High-resolution 4D atmospheric data supporting dark flights and strewn-field of meteorites fragments.

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PRISMA DAY

Online event, December 10th, 2020

www.meteo.expert – Experts of Meteo

ATMOSPHERIC DATA AND METEORITES FRAGMENTS

The knowledge of the **atmospheric conditions** plays a key role in the computation of the dark flight and strewn-field of meteorite fragments to be found on ground (Gardiol et al., 2020)

In particular, **the wind direction and speed** are the major drivers for the accuracy of these results. This effect is even more important in the case of small residual mass and the even smaller expected mass and size of the fragments

ATMOPHERIC DATA: ANALYSIS AND FORECAST

In the last 20 years weather analysis and forecast from the next few hours to few weeks has improved significantly. Disasters at small scales of time and space, such as hail or flash floods, as well as sub-events within large-scale catastrophes, such as flooding and storms, can be detected and managed.

Analysis includes observations, techniques and systems

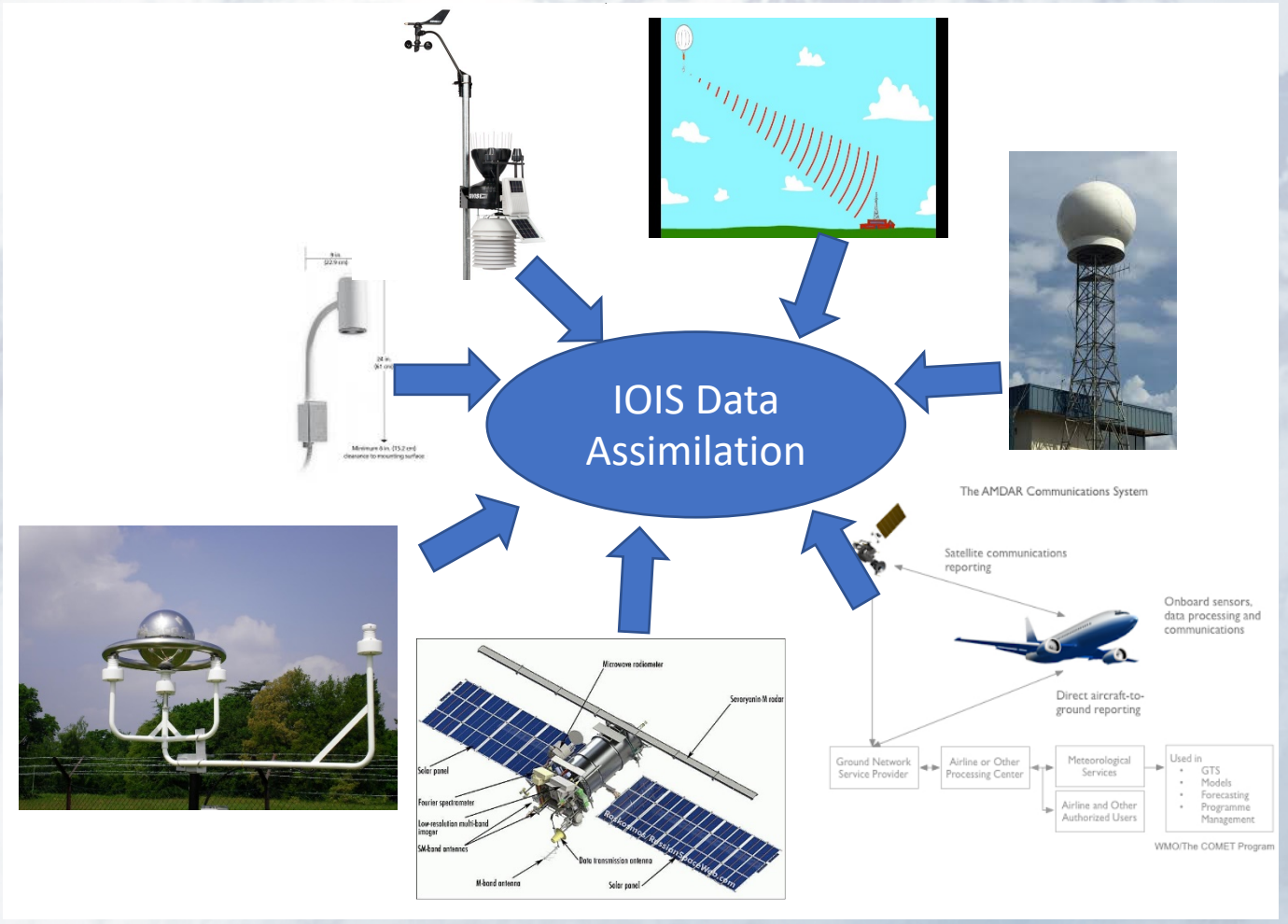
Forecast includes data assimilation, Numerical Weather Prediction (NWP) models, post-processing techniques (which, again, use observations)

Observations need to be quality controlled not only for a quality analysis system but:

a) to be assimilated particularly by NWP;
b) to evaluate the value of model output by comparing the analysis and every frames of a forecast (regarding timing, location and intensity of synoptic-scale to local scale features);
c) to take appropriate action if a mismatch exists between model output and observations;
d) to capture smaller-scale details that may be unresolved by the models;
e) to verify forecasts a posteriori (Salerno, 2020)

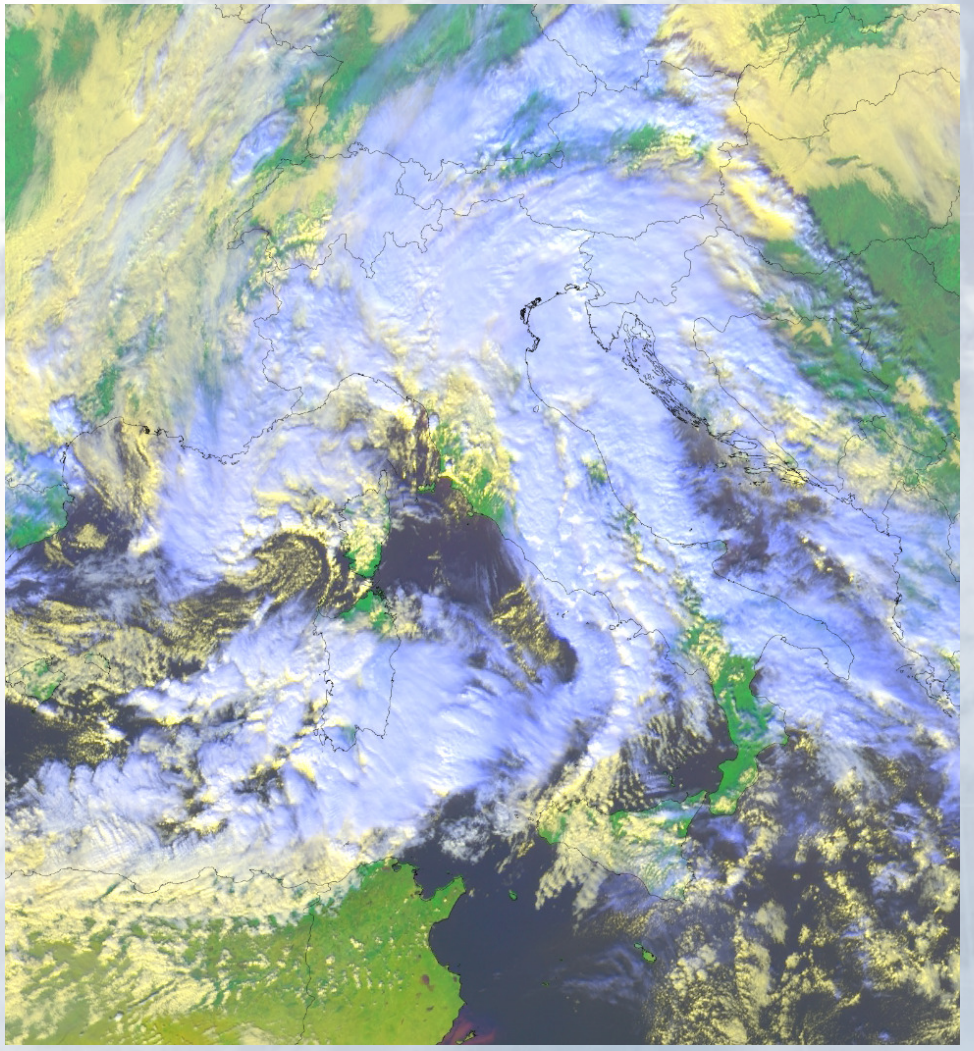
THE OBSERVATIONAL DATA

- Surface observations
- Upper air observations:
  - Radiosondes
  - Aircraft-based observations
  - Profilers
- Satellites
- Lightning detection
- Weather radars
- EFM
- RDCSS



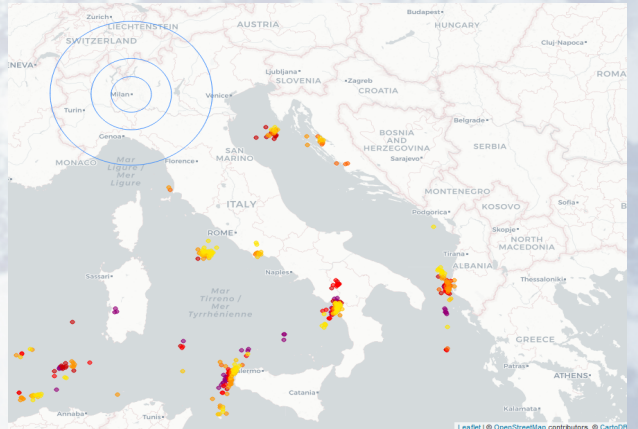
IOIS (Integrated Observations Ingesting System)

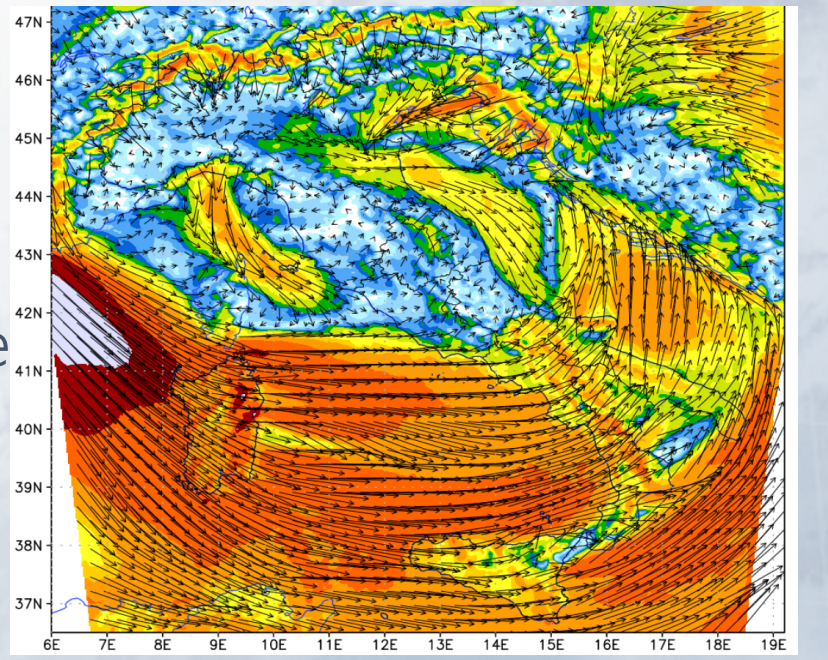
IOIS has been elaborated and used at **Meteo Expert** (previously known as Centro Epson Meteo
Meteo Expert is a private organization providing meteorological services
At **Meteo Expert** weather models and data assimilation are internally developed and applied.
All available information, coming from surface, upper air and remote sensing measurements, are integrated to produce every hour a 3D grid of observed meteorological data
IOIS is the machine producing the initialization to be perturbed for a limited-area ensemble prediction system.



IOIS (Integrated Observations Ingesting System)

A variational quality control is applied to check data consistency (Steinacker et al. 2011; Tavolato & Isaksen 2015); the observation is compared with the background and surrounding observations to determine its analysis weight in the system.





3D hourly grid (4D = space+time) follows the model's horizontal mesh size at 3.5 km, while in the vertical fifty variable-depth levels are used from surface to stratosphere. The scaling of weather parameters at a defined location is made interpolating values by surrounding grid points, with a correction algorithm which takes into account sub-grid terrain characteristics and local gradients.

Data from IOIS have been (successfully) used for Cavezzo meteorite using 3D hourly grid with the horizontal mesh size at 3.5 km.

These data may be used for other situations in the area covered by the 3.5 km grid (35N-48N, 6E-20E, Italy and surroundings). For smaller areas inside this one, resolution is improved up to 1.2 km

Outside this area, horizontal resolution is lower, depending on resolution of atmospheric models over certain areas (Europe, World….)

We are working to **improve resolution** at about 1 km from 3.5 km one, and extend the area covered by the old grid.

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THANK YOU

Questions?

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