How can SINOPTICA support ATM and ATC during severe weather events?

SESAR Innovation Days, 7-9 December 2021

SESAR JOINT UNDERTAKING

SINOPTICA

Satellite-borne and IN-situ Observations to Predict The Initiation of Convection for ATM

Founding Members

EUROPEAN UNION EUROCONTROL

This project has received funding from the SESAR Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement [892362]

Motivations

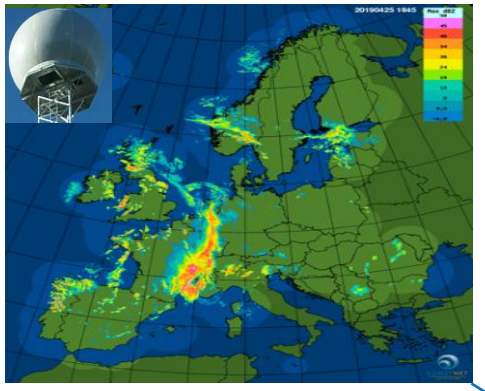
The prediction of rapidly developing thunderstorms in small and localized areas is a challenge for the scientific community. Quickly developing but intense thunderstorms are usually characterized by large hail size, huge amount of rain in a short period, high lightning frequency and strong winds thus potentially capable to affect people and socio-economic activities/infrastructures.

These phenomena affect also the flight safety, when aircrafts have to fly through or nearby storms, and the aviation management, or triggering flight re-routing, delays or cancellations. Weather-related flight cancellations and delays have increased over the past two decades in the US and Europe and this trend is going to increase due to the human-induced climate change.

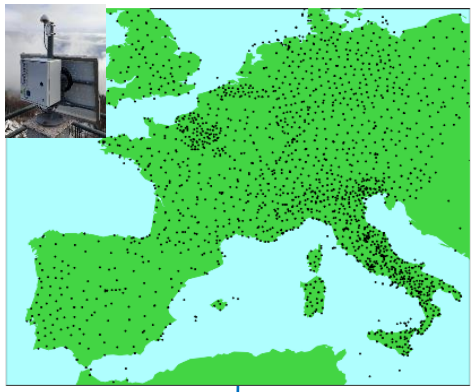
The SINOPTICA project aims at exploiting the untapped potential of assimilating remote sensing data into very high-resolution, very short-range numerical weather forecasts to provide improved prediction of extreme weather events to the benefit of Air Traffic Management (ATM) and Air Traffic Control (ATC) operations in an Extended Arrival Manager (AMAN) framework.

Data and Model

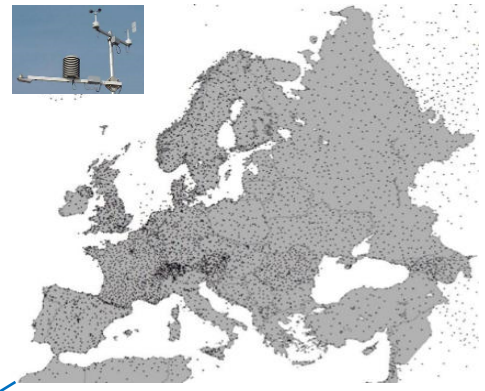
Radar



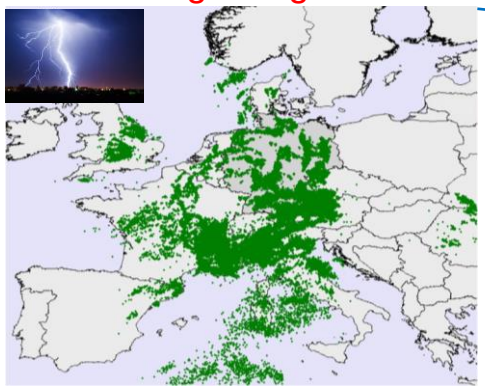
GNSS



Weather stations

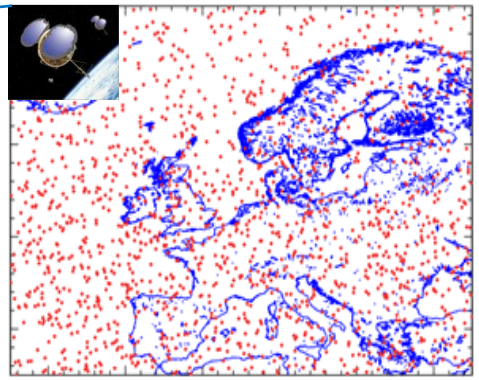


Lightning



WRF
High resolution

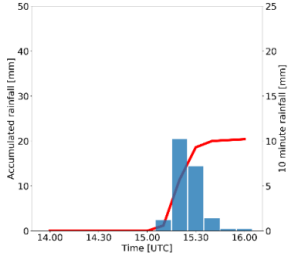
GNSS RO



Case studies

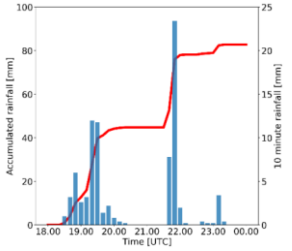
Milano Malpensa
11 May 2019

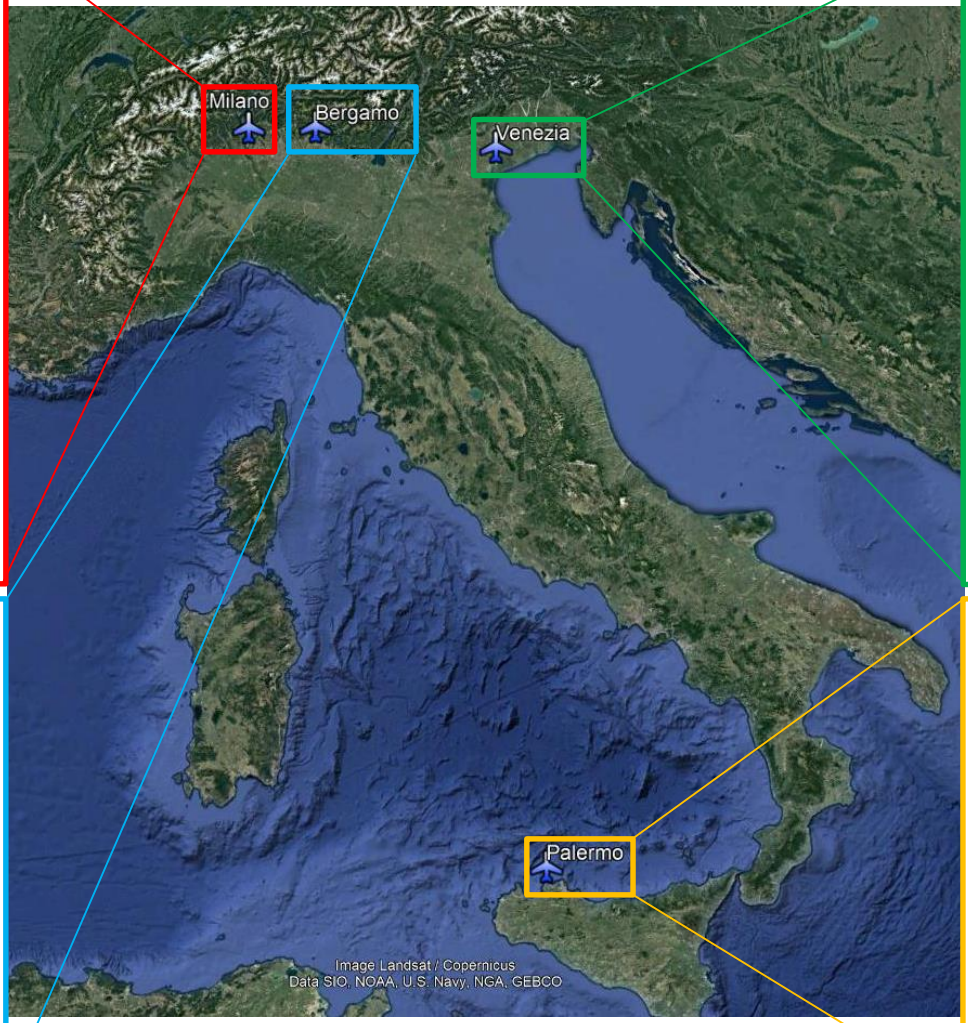
A squall line hit the airport between 14 and 15 UTC. The presence of hail on the runways caused some flight delays and 9 planes were diverted to other airports.



Bergamo Orio al Serio
6 August 2019

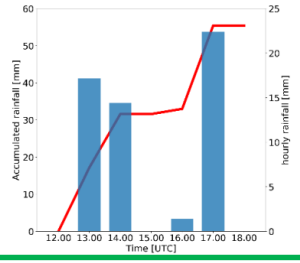
Convective storm producing heavy precipitation, strong wind gusts and small hail.





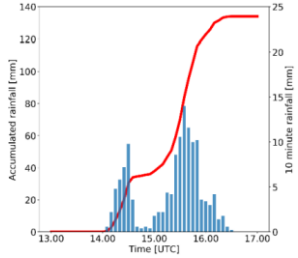
Venice Marco Polo
7 July 2019

Precipitation with a prevalent character of thunderstorms, locally very intense, associated in various cases with hail and strong wind gusts.

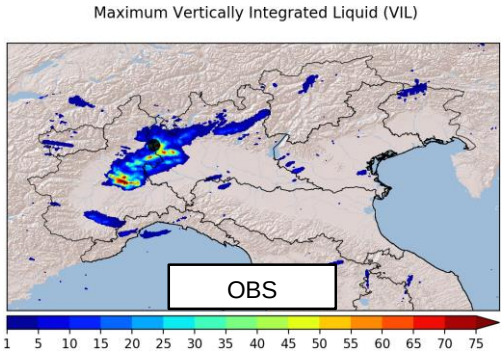


Palermo Punta Raisi
15 July 2020

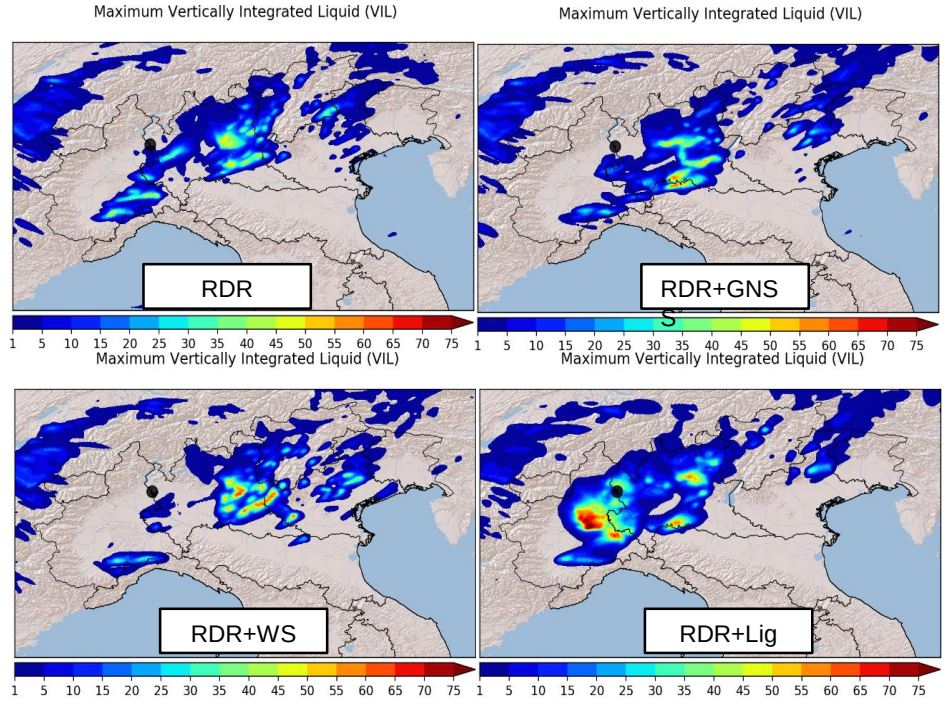
Localised thunderstorm with high amount of rain concentrated in a short time.

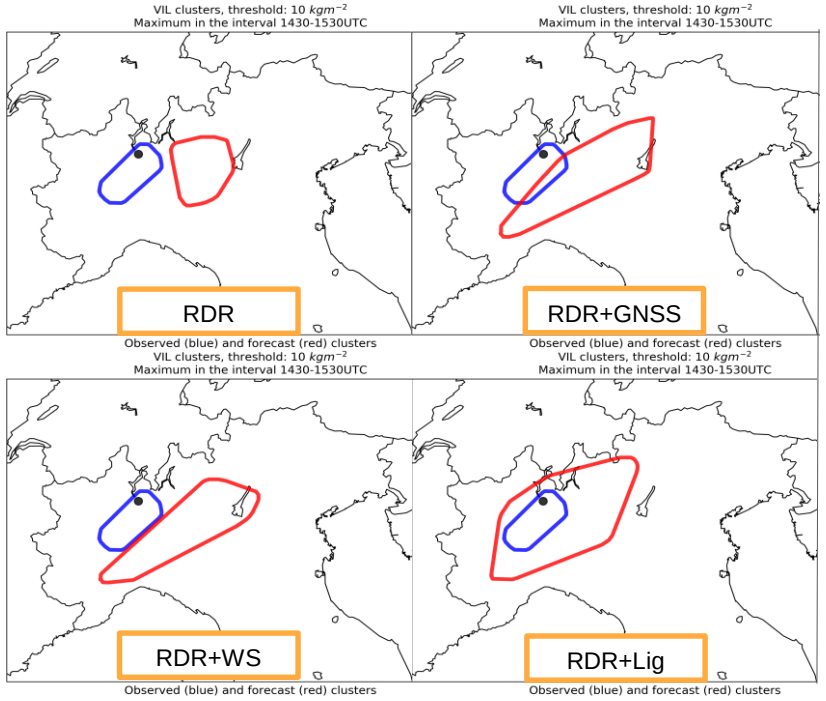


Example of model output

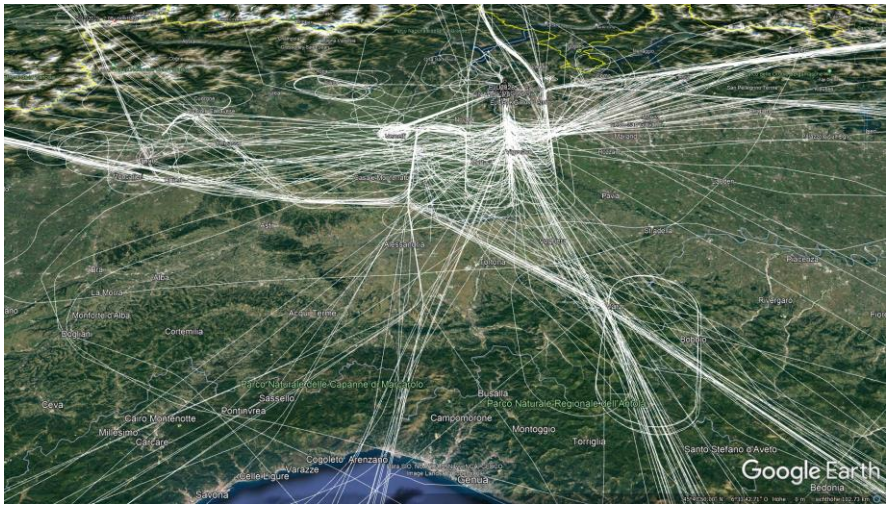


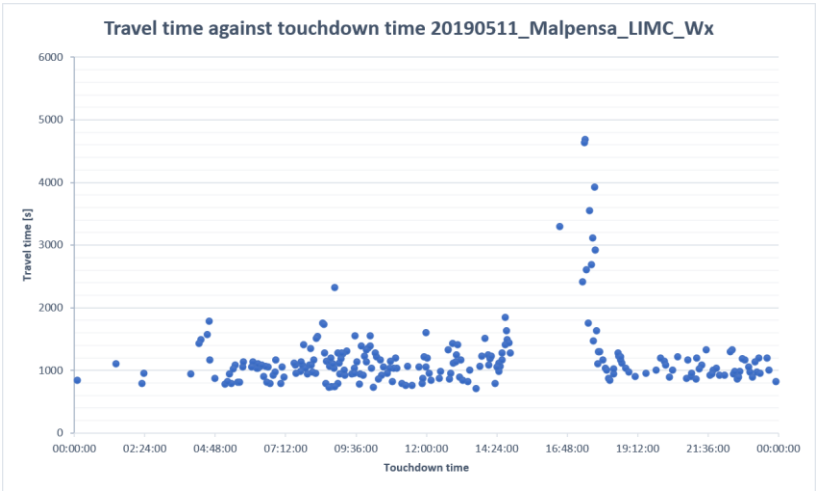
Experiment	Centroid distance (in grid units, 2.5 km)	Observed area (in grid squares, 2.5x2.5 km²)	Forecast area (in grid squares)	Intersection area (in grid squares)	Interest
RDR	62,41	874	1342	0	0,69
RDR+GNSS	50,10	874	1947	75	0,80
RDR+WS	70,53	874	1451	0	0,68
RDR+Lig	21,92	874	3500	822	0,91

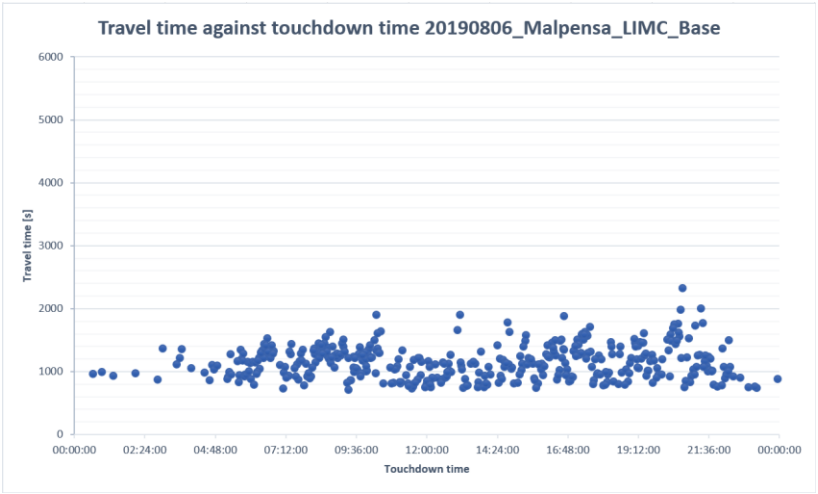




Example of trajectories diverted during the case study







Integration of model output with AMAN

Thank you very much
for your attention!

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