Snowdrift event detection at Princess Elisabeth station

Comparison of

Ground-based and spaceborne remote sensing

✓ On Snowdrift
✓ Satellite blowing snow retrieval
✓ The cloud-precipitations observatory
✓ The ground based observations
✓ The whole project / outlook and perspectives

- Surface mass balance (SMB) component

$$SMB = P_{in} + M_{out} + (S_{out} + S_{d,\,out}) + Er_d$$

- Snowdrift as residual term including uncertainties (relocation + sublimation) (Gorodetskaya et al., 2015)


Princess Elisabeth Station
Utsteinen, Antarctica
2016-04-22 GMT 09:59:52

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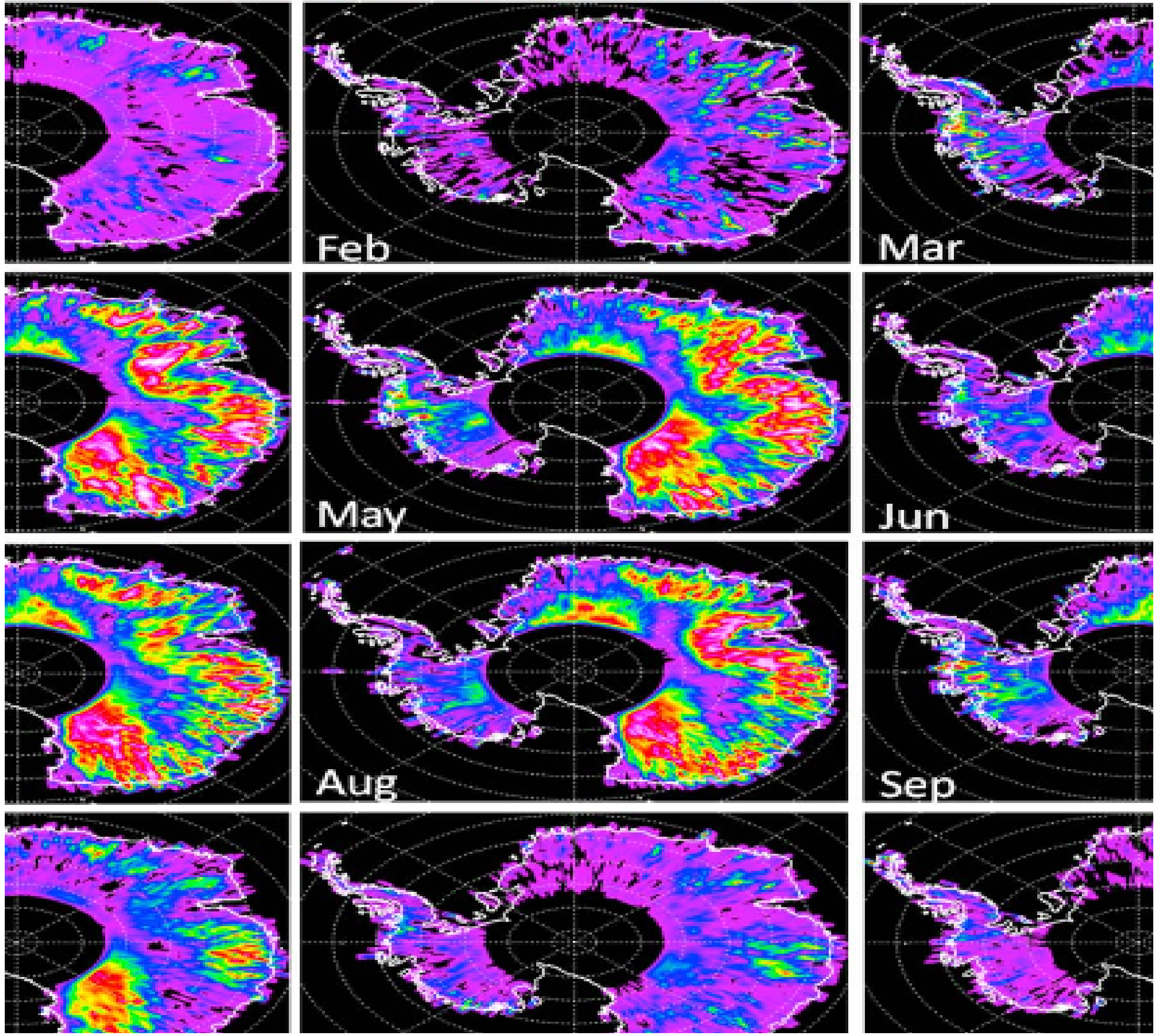
- Palm et al (2011): routine to estimate blowing snow
  - spatial and temporal frequency
  - layer height
  - optical thickness
  - mass transport
- Data:
  - Satellite Lidar Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) at 532 nm
  - Moderate resolution Imaging Spectroradiometer (MODIS)
- Method:

- minimum backscatter threshold at the lowest range gate
- decreasing backscatter profile
- minimum windspeed

The blowing snow frequency (fraction) and spatial distribution for each month of 2009 as determined from analysis of CALIPSO data



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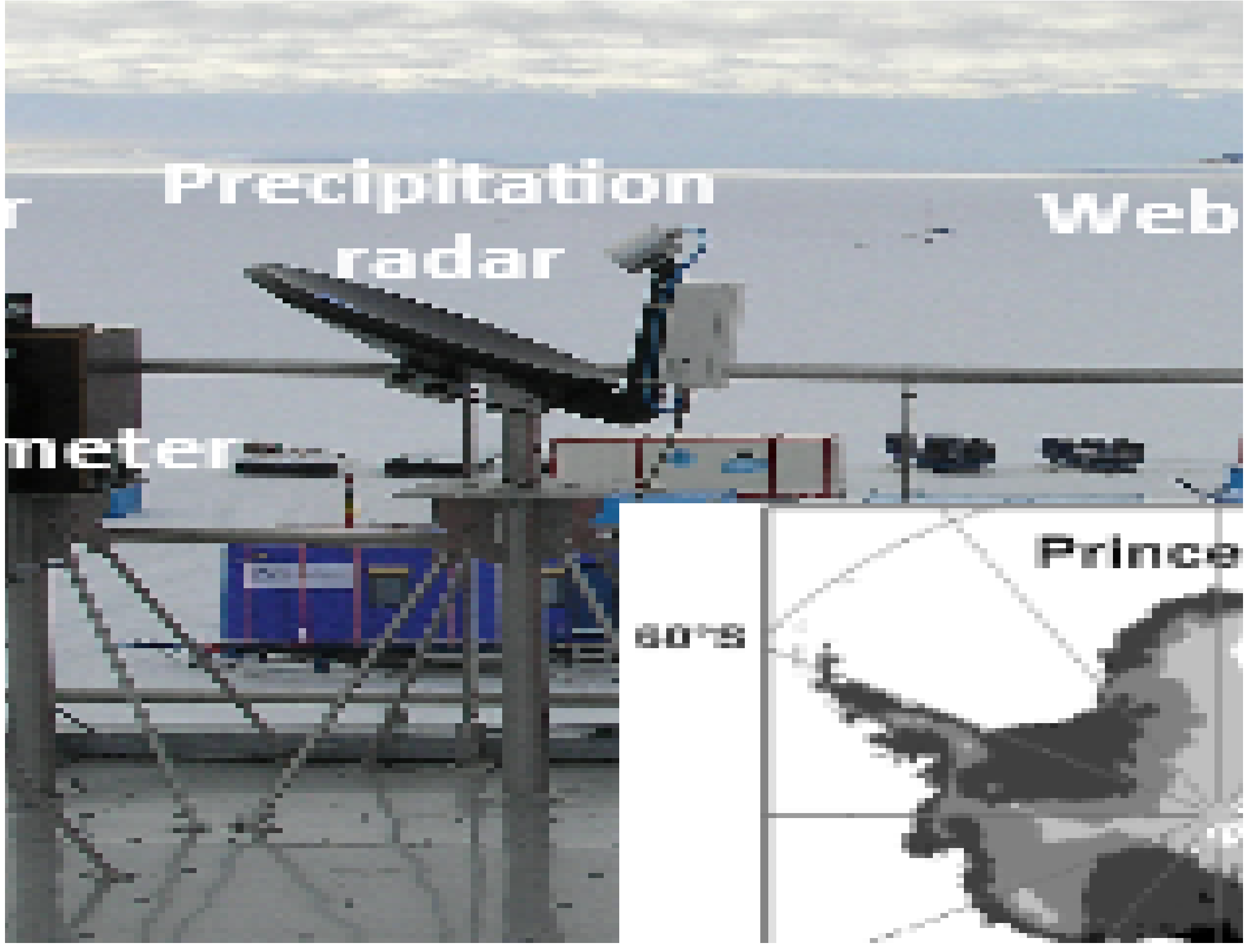
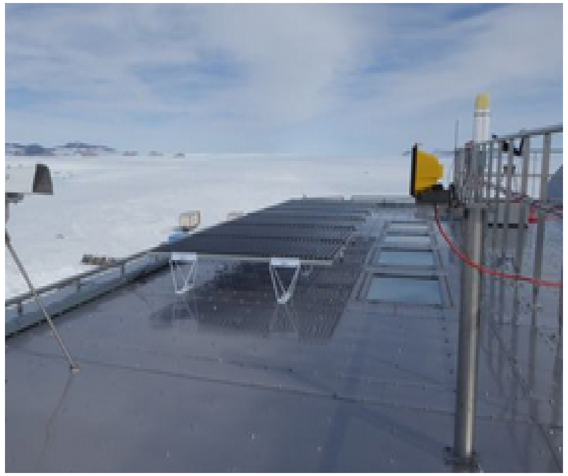
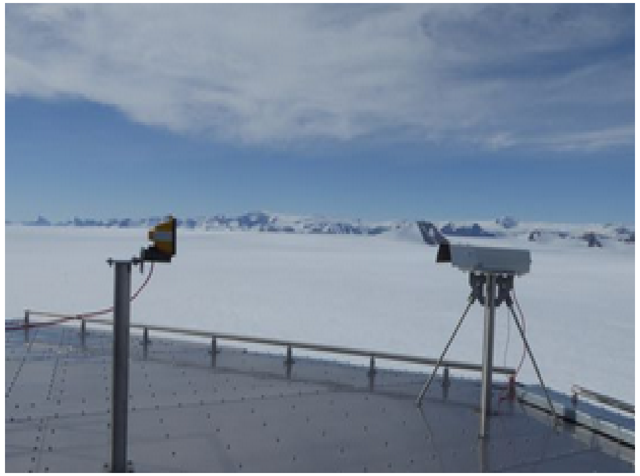


- Vaisala ceilometer (CL-31) : 910 nm attenuated backscatter
- Metek Micro-rain radar: 24GHz radar reflectivity
  (Maahn and Kollias, 2012)
- Heitronics infra-red Pyrometer
- Webcam and spotlight
- Automatic weather station (AWS)
- Nasa Snowflake Video Imager (Newman et al., 2009)
-





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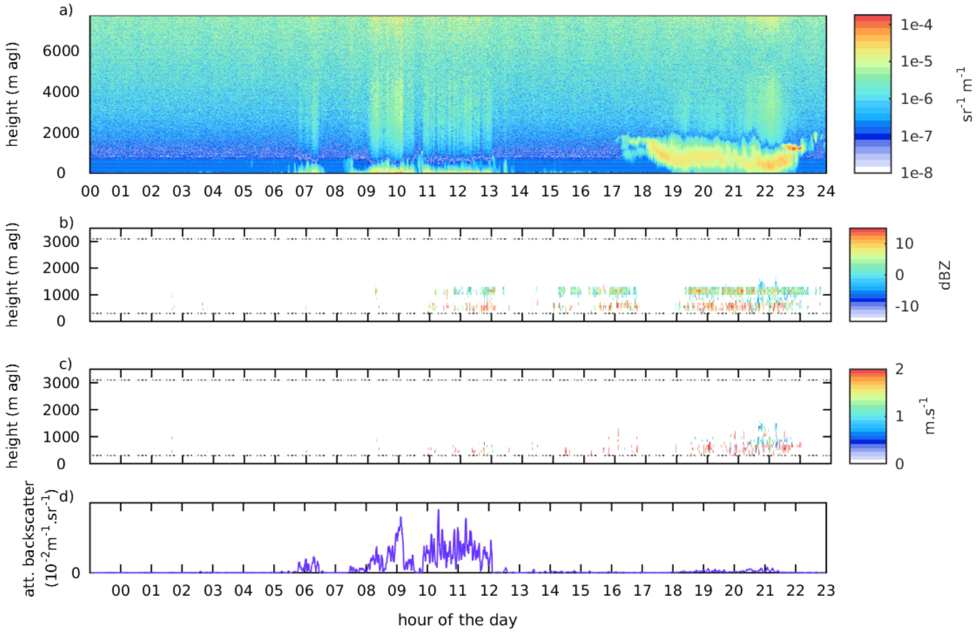
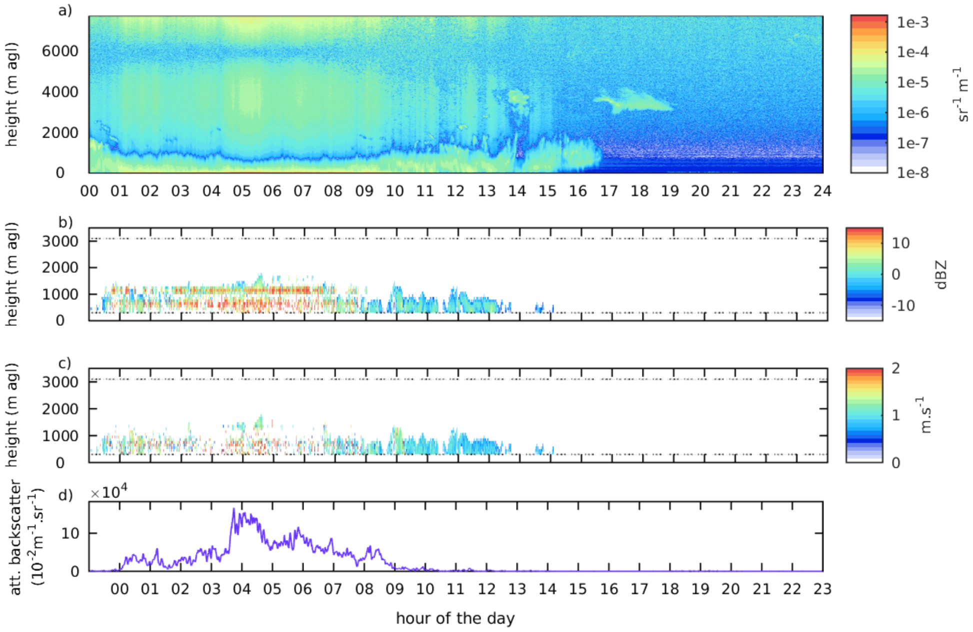
- use of the ceilometer backscatter to detect blowing snow
- development of a « ground truth » robust algorithm not limited by clouds or sunlight
- backscatter threshold based on clear-sky profiles

ceilometer

22.04.2016 event,
clear-sky conditions



24.02.2016 event,
mixed conditions



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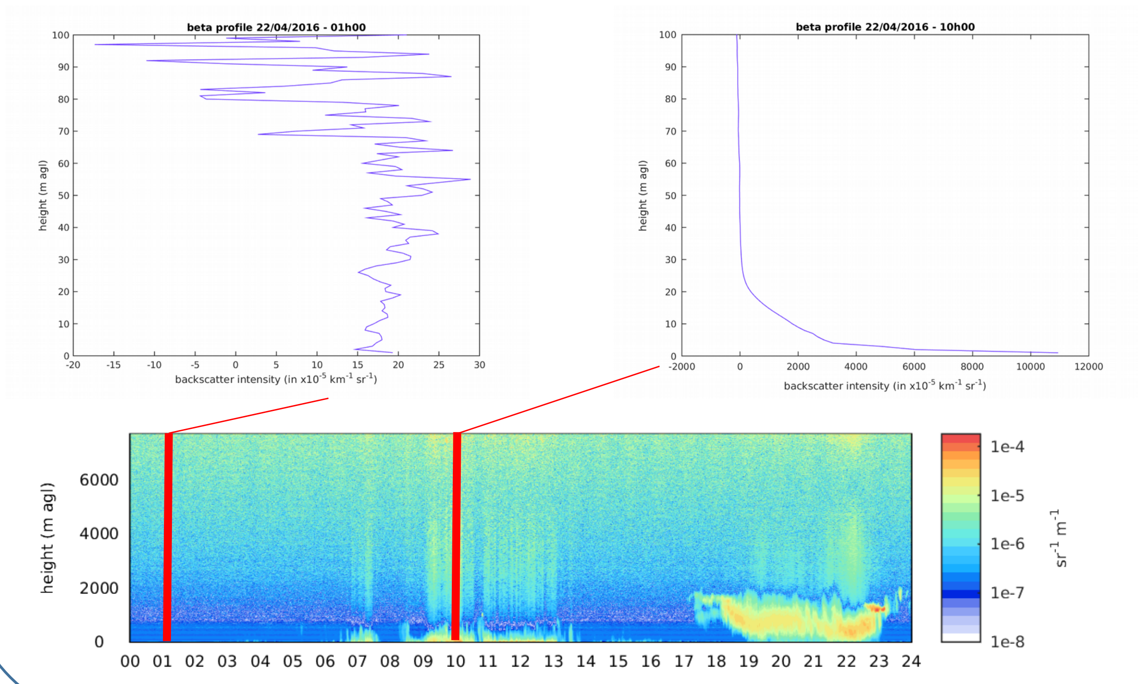

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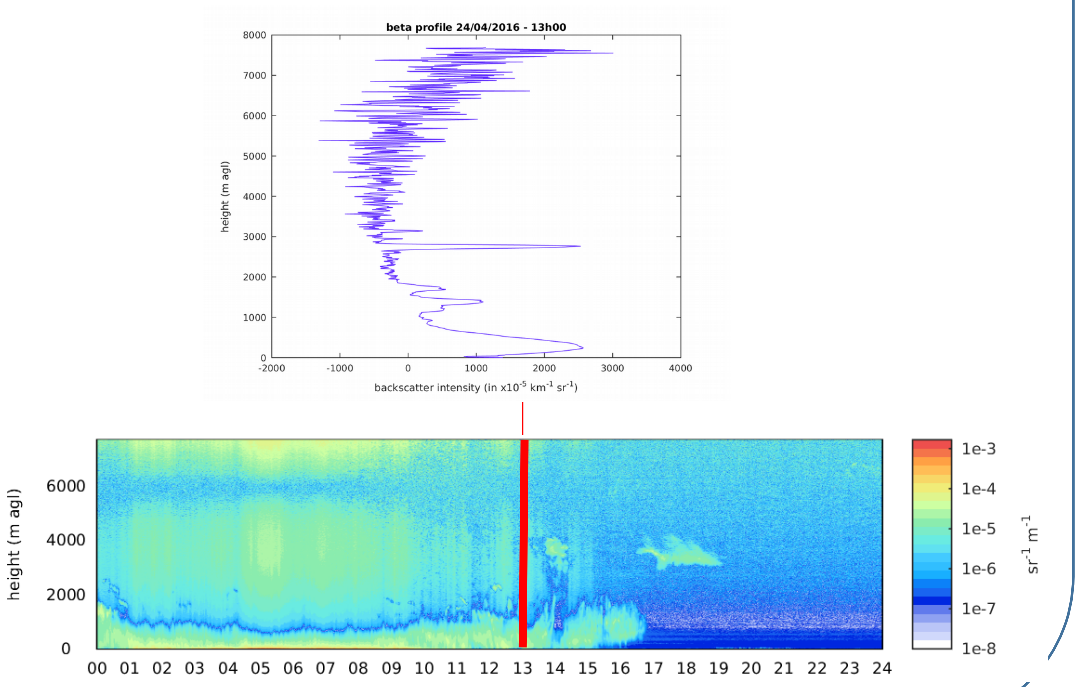

webcam

22.04.2016 event,
clear-sky conditions

24.02.2016 event,
mixed conditions

snowflake video imager

- operating since January 2016 only
- a few events recorded
- potential to discriminate blowing snow from precipitations based on particles properties (diameter distribution)

- Limitations for blowing snow detection

- availability of the data
- snow threshold determination
- sensitivity of the instrument
- attenuation of the backscatter signal with height

- Advantages for blowing snow detection
  - closer to the ground
  - cross-checking with other data
  - not limited to clear-sky conditions and detection of mixed cases

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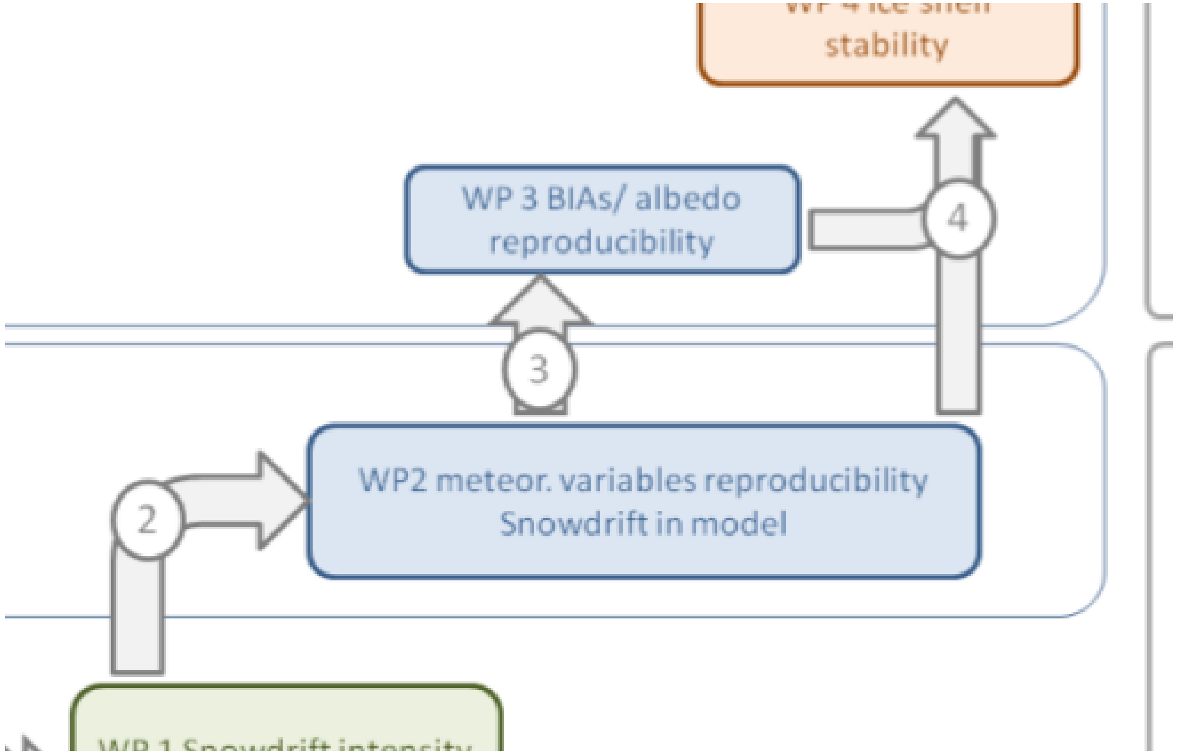
Project : How does wind affect the health of East Antarctic Ice Shelves?

- Observations
- Modelling snowdrift and blue ice areas formation and albedo



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