Fog dissipation through ground warming monitored by satellite image : an approach to support regional forecasting

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LMD

SIRTA
Site Instrumental de Recherche par Télédétection Atmosphérique

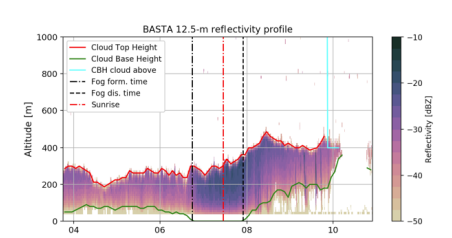
École Polytechnique

Institut Polytechnique de Paris

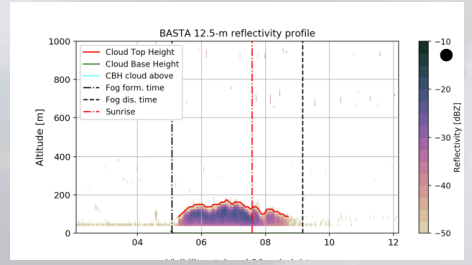
EMS European Meteorological Society

How to forecast fog dissipation?

- Fog dissipation is a highly valuable information for transport, defence, air quality, solar energy …
- Dissipation event has 2 distinct processes

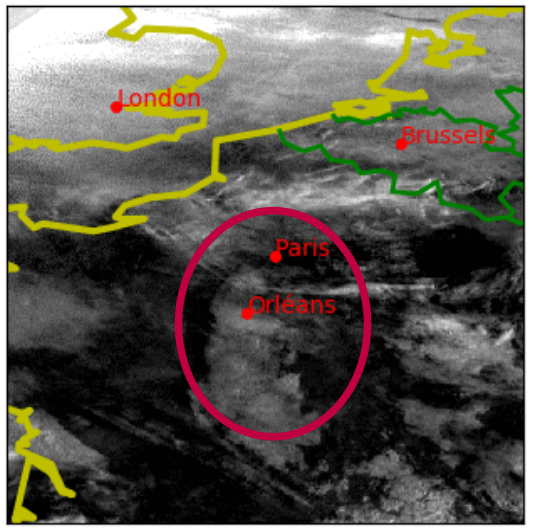


An adiabatic elevation converts fog into a low stratus



Radiative ground warming breaks and reduce a large continuous fog deck

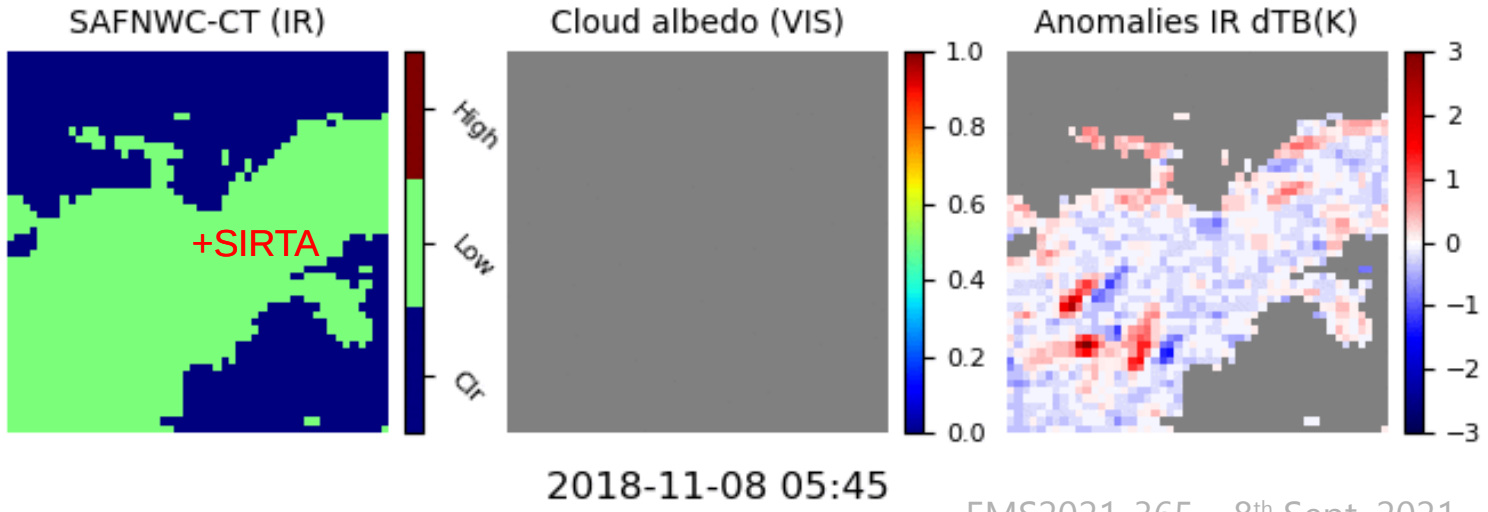
- Both cases are difficult to forecast because of:
  - **non-linear processes** at small spatiotemporal scale for NWP
  - Fog presence sensors networks **are too scarce** to anticipate the phenomena
- **GEO satellites** can observe some radiative dissipation cases
- **But how to forecast them using such images?**



Meteosat-9, 25th January 2020

Looking for dissipation predictors among satellite data…

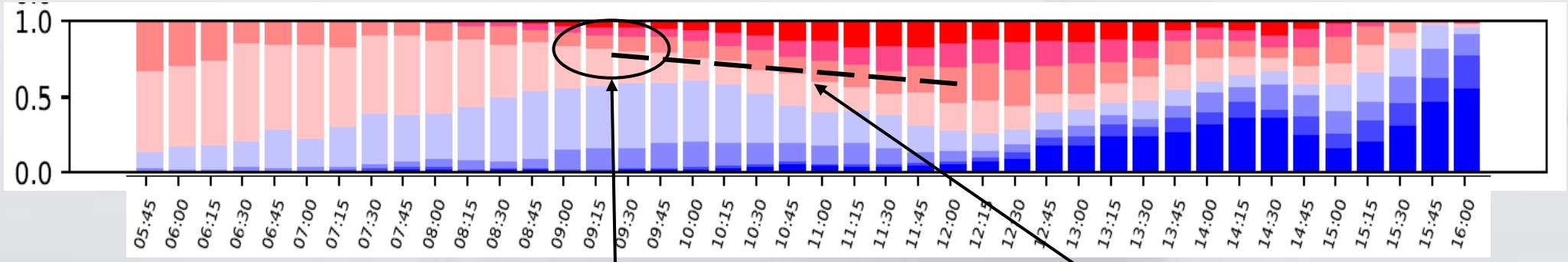
- Fog event have been selected using visibilimeter and Basta radar at SIRTA observatory
- Following MSG products have been explored as potential dissipation predictors:
  - SAFNWC cloud classification (where low cloud are assumed to be fog deck during a fog event)
  - Cloud albedo using HRV channel (same used in Heliosat method to retrieve surface solar irradiance)
  - Brightness temperature (BT) at the IR window channel 10.8µm assessing surface radiative temperature

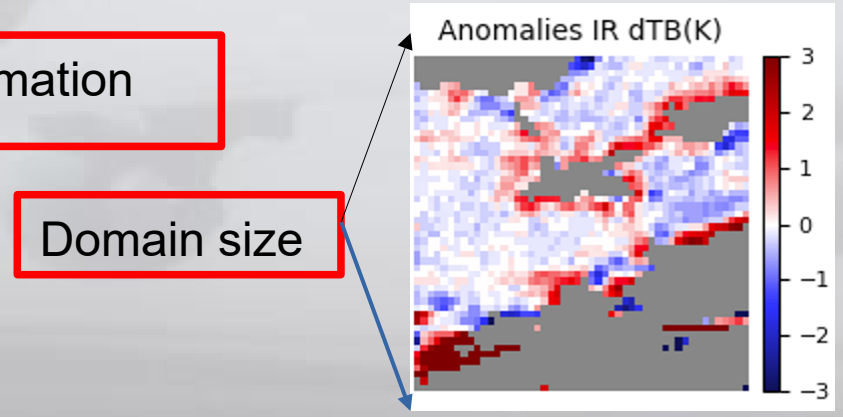


- Promising predictor : spatial BT anomalies in low cloud areas from BT temporal gradient. **Ano_dTB = [BT(t-15min.) - BT(t)] / mean(BT(t))**
- High anomalies (red pixels) announce edge fog deck dissipation

Toward a fog dissipation forecast method

- Monitoring **ano_dTB pixels proportion** within an image provides **a signal to radiative fog dissipation**





- With dissipation signal date, slope estimation and domain size, we can assess time elapsed between remote dissipation signal and dissipation at target point
- However, such approach works only if fog is not too covered by a higher cloud
- More ground-based observations over Europe are currently being processed to set up a forecasting scheme