ACTRIS/Cloudnet measurements for the study of aerosol and clouds

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25 ANNI DELL'OSSERVATORIO CLIMATICO ENEA DI LAMPEDUSA

Ricerca scientifica e contributo allo sviluppo sostenibile sul territorio

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Cloudnet/ACTRIS mission

- There are large uncertainties due to the complexities of cloud systems and how they respond to aerosols, in particular the concentration of cloud condensation nuclei.

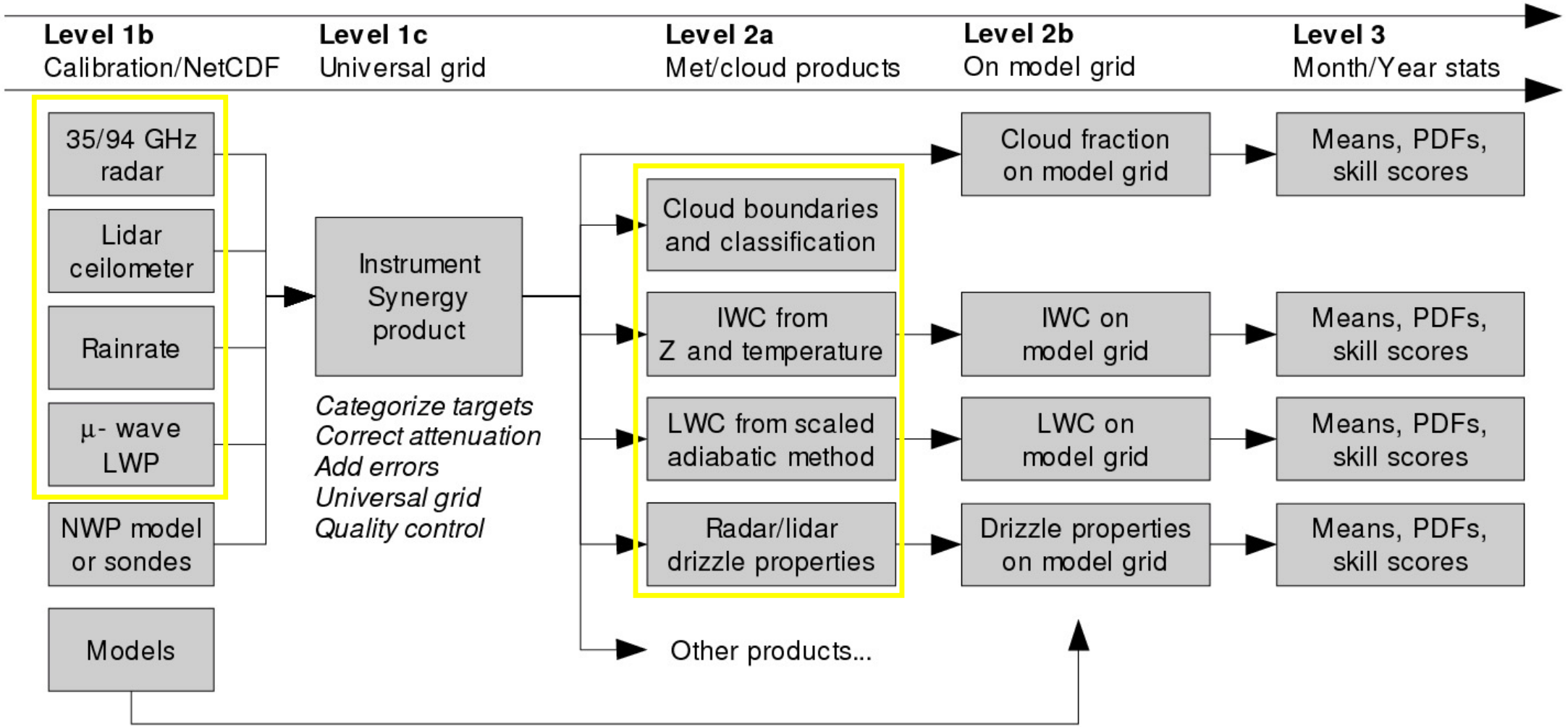
- Clouds are one of the major sources of uncertainty in future climate predictions.

- ACTRIS/Cloudnet has developed and implemented a comprehensive suite set of objective metrics for the evaluation of model cloud parameters.

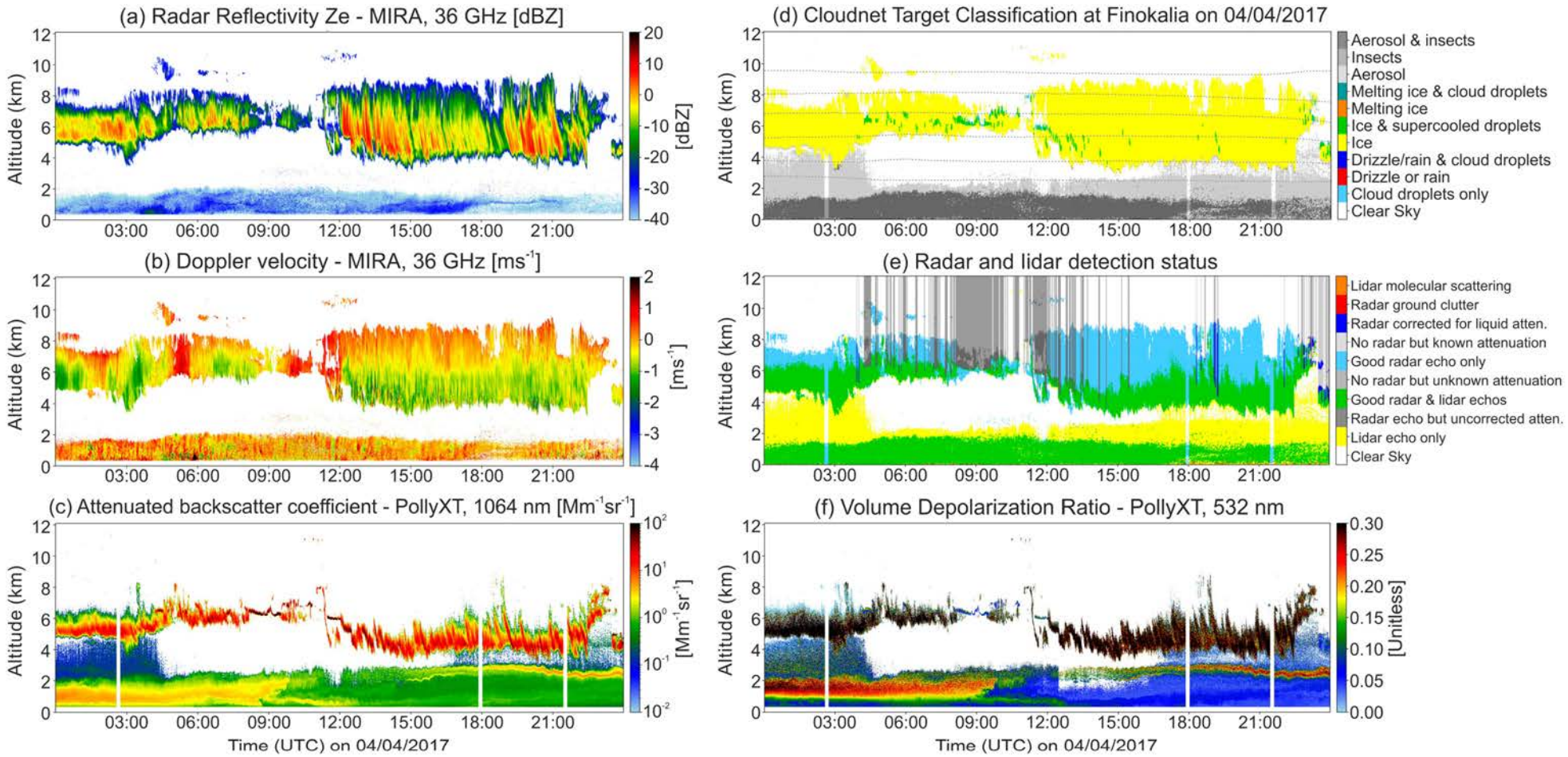
- The set of evaluation metrics is designed to investigate both the climatological aspects required of a climate model, and the ability to forecast the correct cloud at the right time, a necessary validation for NWP.

Cloudnet/ACTRIS stations

Cloudnet Instruments and products

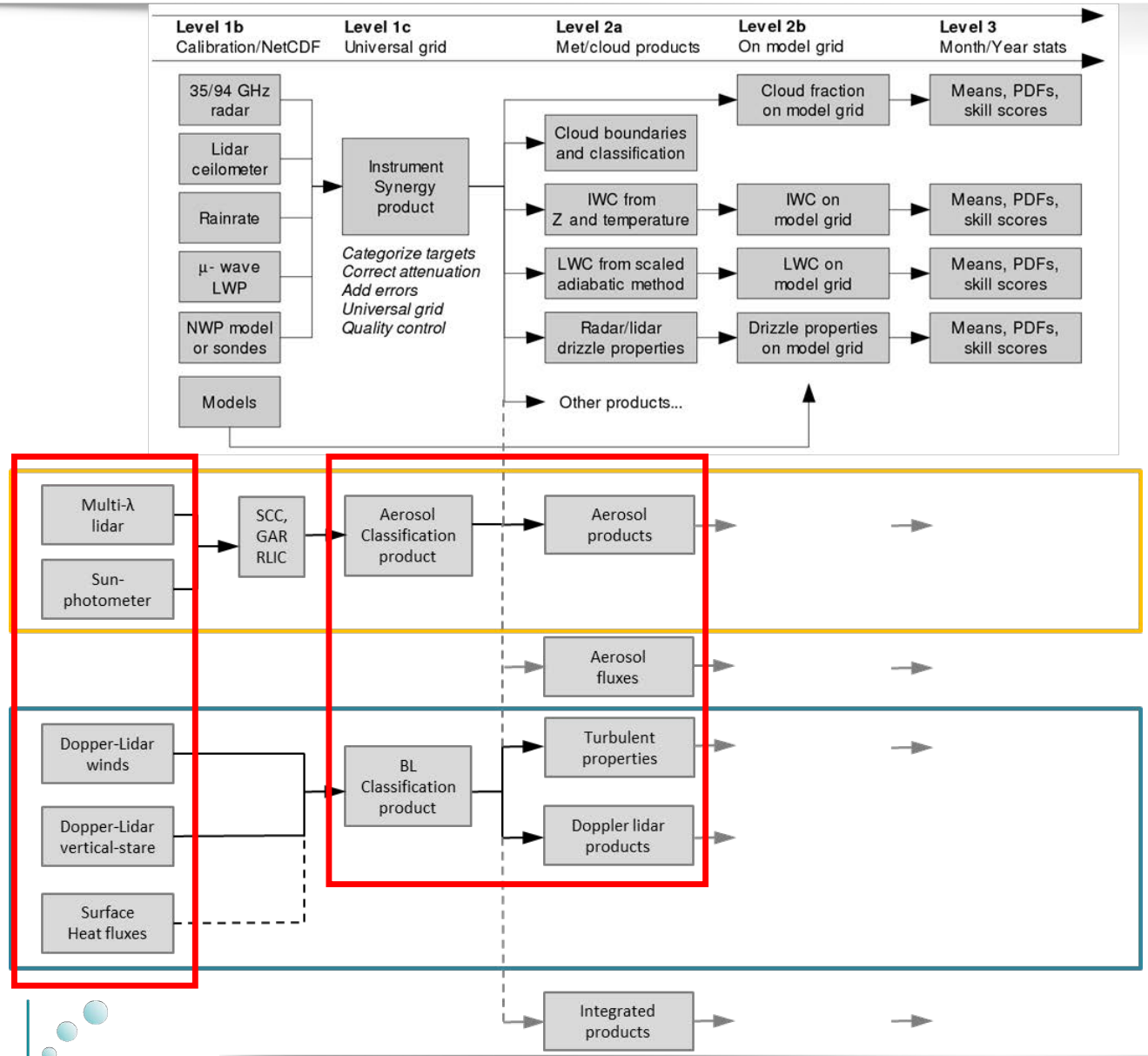


Cloudnet/ACTRIS products



Radar reflectivity (**a**), radar Doppler velocity (**b**), and lidar attenuated backscatter coefficient (**c**) measured on 4 April 2017 in Finokalia, Crete. Cloudnet target classification (**d**), radar/lidar detection status (**e**), and lidar volume depolarization ratio (**f**) for the same day (Marinou et al., 2021).

ACTRIS/Cloudnet Instruments and products



- The synergy of EARLINET and Cloudnet facilitates the increasing scientific interest in combined aerosol and cloud observations to study aerosol-cloud interactions.
- A major goal is the innovative and sustainable advancement of cloud-related observations within Cloudnet and ACTRIS as a whole.

Enhancing the ACTRIS-IT network: the Potenza station

CNR-IMAA (Tito, Potenza)

- Doppler Radar Ka-band (polarimetric)
- Doppler Radar W-band (polarimetric)
- Microwave radiometer (22-60 GHz)
- 2 Ceilometers (910 nm e 1064 nm)
- Radiosouding systems (automatic + manual)
- Radiation station
- GNSS Trimble antenna
- Doppler wind lidar (polarimetric)
- Rain radar (24 GHz)
- Disdrometer

Applications

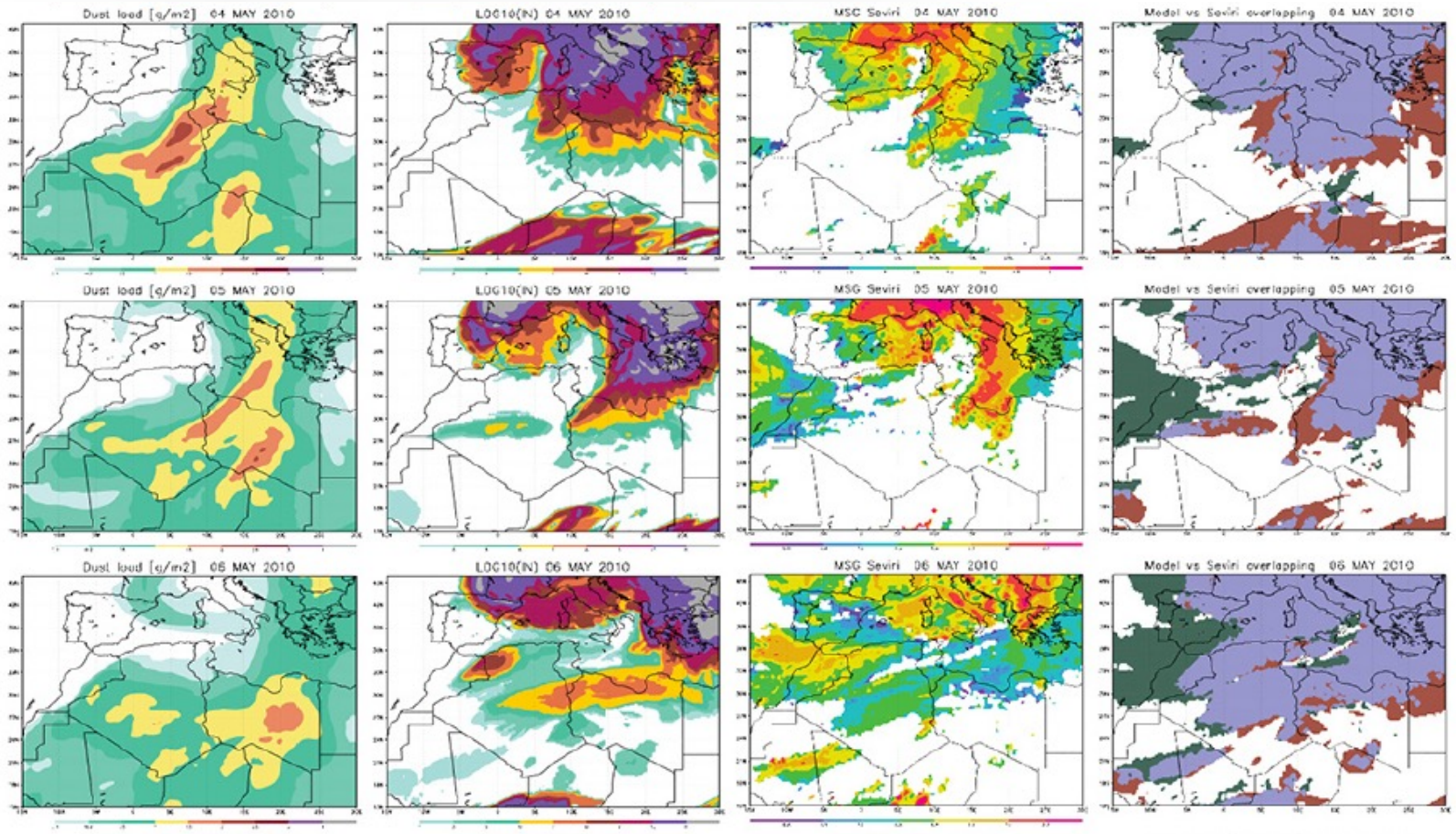
1. Validation of ice nucleation models
2. Ceilometers for aerosol profiling

Ice nucleation on dust nuclei

04-MAY-2010

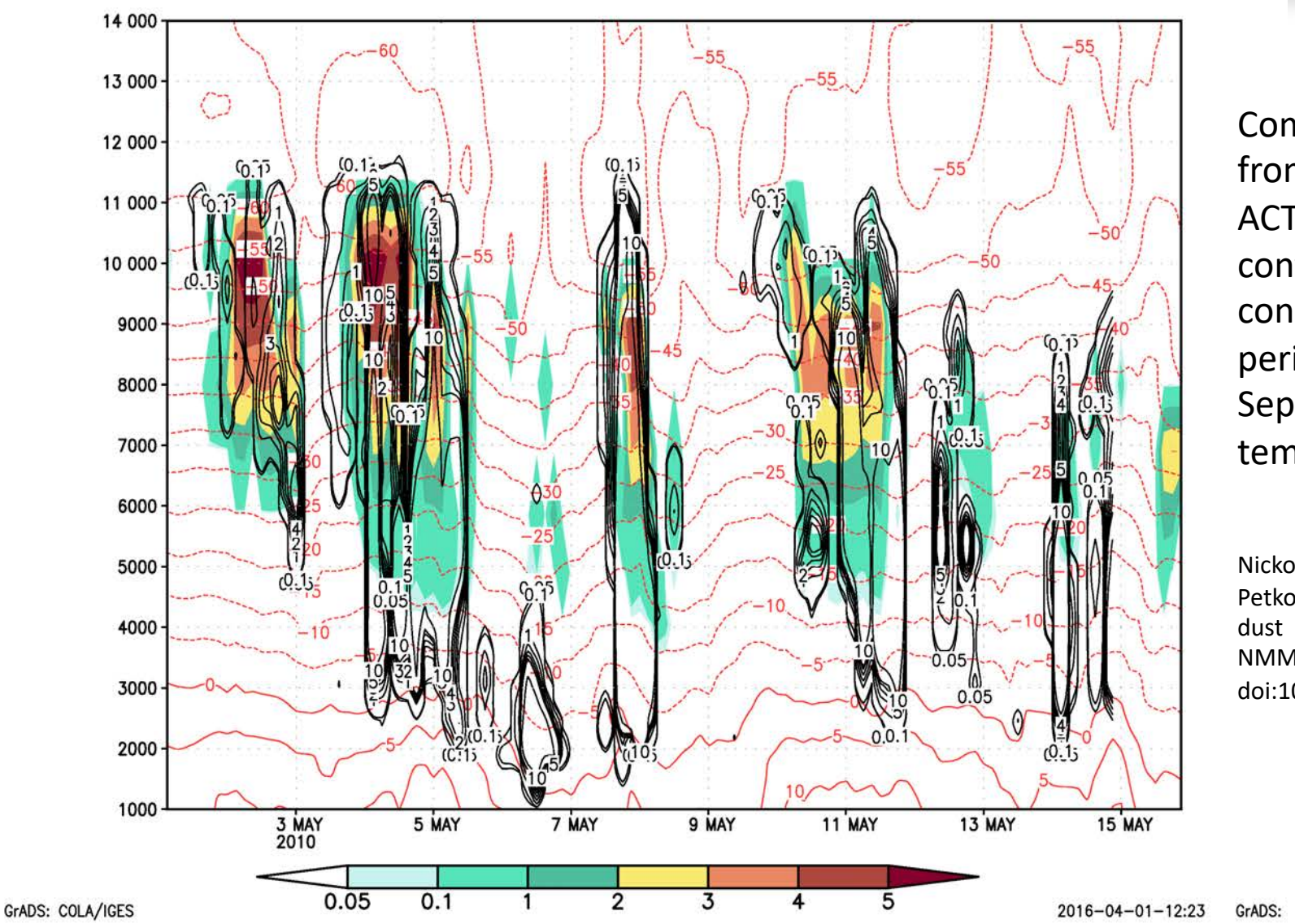
05-MAY-2010

06-MAY-2010



Daily averages of (a) the NMME+DREAM model dust load (gm^{-2}), (b) the model Log10(NL) ice nuclei column concentration, (c) the MSG-SEVIRI IWP, and (d) overlap of normalized NL and IWPL. Colour selection: hits – blue; misses – green; false alarm – brown.

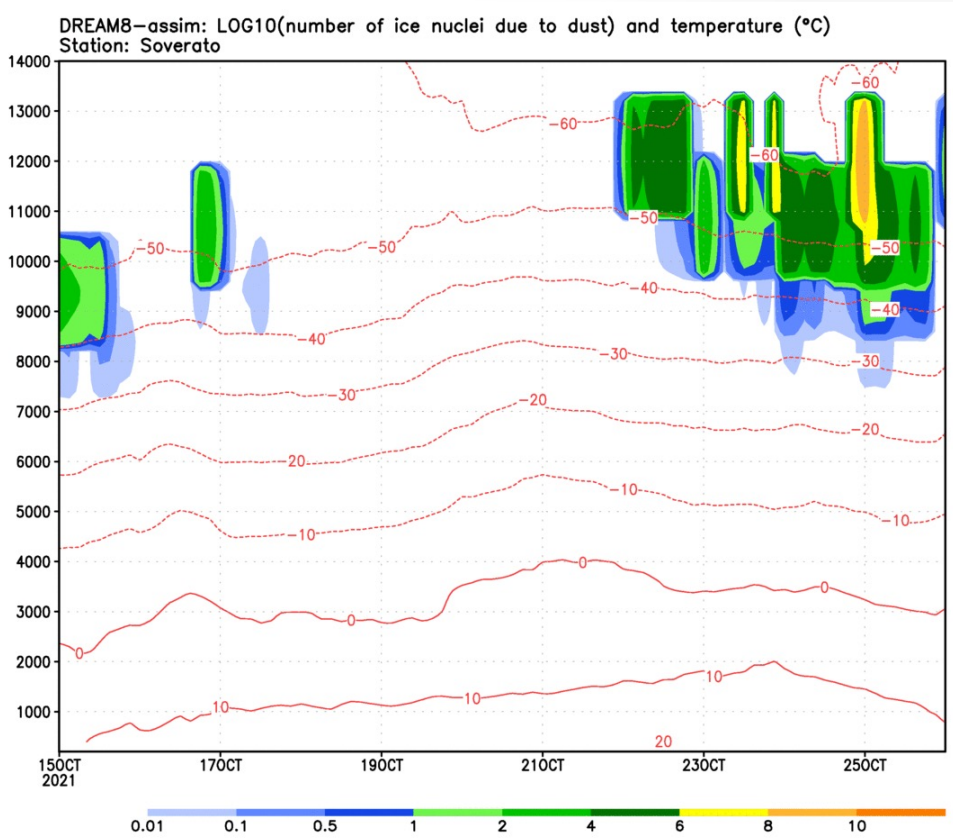
Comparison with IN concentration



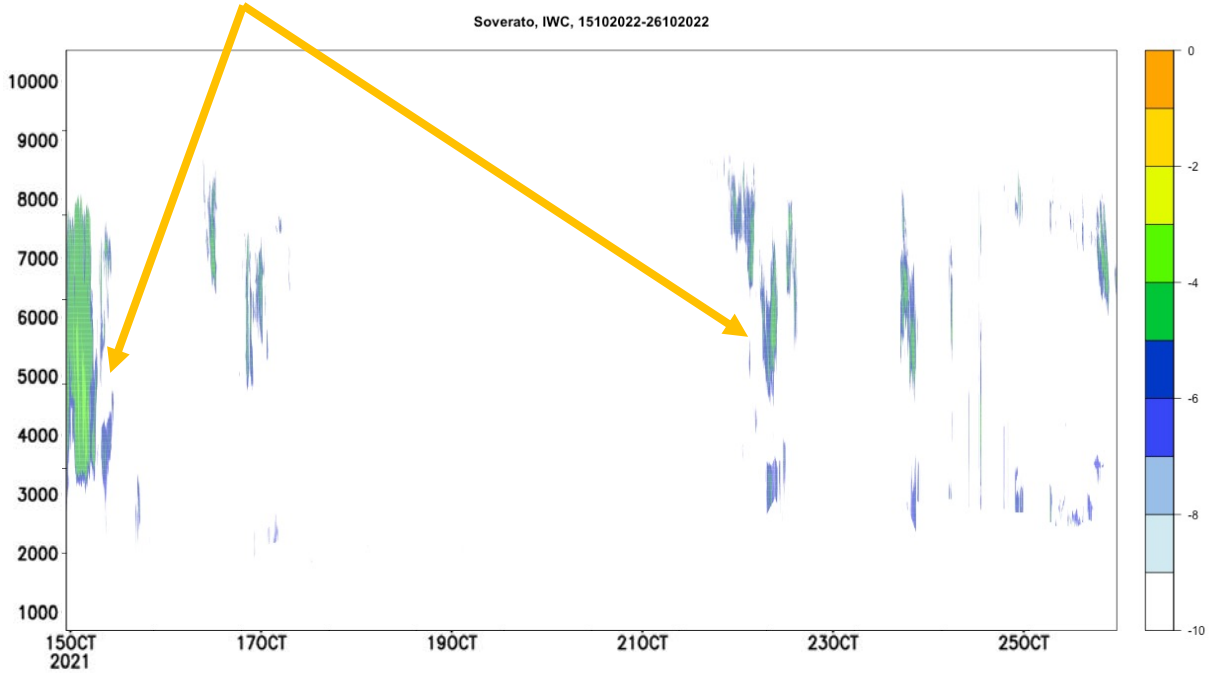
Comparison of log10(IWC*10^{-6} kgm^{-3}) obtained from the Doppler radar reflectivity using the ACTRIS-Cloudnet algorithm (solid black line contour plot) vs. DREAM log10(nIN) ice nuclei concentration (coloured shaded plot) for the periods 1–15 May 2010 (left) and 22–30 September 2012 (right). Red contours show temperature as provided by the NMME model.

Nickovic, S., Cvetkovic, B., Madonna, F., Rosoldi, M., Pejanovic, G., Petkovic, S., and Nikolic, J.: Cloud ice caused by atmospheric mineral dust – Part 1: Parameterization of ice nuclei concentration in the NMME-DREAM model, Atmos. Chem. Phys., 16, 11367-11378, doi:10.5194/acp-16-11367-2016, 2016.

Comparison with IN concentration/2



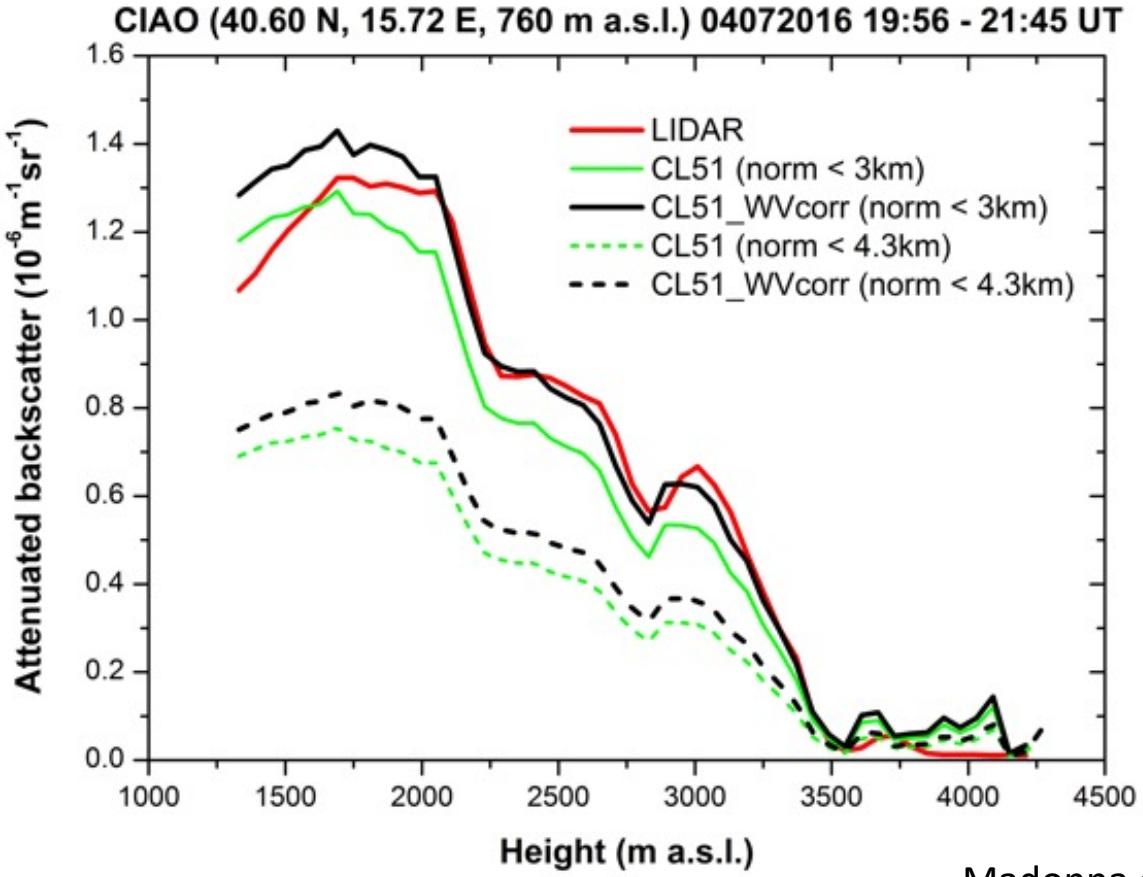
Ice content due to marine IN

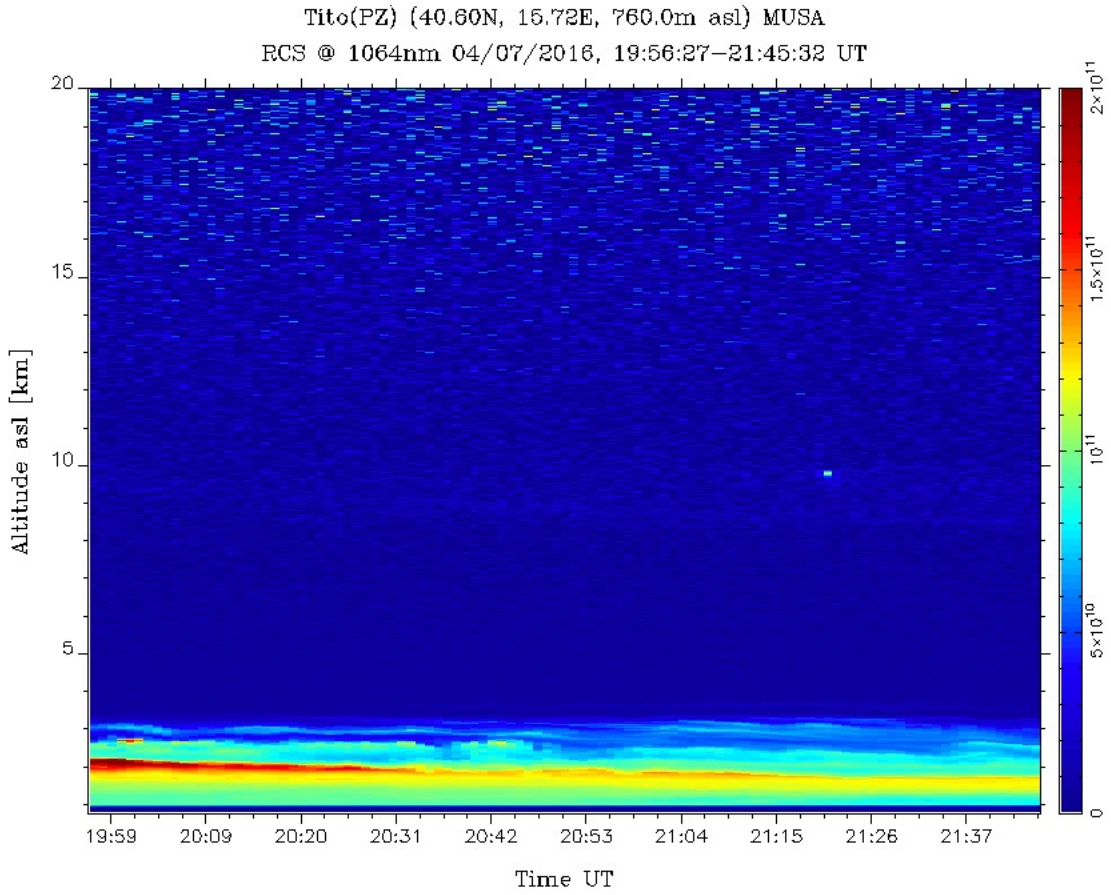


Comparison of DREAM log10(nIN) ice nuclei concentration (coloured shaded plot) for the periods 15-26 Oct. 2021 and the log10(IWC) obtained using the ACTRIS/Cloudnet algorithm during the MESSA-DIN campaing in Soverato, Italy (Rosoldi, M. et al., 2023, in preparation). Red contours show temperature as provided by the NMME model (Cvetkovic, B. et al., 2023, in preparation)

Aerosol profiling with ceilometers

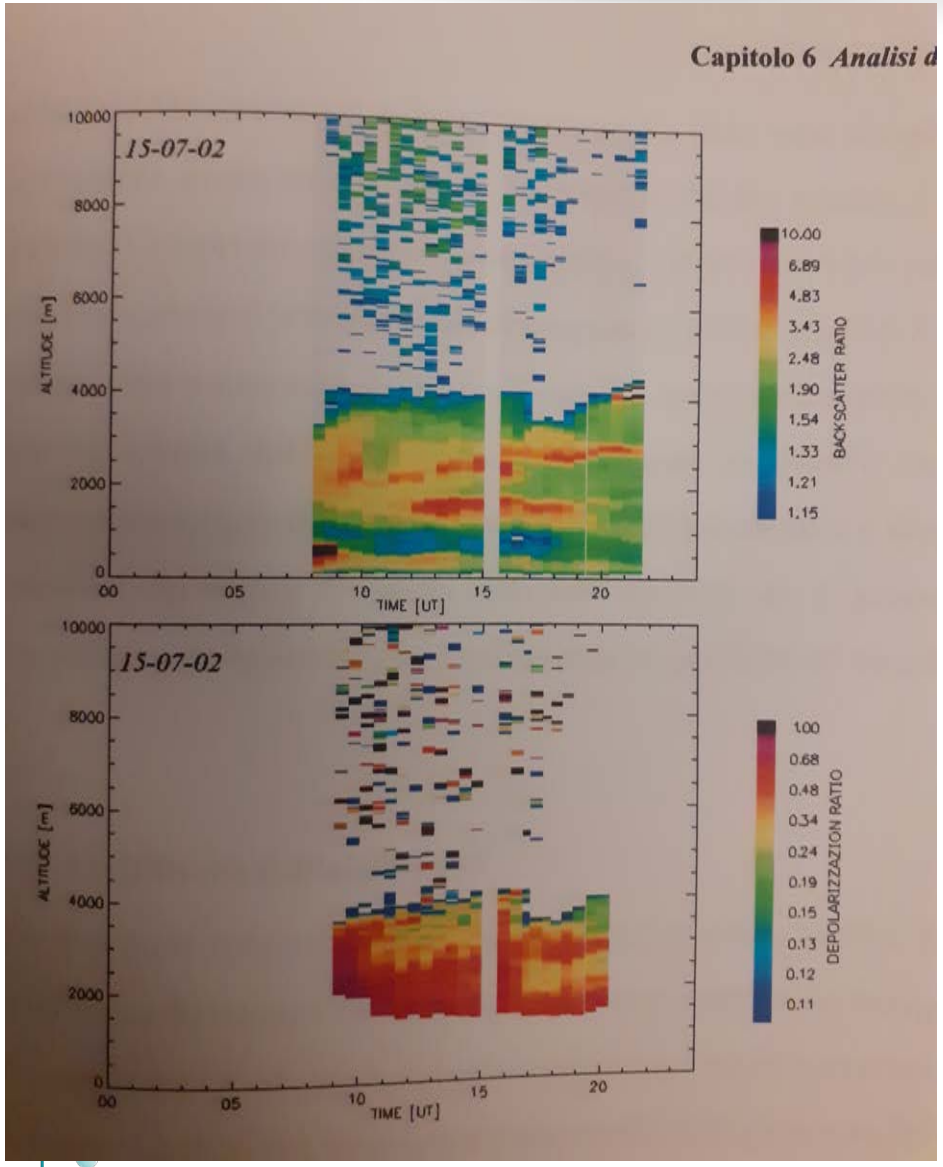
Comparison of the attenuated backscatter retrieved from MUSA/PEARL and CL51 795 on 4 July 2016 from 19:56 to 21:45 UT, using two different normalization ranges (the first below 3 km and the second below 4.3 km); both the raw calibrated profiles and the water vapor calibrated corrected profiles are shown; right panel MUSA/PEARL 1064 nm RCS during the same time.





Madonna et al., 2015; 2018

My personal happy birthday



Aerosol lidar backscattering and particle linear depolarization ratios measured in Lampedusa on 15-07-2002.

During my graduation thesis, I studied and discussed observations collected with the lidar operating in Lampedusa and had the chance to work with a few ENEA colleagues (some of them at that time from University of Rome «La Sapienza»). I learned a lot from them.

I wish the observatory and its team to achieve new fascinating objectives in the next 25 years and longer….