1**	**2010 Dec 31**

[a]ID correspond to names in Figure 1, while sensor platform distinguishes between continuously recording GPS (cGPS) stations, Automated Meteorology-Ice/Indigenous species-Geophysics Observation System (AMIGOS) sensors, and the permanent base at Matienzo (MTZO, bold). Hg corresponds to mercury thermometer, while other listings correspond to Vaisala instrument model. Note that temperature and relative humidity sensors at Matienzo were installed in a Stevenson screen. Latest data refers to date of latest data used in this analysis.

Data from www.unavco.org

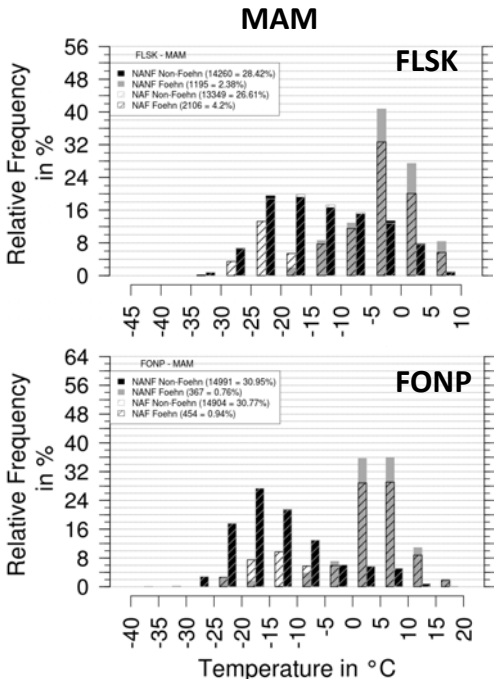
- Foehn event onset
  - Increase in temperature of 1 °C/h
  - Decrease in rel. humidity of 5 %/h
  - Wind speed > 5 m/s from westerly direction (>=225° and <= 45°)

- Foehn event
  - Minimum of 6 hours from onset on with westerly wind speed >=5 m/s

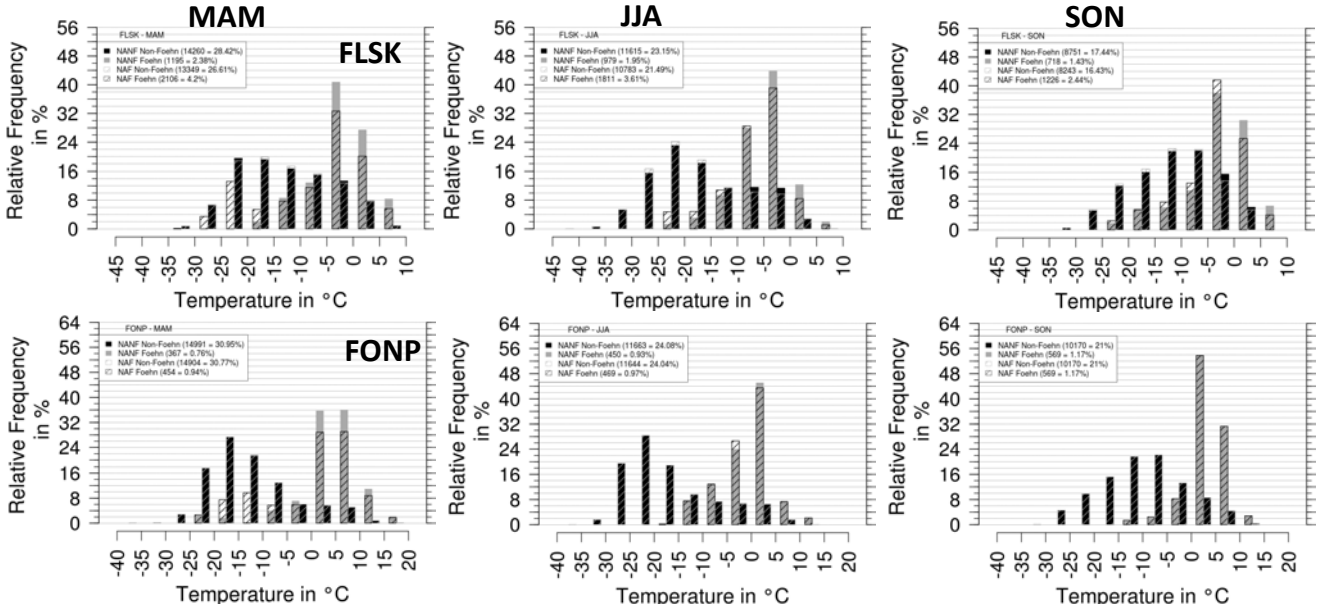


Cape et al. (2015)

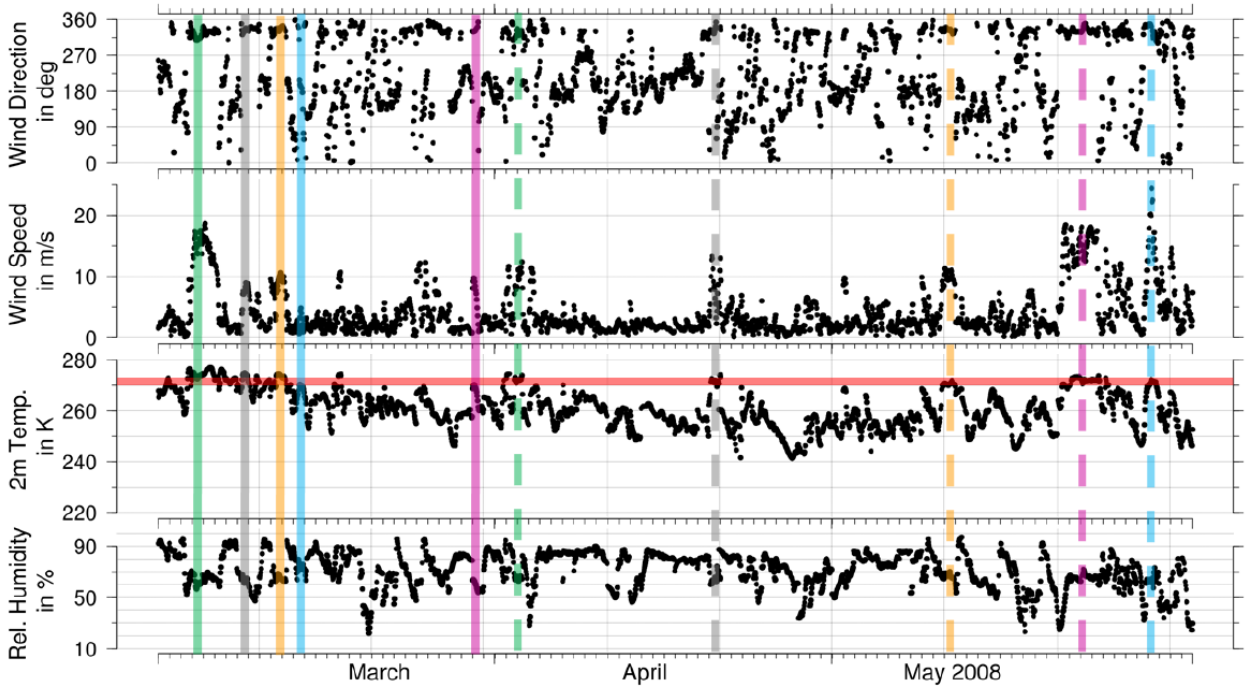
Foehn (black)/no foehn (grey) 2010-2015 (FSLK2014)



AWS: Foehn (black)/no foehn (grey) 2010-2014/15



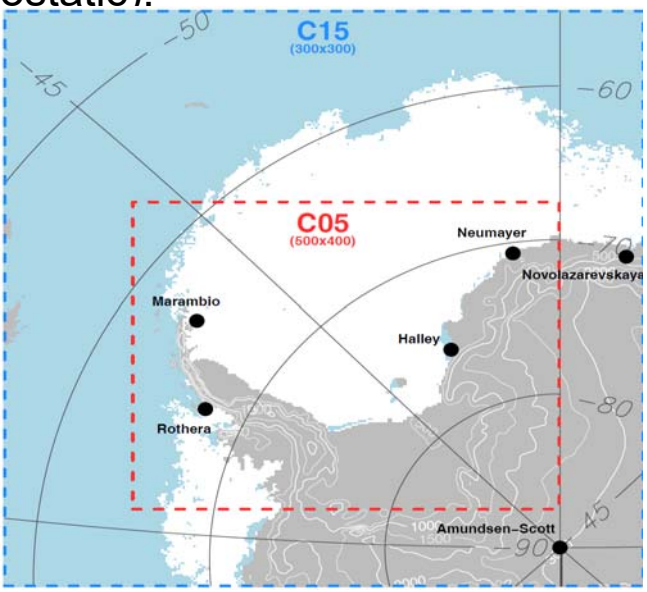
Station Foyn Point (FONP)



Atmospheric modelling: CCLM

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

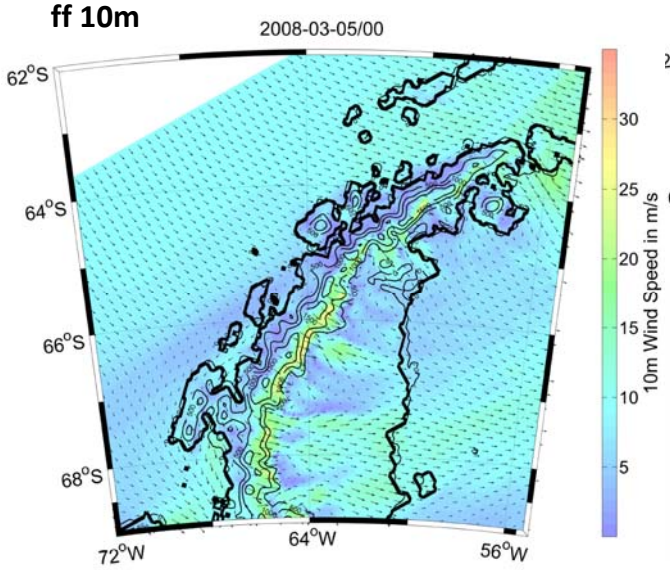
CCLM nested runs (ERA-Interim -> 15km (C15) -> 5km (C05)
C15: 2002 – 2016
C05: winter 2002 – 2016
Hourly data



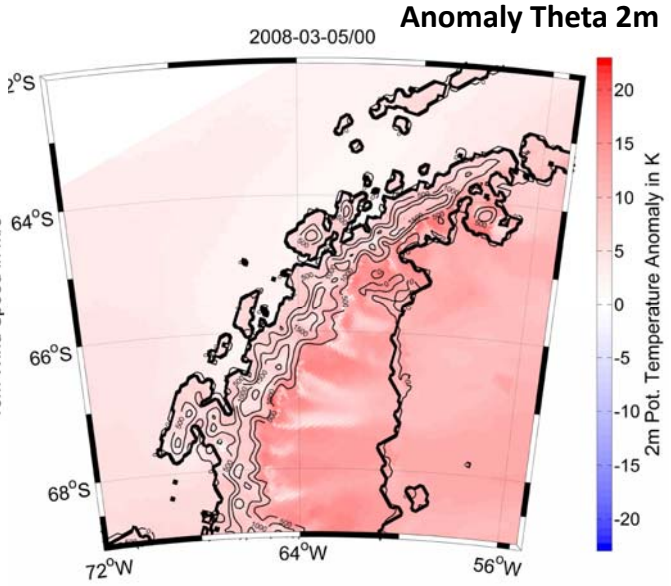
Climate Limited-area Modelling Community

Case study 5 March 2008

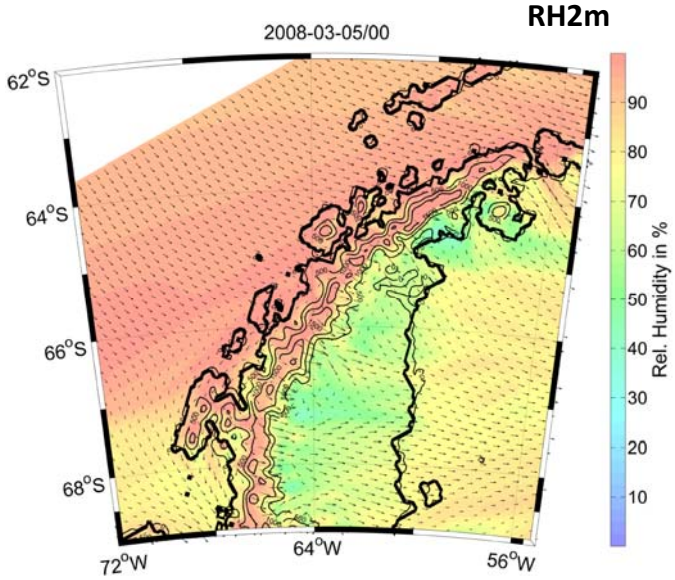
ff 10m



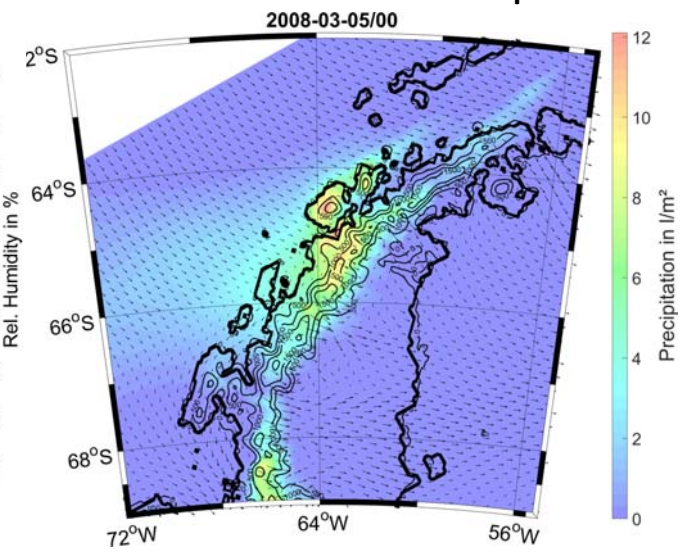
Anomaly Theta 2m



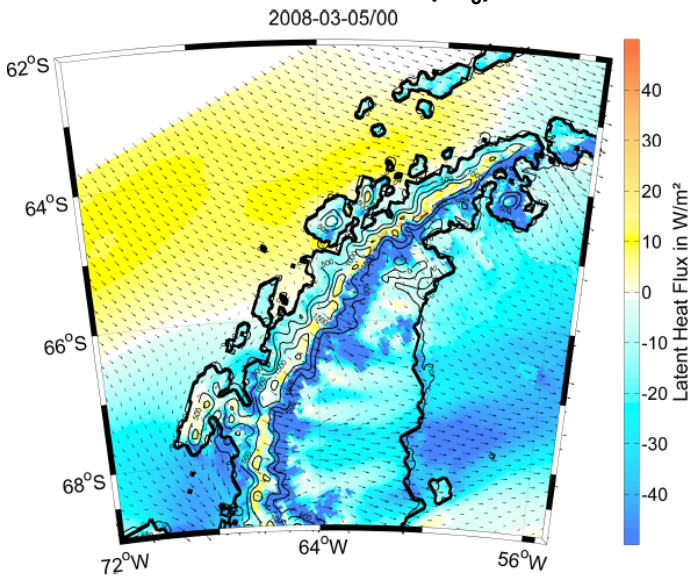
RH2m

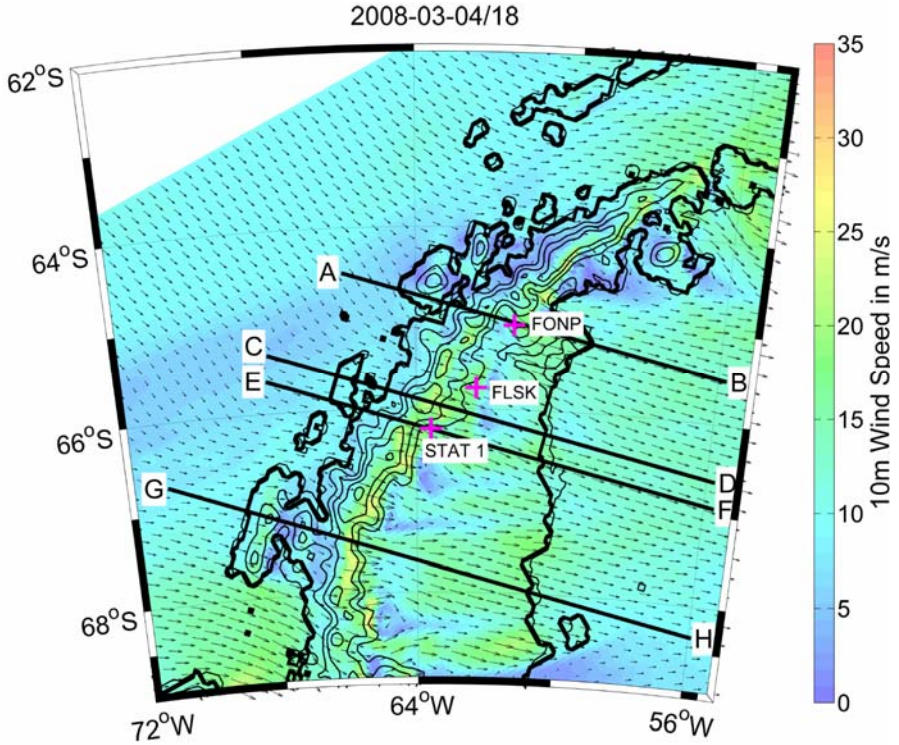


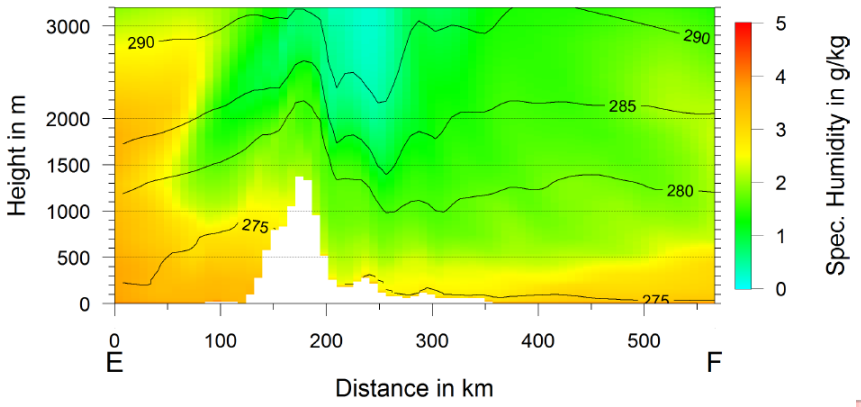
Precip



Latent heat flux ($-E_0$)

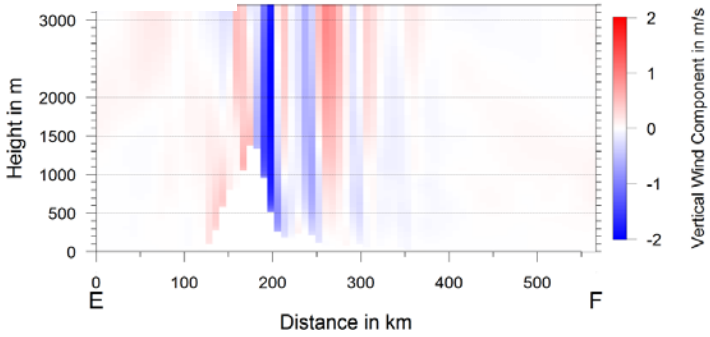


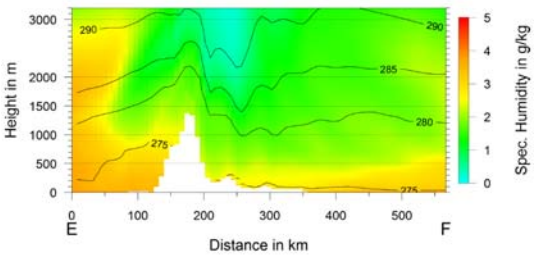




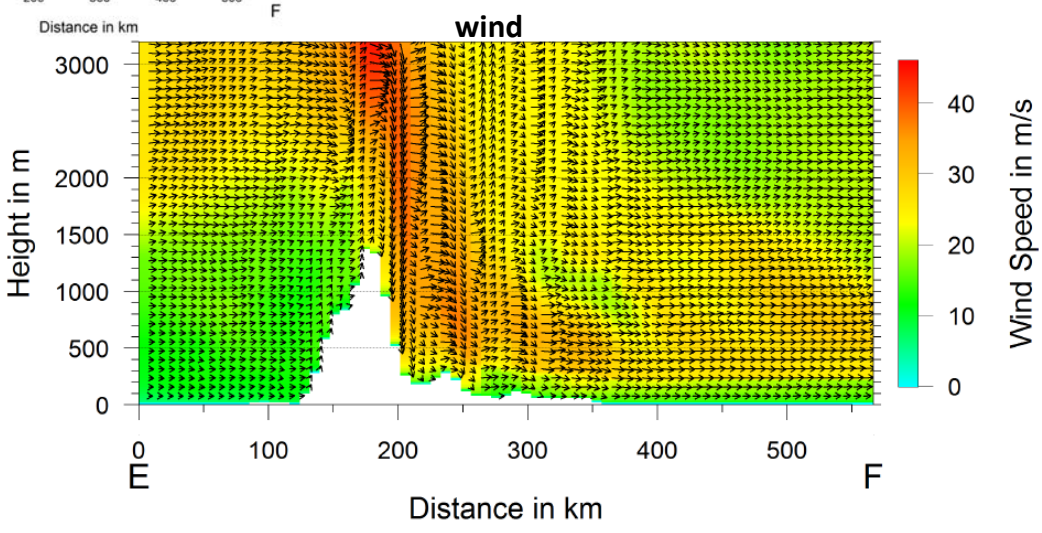
Pot. temp and spec. hum.

vert. wind





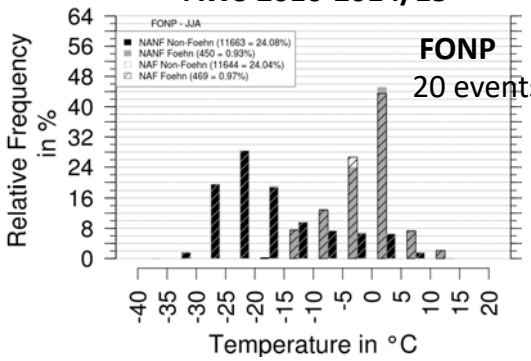
wind



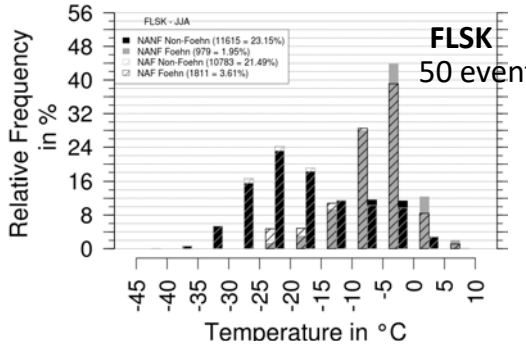
AWS 2010-2014/15

JJA

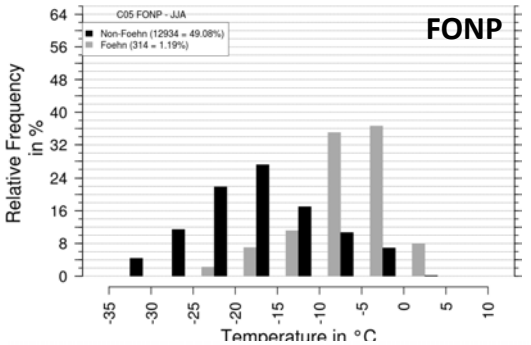
grid point C05 2002-2015



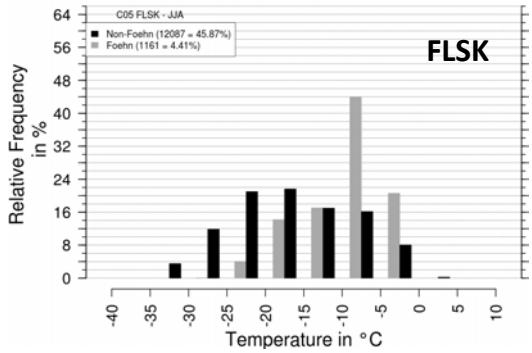
FONP
20 events



FLSK
50 events



FONP

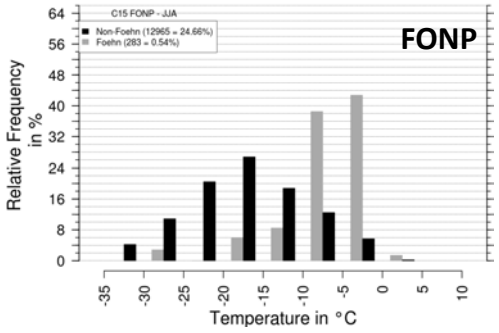


FLSK

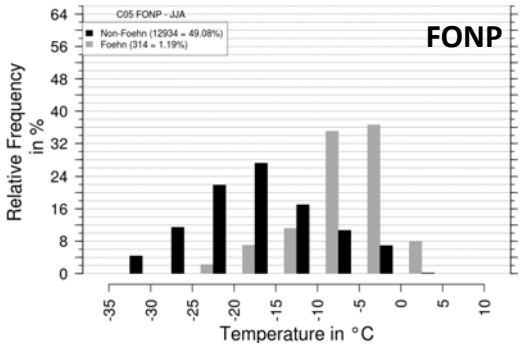
grid point C15 2002-2015

JJA

grid point C05 2002-2015



FONP



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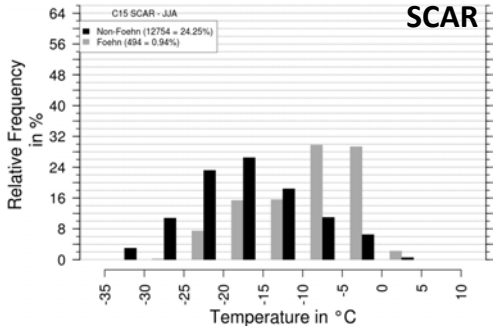
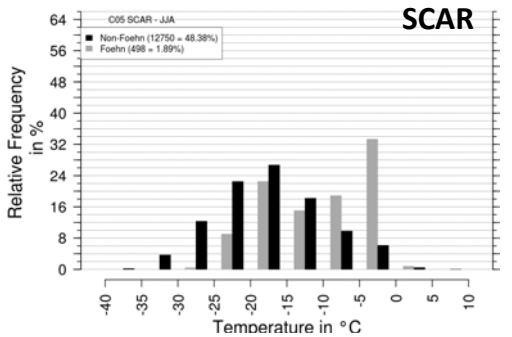


SCAR



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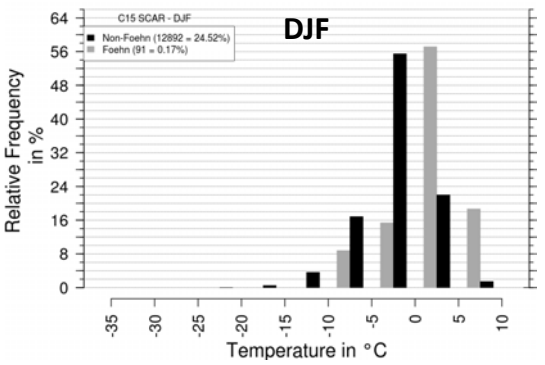
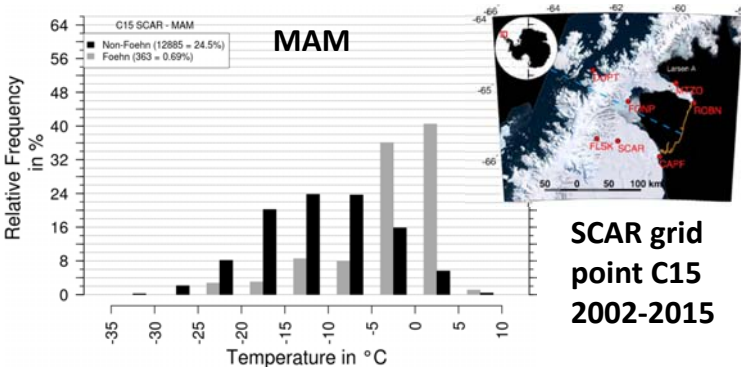
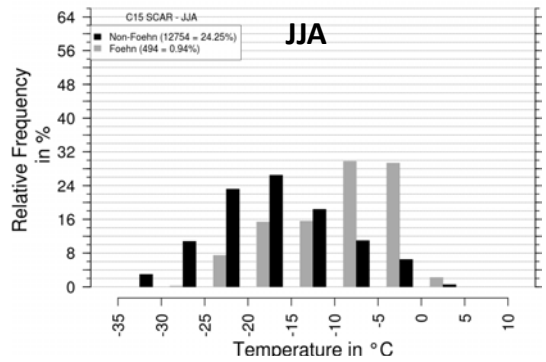
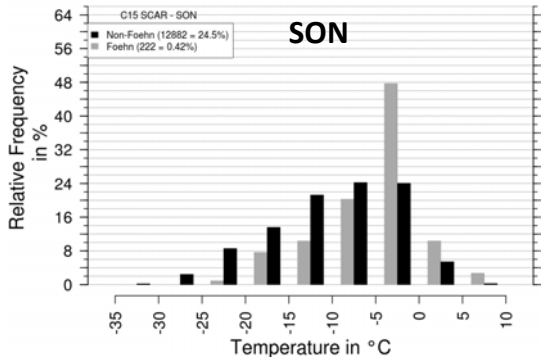






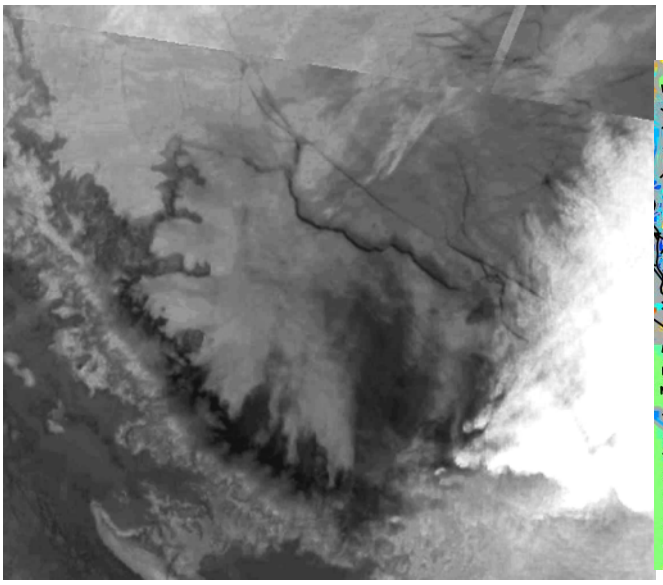


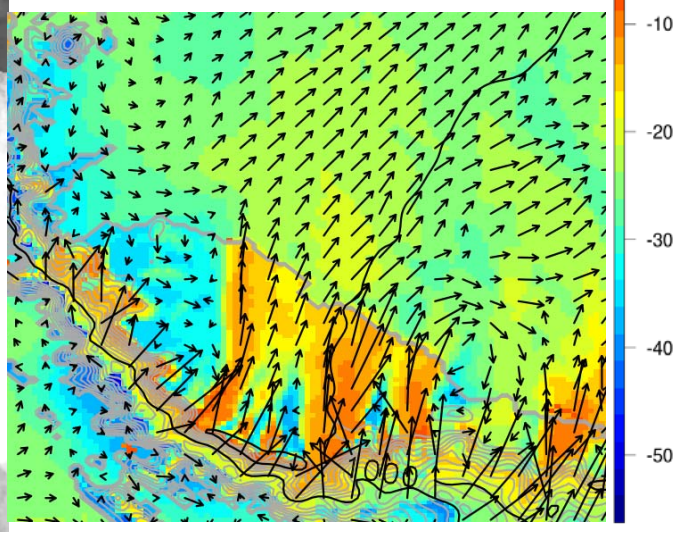
SCAR grid point C15 2002-2015

MODIS IR

7 July 2015

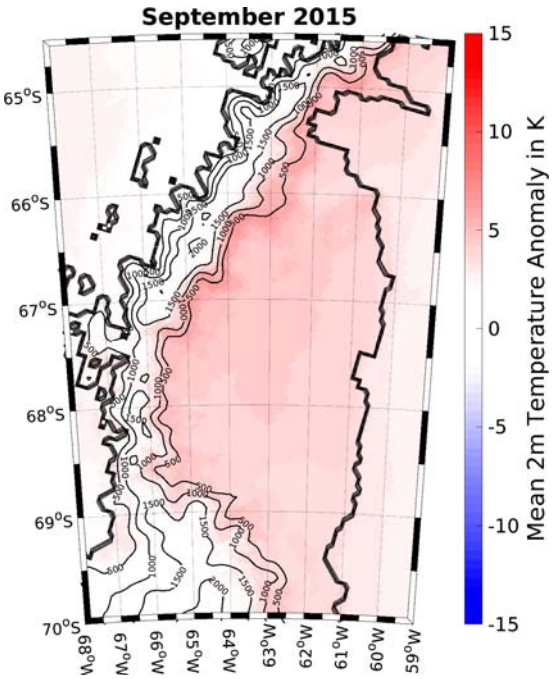
C05 Tsurf

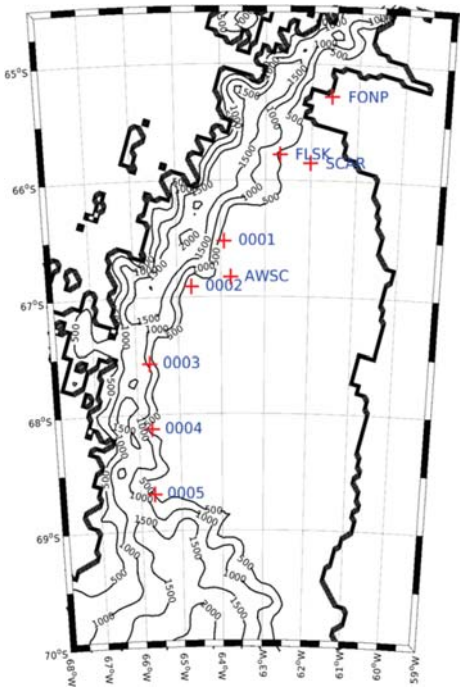




Foehn anomalies

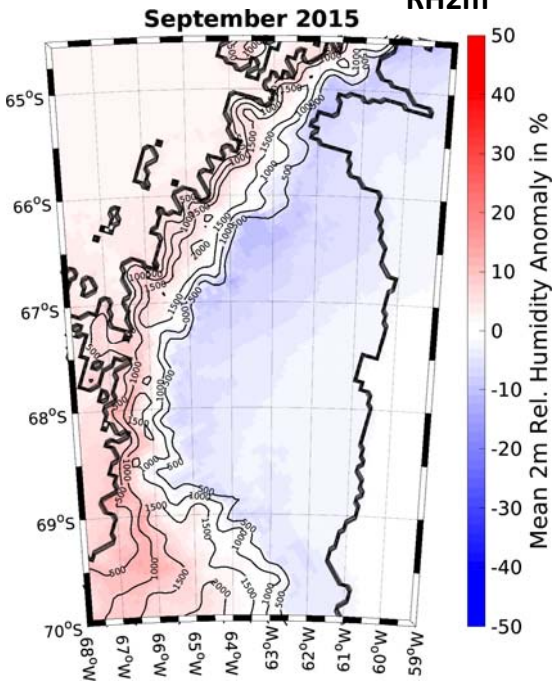
T2m



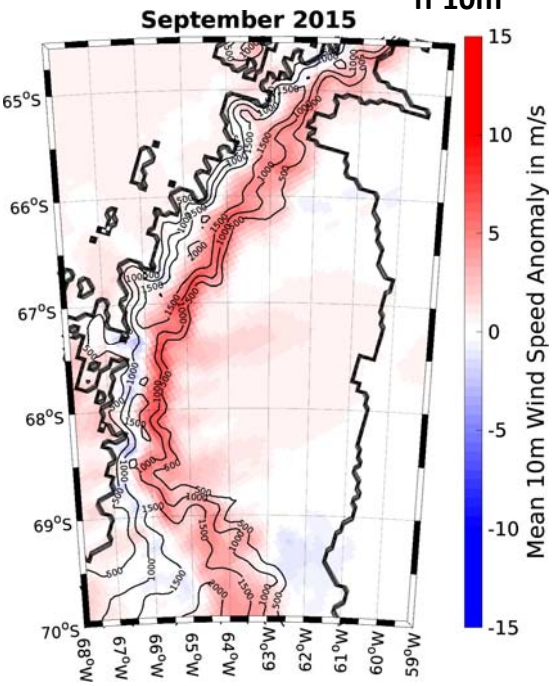


Anomalies

RH2m



ff 10m



Summary and outlook

Foehn events in the AP region
AWS 2010-2015 and C15/05 simulations 2002-2015

Foehn criteria: changes in wind, temperature and humidity
only foehn events exceeding 6h -> change foehn criteria ?
(studies of King et al. 2017, Turton et al. 2018)

longest events last more than 2 days
foehn events cause melting frequently for spring and autumn. In winter, a few cases of melting occur as well.

Implications for during climate change