

THE APRES3 PROJECT AND ITS INSIGHTS INTO CLOUDS AND SNOWFALL IN ANTARCTICA

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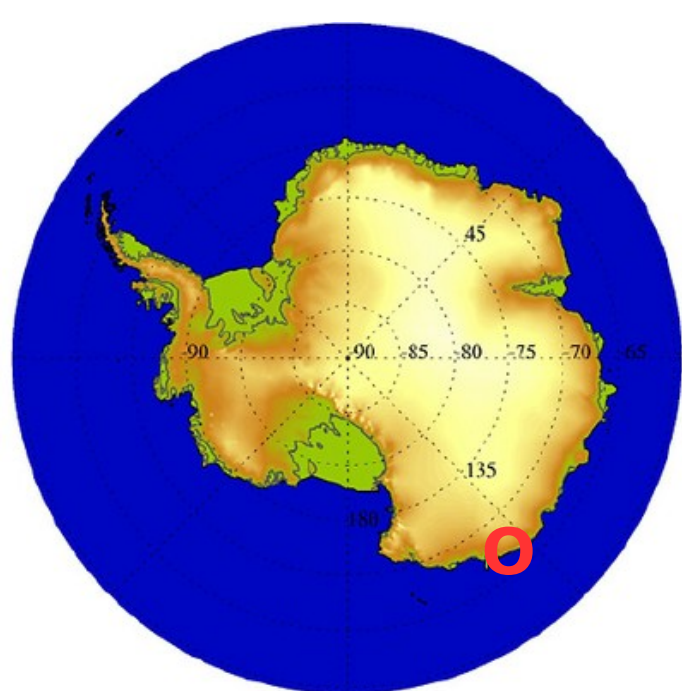
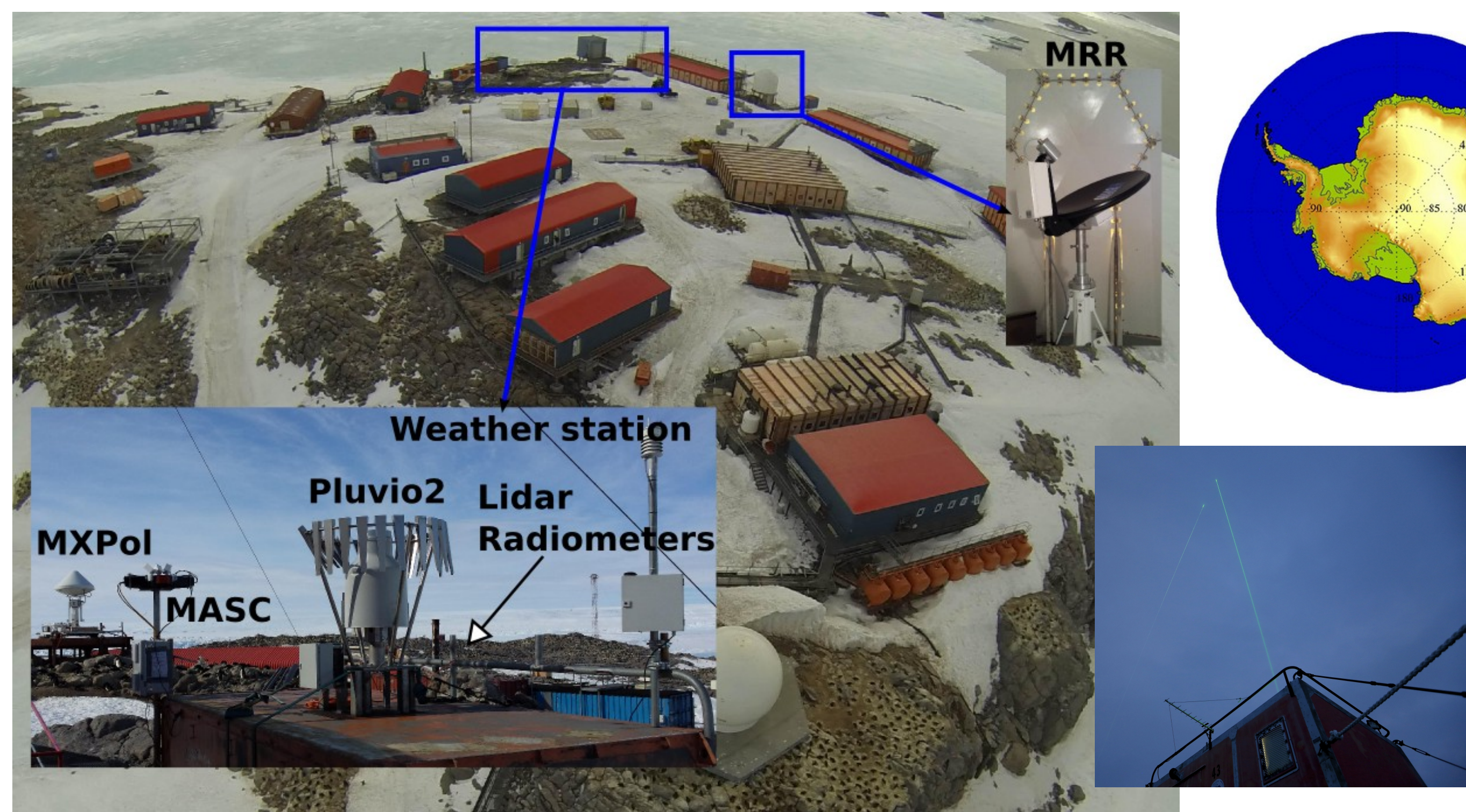
What is APRES3 ?

The APRES3 project (Antarctic Precipitation : Remote Sensing from Surface and Space) is a 4 year French research project aimed at better characterizing snowfall in Antarctica (using ground and satellite observations) and improving climate models. See <http://apres3.osug.fr>.

$$\Delta M_{T_0}^T = \int_{T_0}^T \text{SMB} dt - \int_{T_0}^T D dt, \text{ where } \text{SMB} = P - \text{SU} - \text{ER} - \text{RU}$$

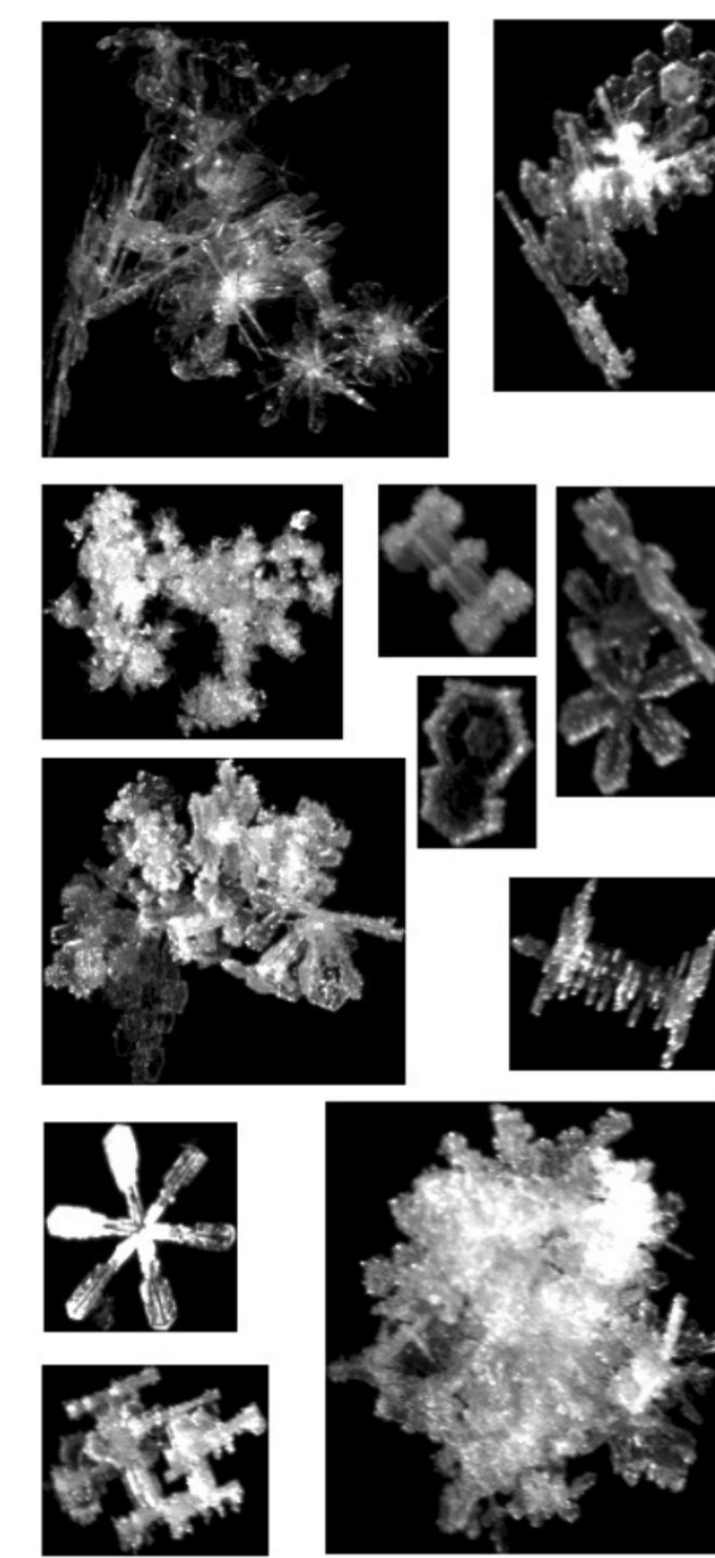
Total mass change (ΔM), surface mass balance (SMB), precipitation (P)

Campaign instruments (French Dumont d'Urville station)

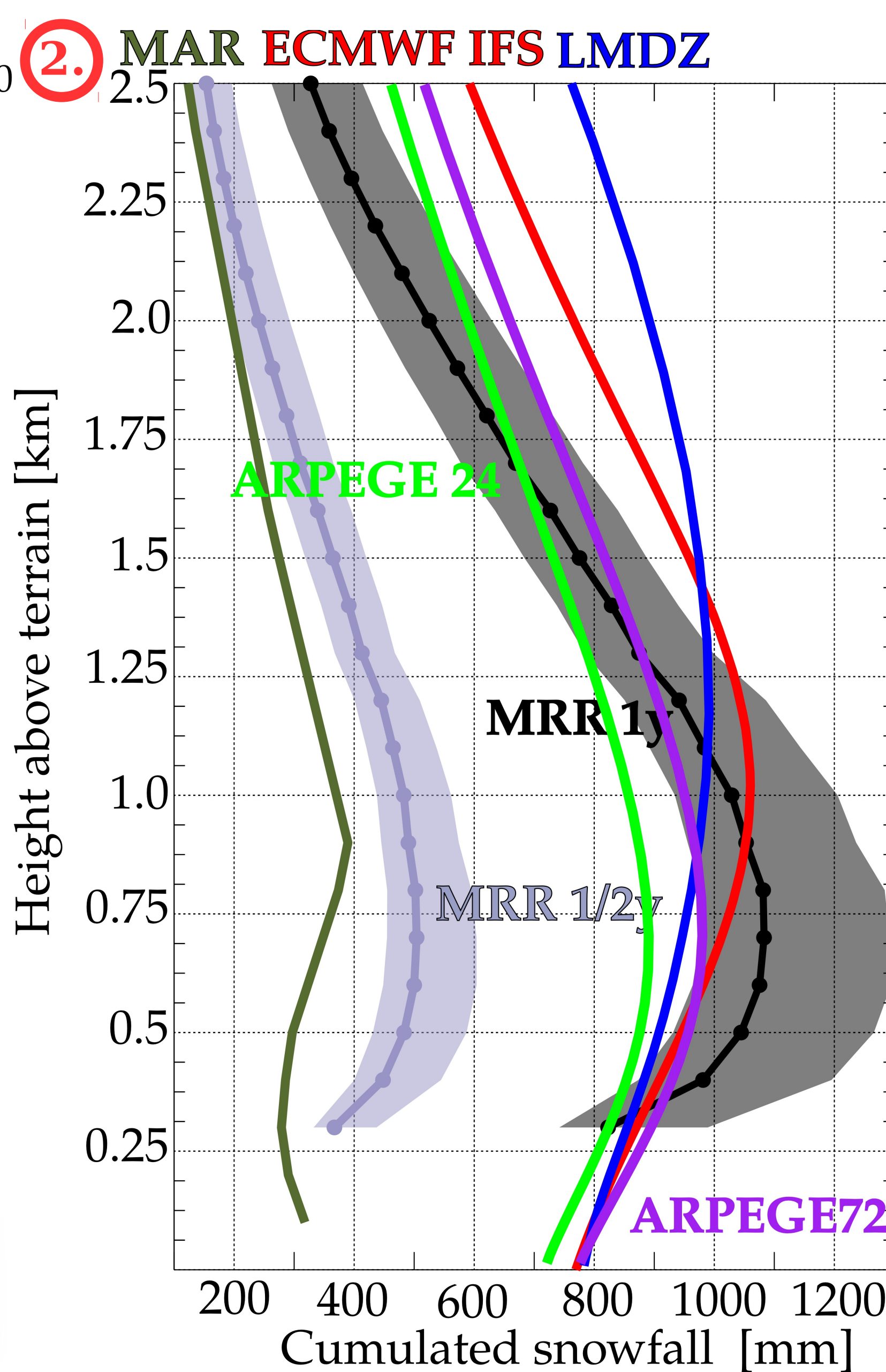
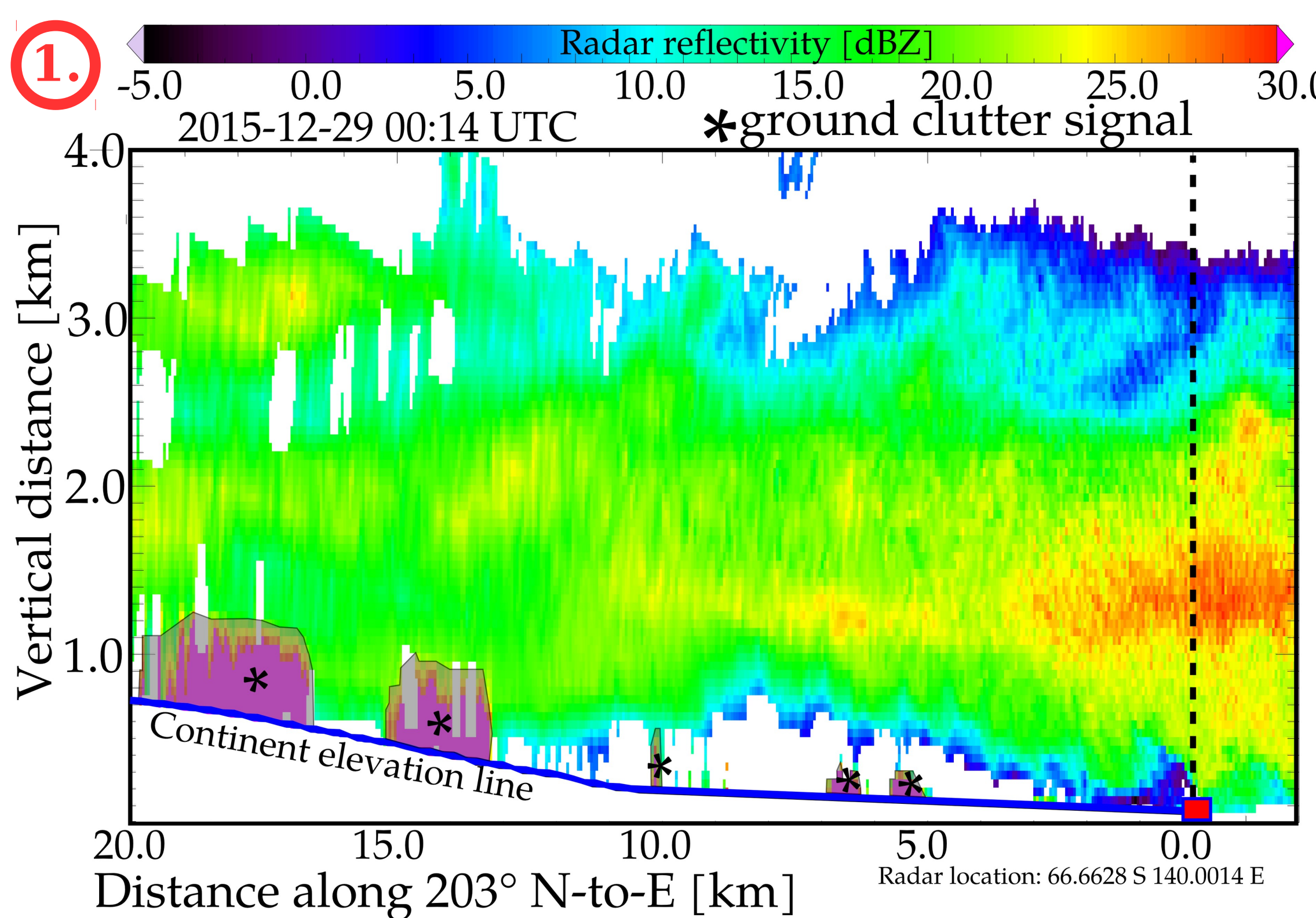


- **MXPoL** : Doppler dual-polarization radar (X-band, precipitation).
- **MRR**: K-band frequency modulated continuous wave profiler. 100 m resolution.
- **2nd MRR**: 15 m vertical resolution.
- **Pluvio²**: OTT weighing precipitation gauge with standard wind fence.
- **MASC**: Multi Angle Snowflake Camera.
- **LIDAR**: Depolarization 532 nm tropospheric lidar (clouds and precipitation).
- **Disdrometers**: BIRAL VPF730 (200 cm³ cylindrical sampling volume) and Campbell PWS100 (sampling surface of 40 cm²).

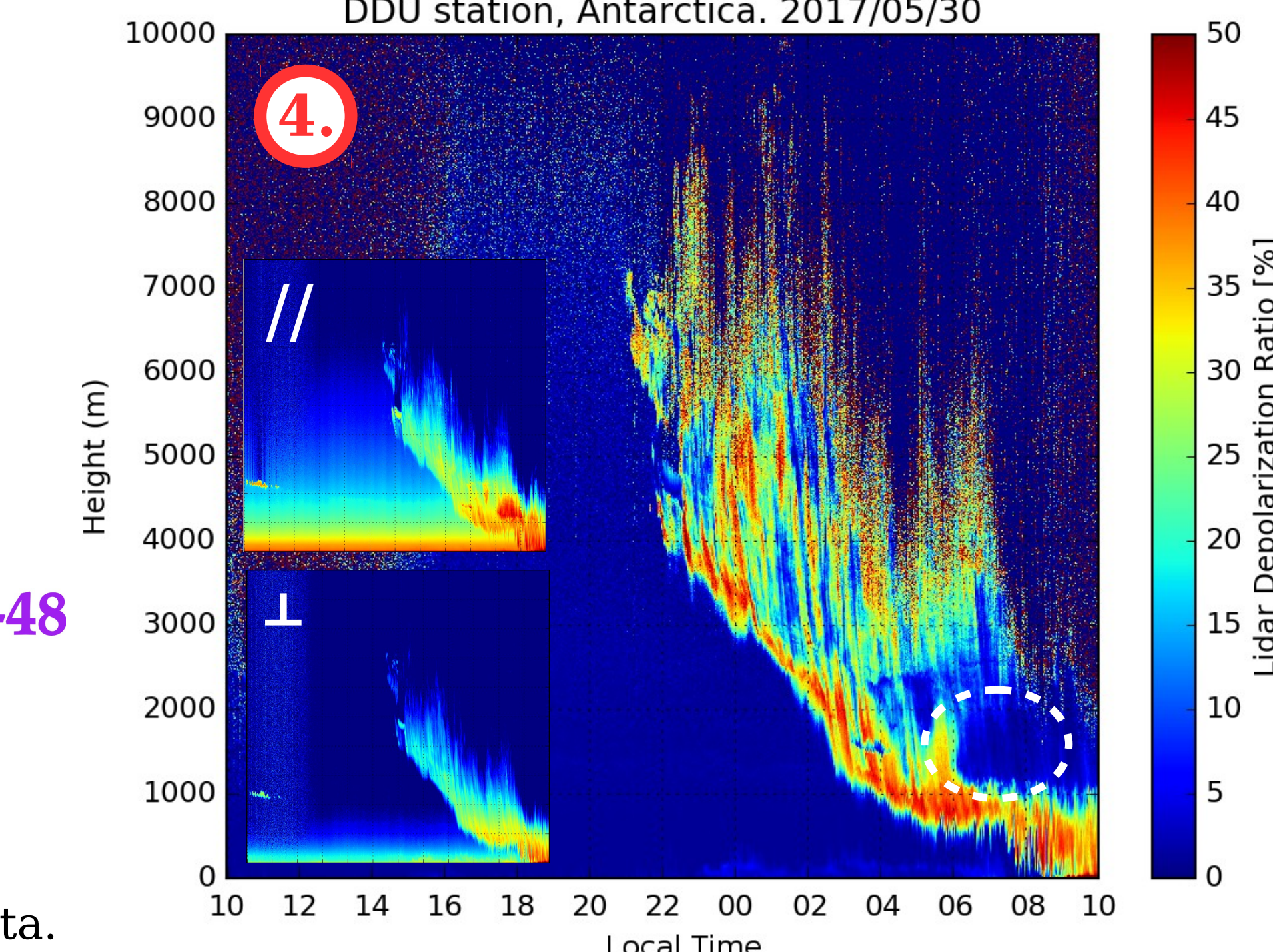
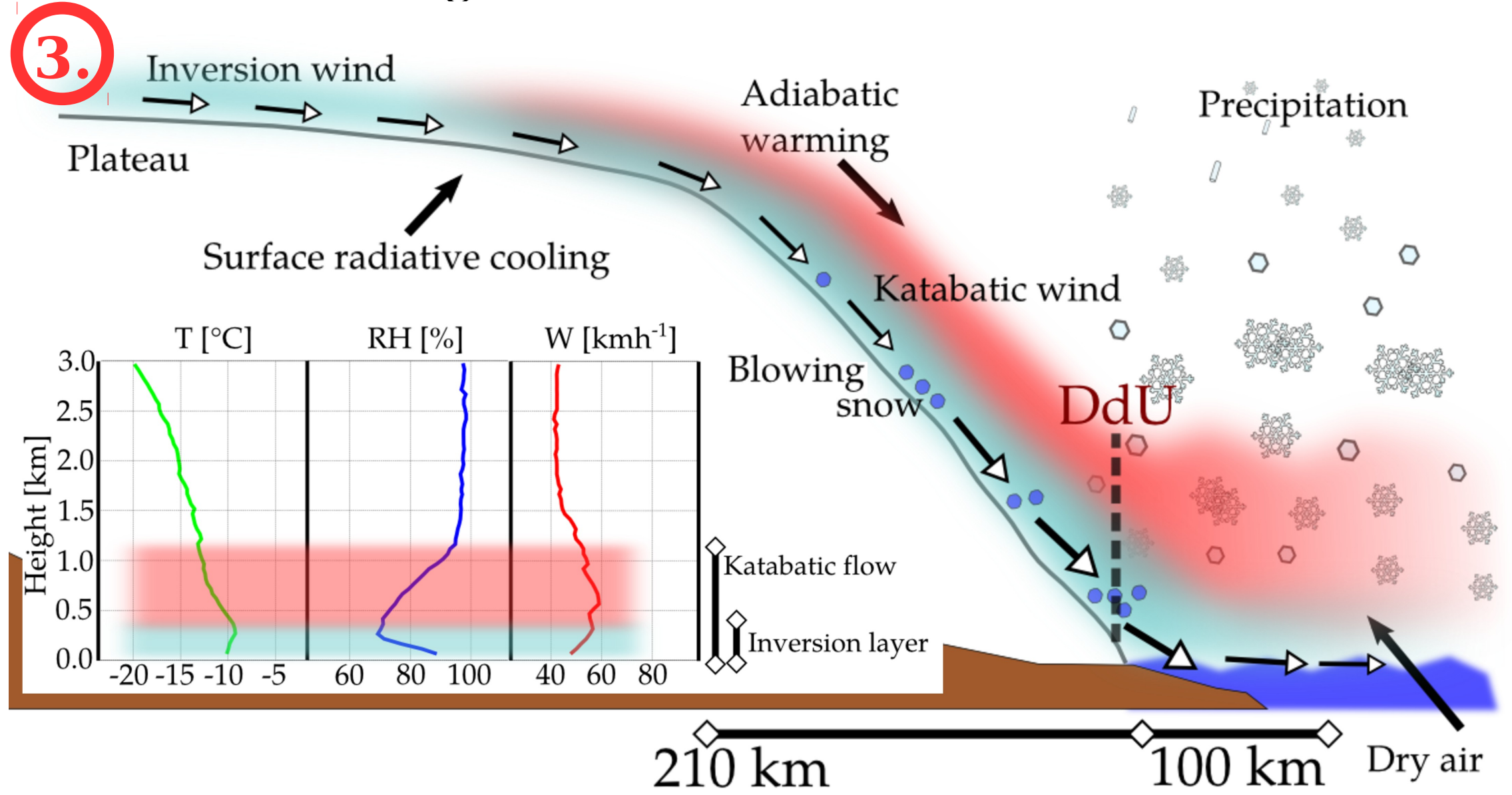
(along with the usual weather station, SW and LW radiometers and daily radiosounding)



Key results



- **1.** Vertical cross section of MXPoL radar measurements on December 29th, 2015, showing **low-level sublimation of snow**.
- **2.** Comparison with multiple atmospheric models. Over the entire continent, **17% of total snowfall** (651 Gt) is lost through this process (based on ECMWF IFS results).
- **3.** Schematic diagram showing the process. *Inset*: relative humidity (RH), temperature (T), and wind speed (W) from daily radiosoundings (annual mean, conditioned on precipitation occurrence).
- **4.** Preliminary results of the lidar, showing the passing of a front and **mixed-phase clouds**.



We thank E. Bazile (ARPEGE, Météo-France) and R. Forbes (ECMWF IFS) for providing data.

Next campaigns

- During the **YOPP Special Observing Period (SOP)**, mid-November 2018 to mid-February 2019, cloud and precipitation profiles will be acquired by the **2 MRR and lidar**.
- Surface snowfall will be characterized by the **Pluvio² gauge** and **disdrometers**.
- Météo-France will also conduct an **intensive radiosonde campaign** covering the SOP.
- **Atmospheric simulations** will be achieved using three French atmospheric models: two NWP models (ARPEGE-AROME and MAR) and the IPSL-CM global climate model.



	9/2015	1/2016	9/2016	1/2017	9/2017	1/2018	9/2018	1/2019	9/2019
MXPoL	→								
MRR	→	→	→	→	→	→	→	→	→
2 nd MRR			→	→	→	→	→	→	→
MASC	→								
Pluvio ²	→								
Disdrometer	→								
LIDAR			→	→	→	→	→	→	→
Weather station	→	→	→	→	→	→	→	→	→
Radiometers	→	→	→	→	→	→	→	→	→
Radiosounding	→	→	→	→	→	→	→	→	→
Intensive radiosounding							→	→	→

References

[1] Grazioli, J. et al. (2017) Measurements of precipitation in Dumont d'Urville, Terre Adélie, East Antarctica. *Accepted for publication in The Cryosphere*. [2] Grazioli, J. et al. (2017) Katabatic winds diminish precipitation contribution to the Antarctic ice mass balance. *Under review*.