DICHOTOMI

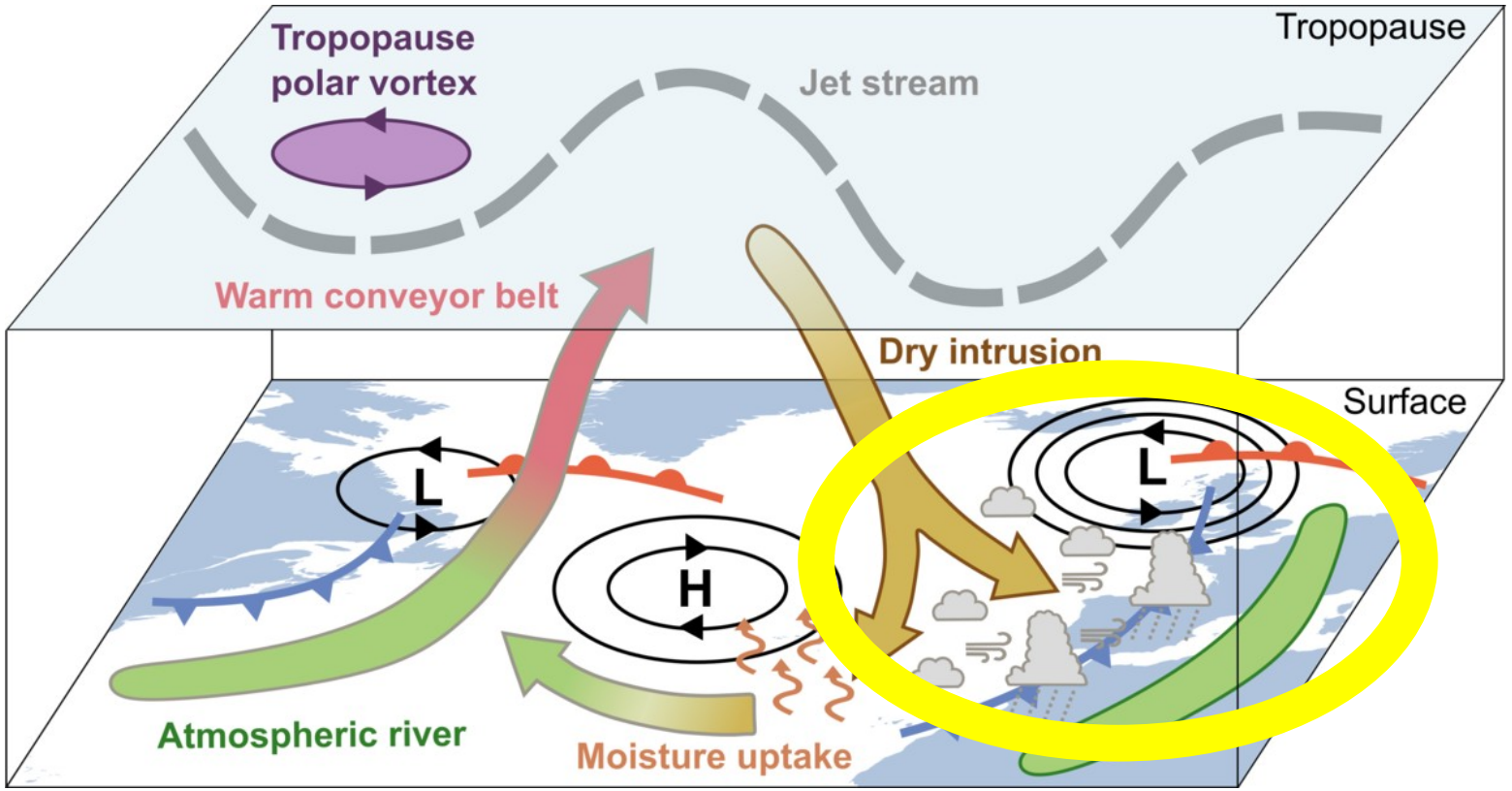
Dry Intrusion and Cloud Head winds On Top Of Marine Interfaces

Gwendal Rivière, **Florian Pantillon**, Julien Delanoë,
Didier Ricard, Céline Planche, Pierre Coutris, Aurélien Bourdon

Julian Quinting, Annika Oertel, Philipp Gasch

11th Workshop on European Storms in Delft, 17-19 June 2026

Contribution to NAWDIC



https://www.nawdic.kit.edu/

Scientific Goals of NAWDIC

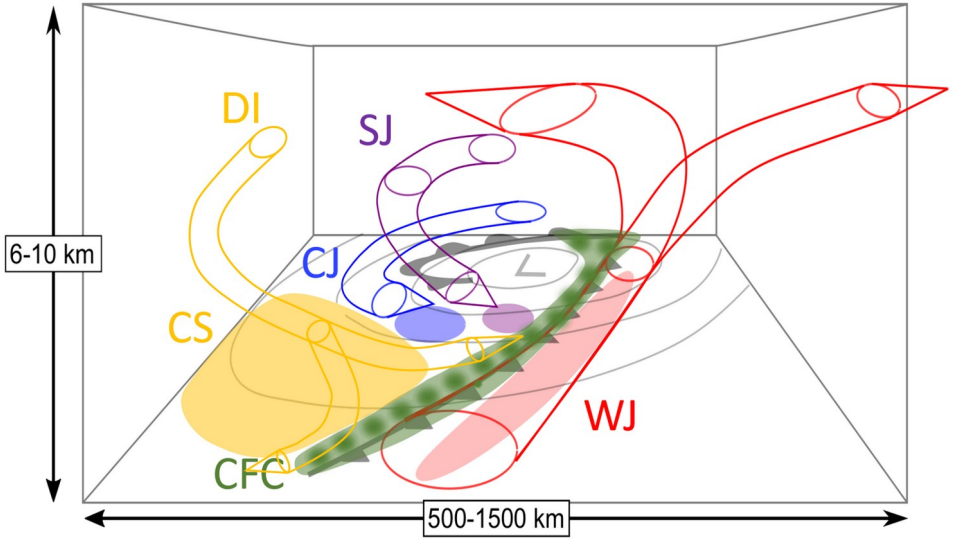
1) Mesoscale structure of the cloud and wind field within the jet stream
2) Momentum transport into the boundary layer and its role in the formation of severe wind gusts
3) Surface fluxes in the cold sector and near fronts for HIW and subsequent cyclogenesis

NAWDIC 2026

North Atlantic Waveguide, Dry Intrusion and Downstream Impact Campaign

Scientific objectives of DICHOTOMI

- Goal better understand the **formation of near-surface strong winds** in extratropical cyclones
- Focus **low-tropospheric and boundary-layer processes**



Adapted from Eisenstein et al (2022)

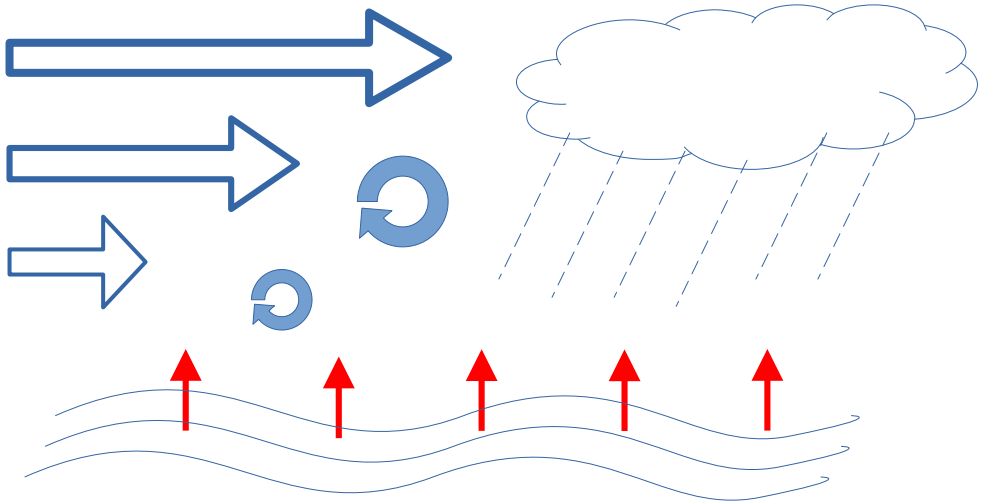
CJ: Cold-Conveyor-Belt Jet
CS: Cold Sector
CFC: Cold Frontal Convection
DI: Dry Intrusion
WJ: Warm-Conveyor-Belt Jet
SJ: Sting Jet

Research questions

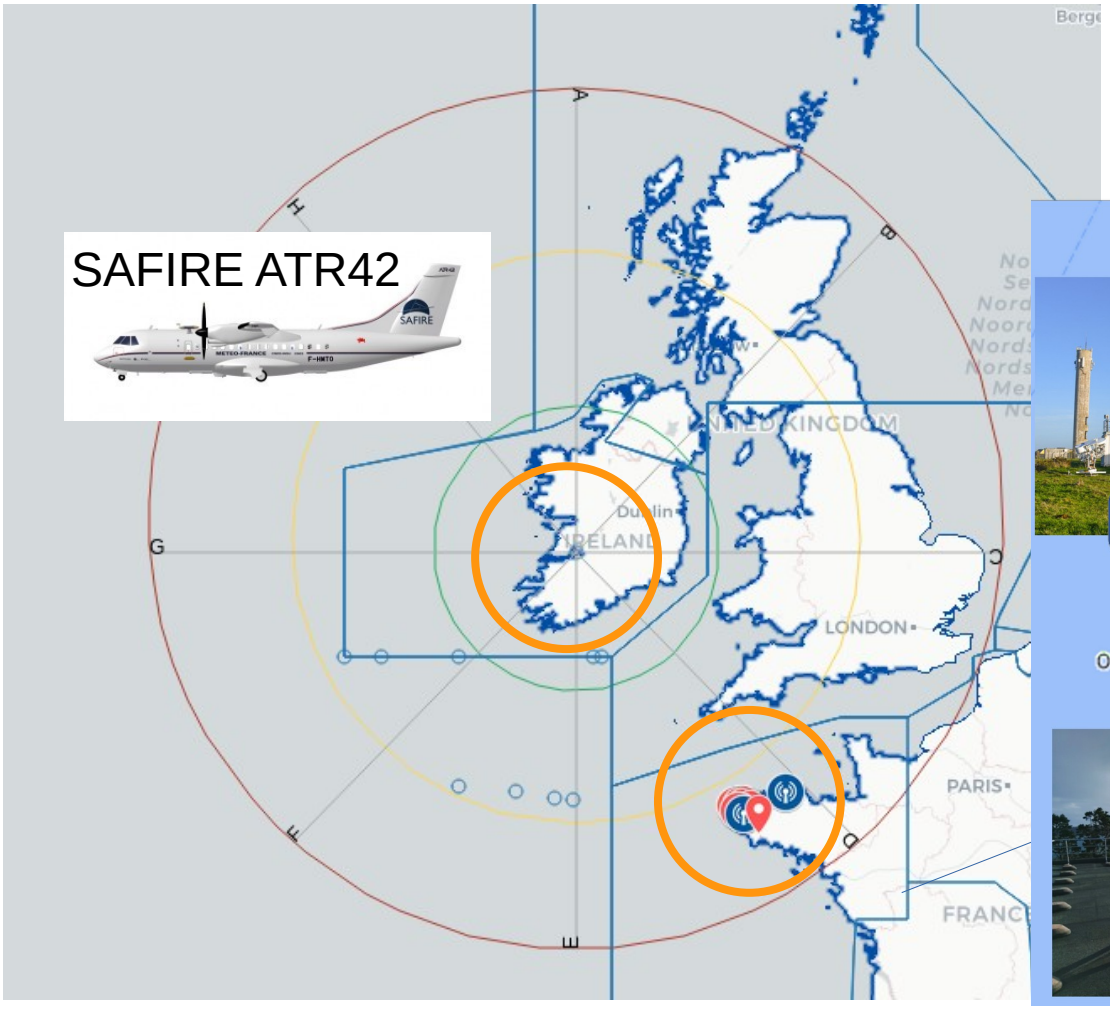
I. What are the involved mesoscale regions of strong winds?

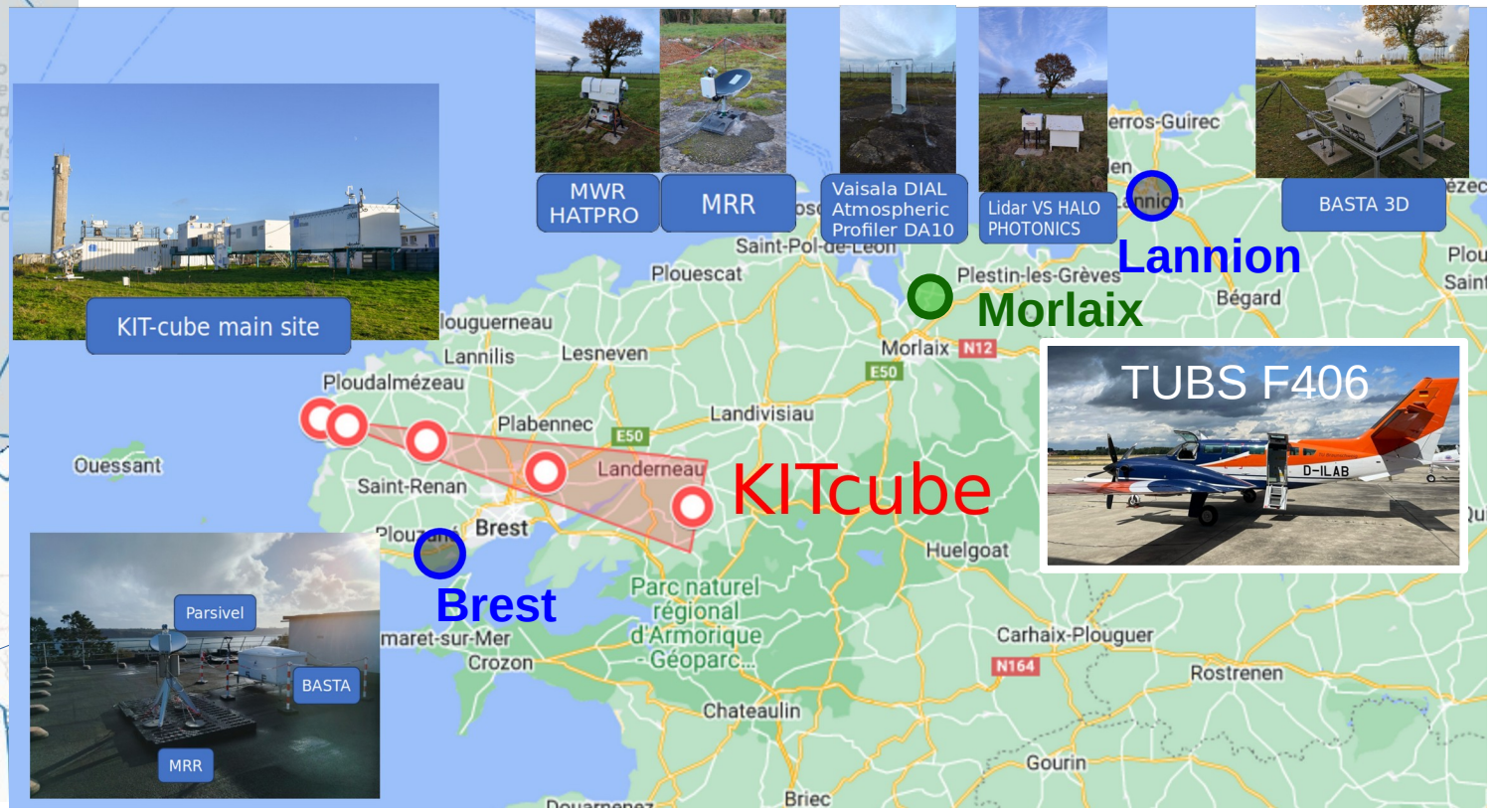
II. What is the role of stability, shear, evaporative cooling, surface roughness and fluxes in downward momentum transport?

III. How are they represented in weather and climate models?



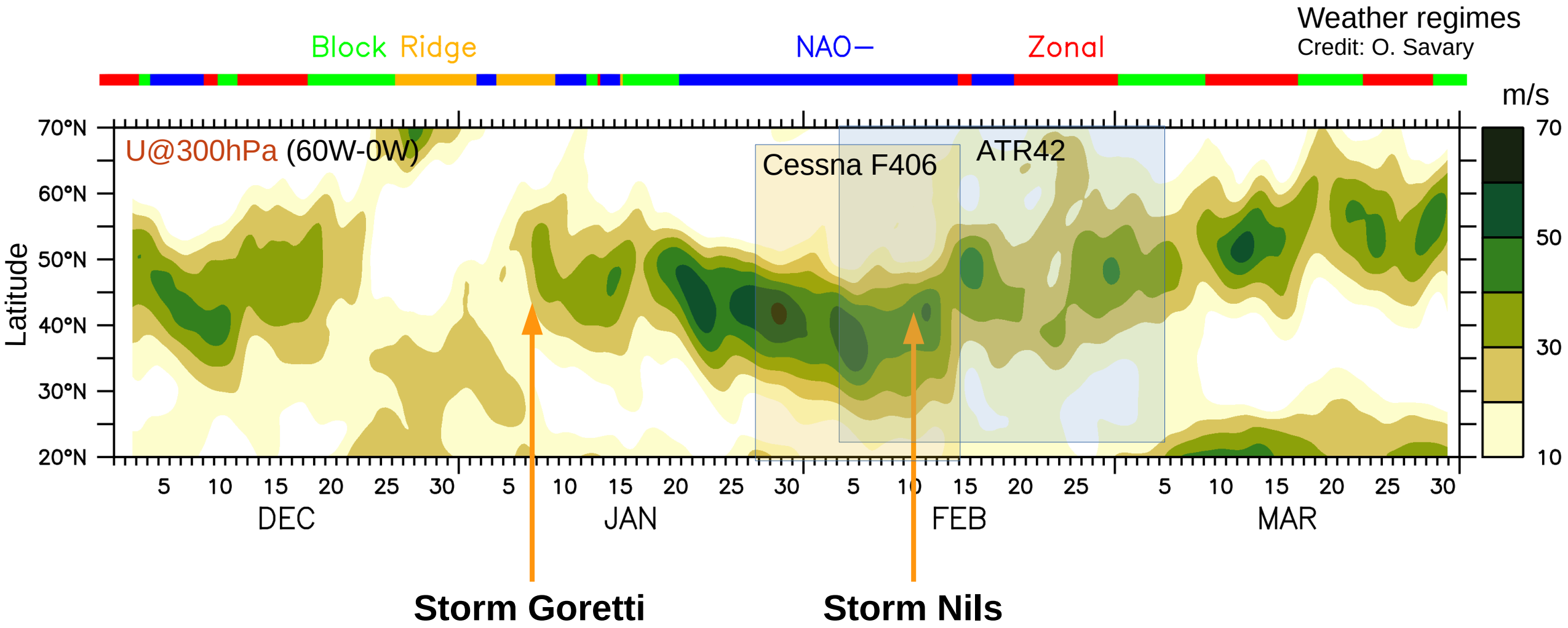
Airborne and ground-based observational platforms



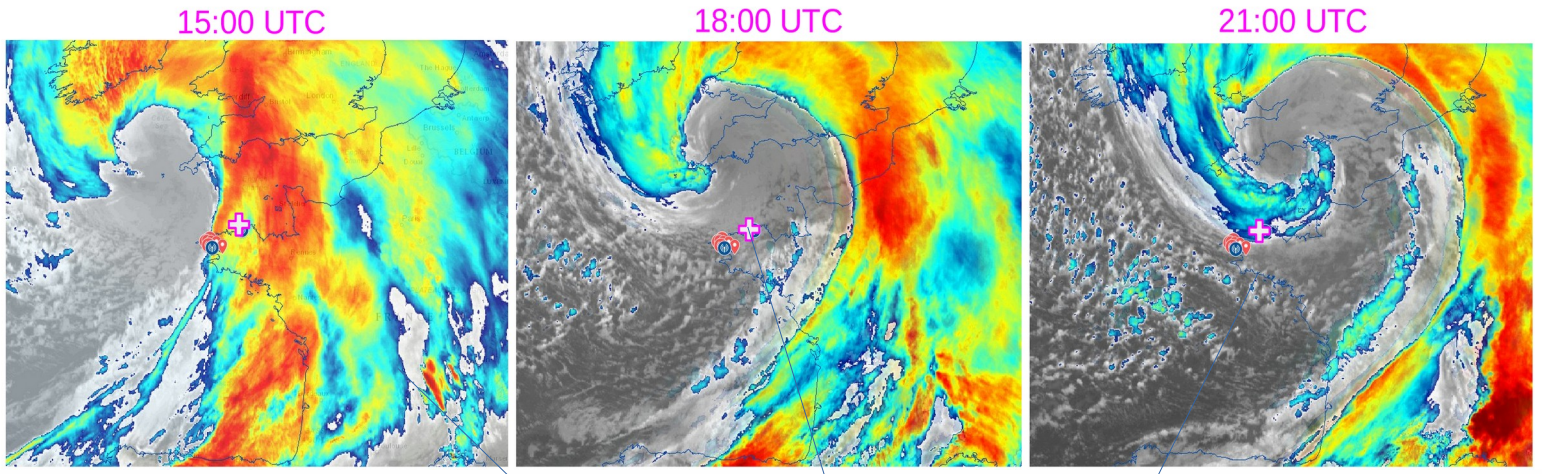


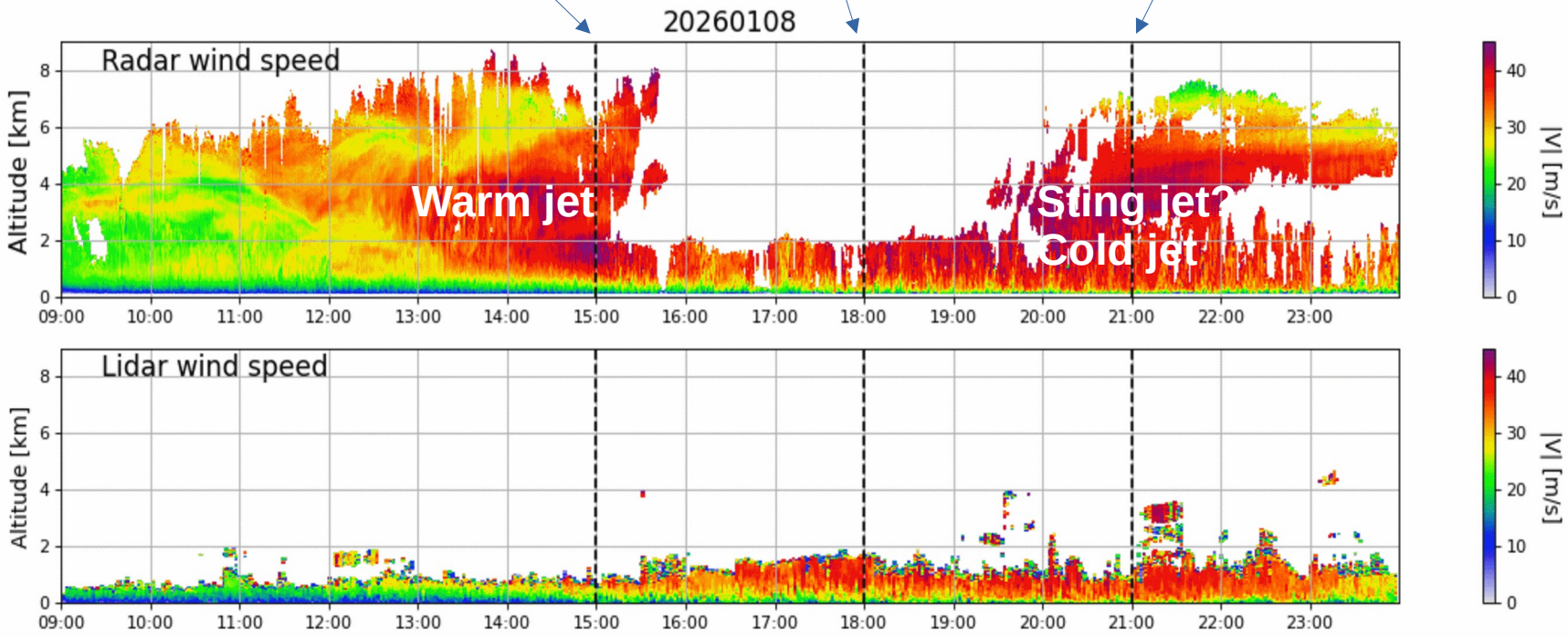
2 aircraft, 1 radiosonde station, several wind lidars, water vapour lidars, cloud radars, rain radars, …

The large-scale atmospheric circulation during NAWDIC



Ground-based wind measurements: Storm Goretti (8 Jan)



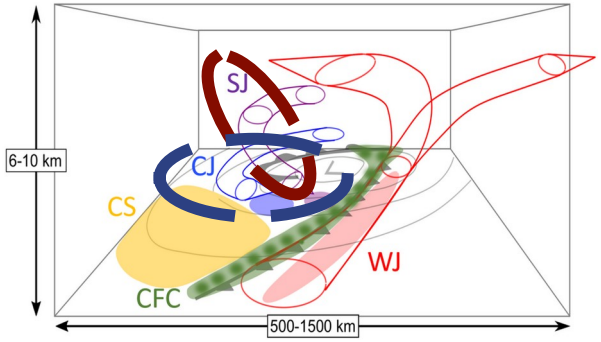


Credit: Julien Delanoë, Guylaine Canut

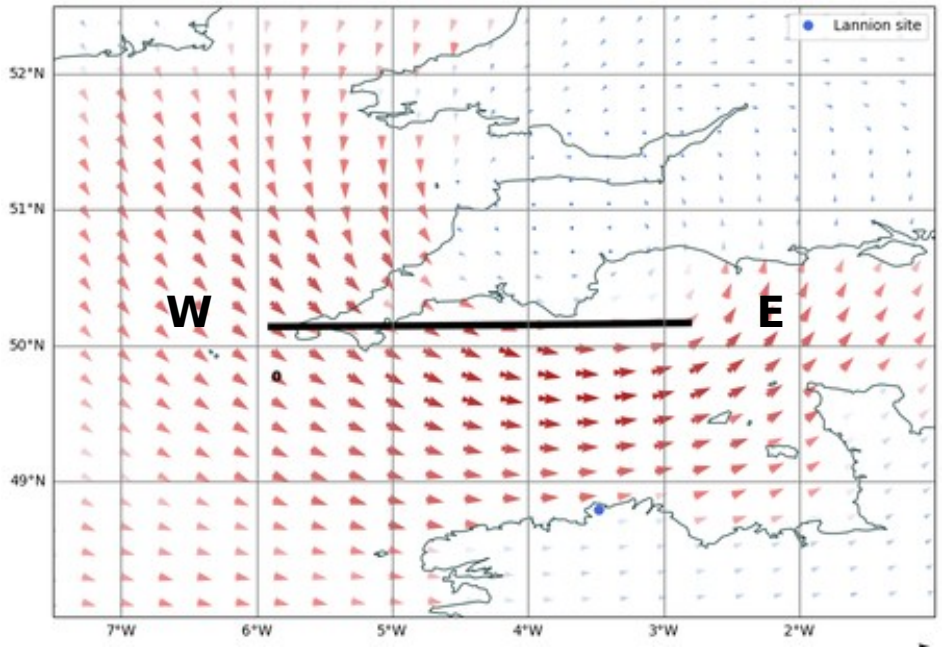
A sting jet in Storm Goretti?

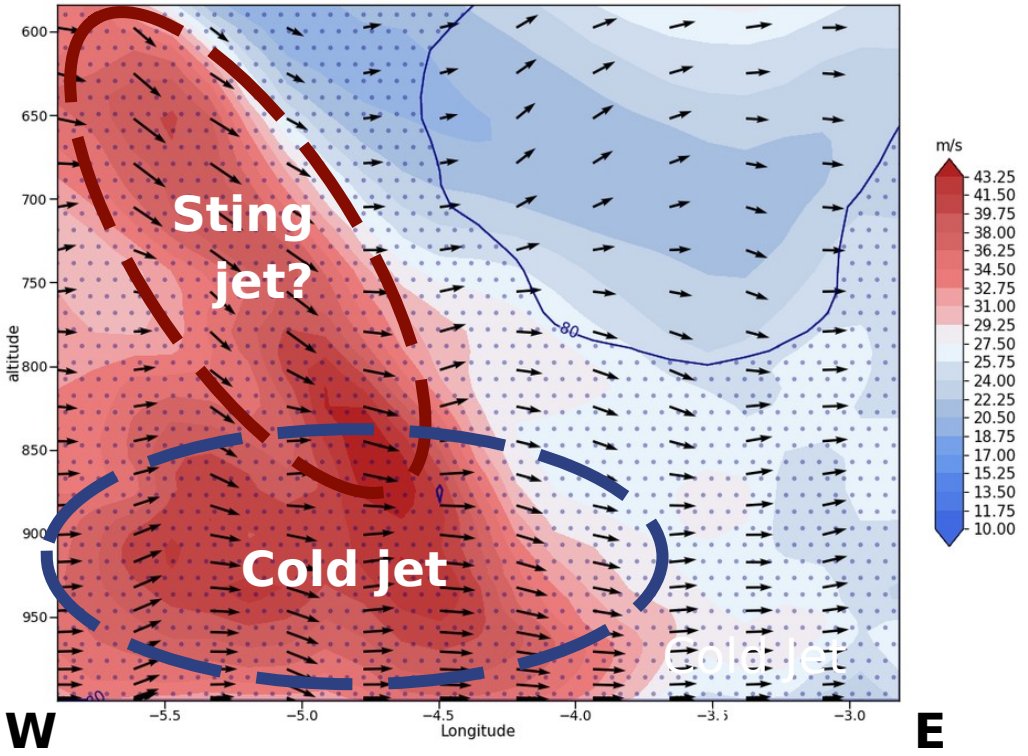
Ongoing work @CNRM (Camille Jarrousse)

Investigating origin of strong winds
with numerical simulations



Meso-NH
mesoscale non-hydrostatic model





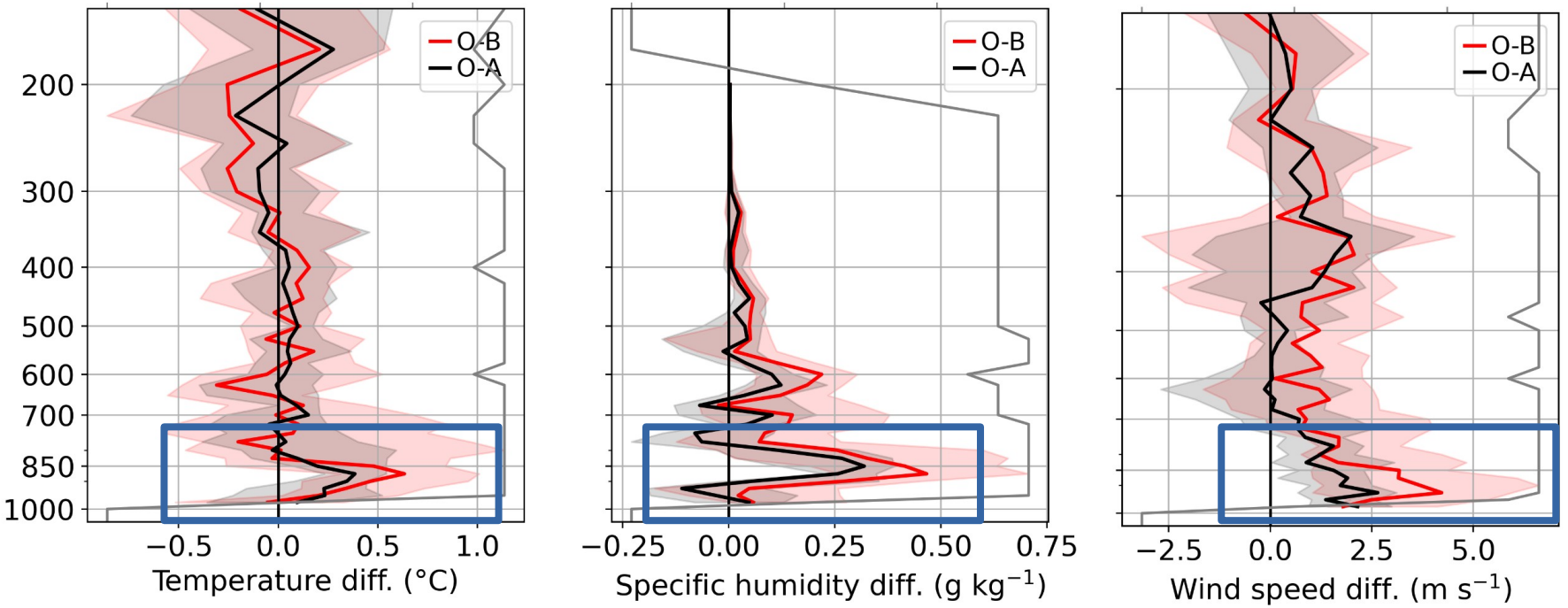
Ground-based radiosondings: systematic analysis

Ongoing work @KIT (Viktoria Dürlich)

Investigate biases in DWD ICON global model compared to KITcube radiosoundings

Intense wind cases

- Cold and dry bias
- Slow bias in wind speed



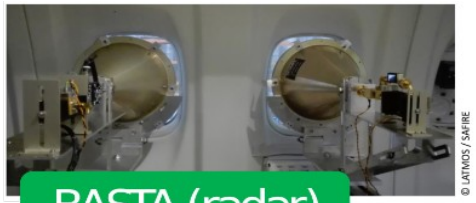
Assimilated radiosondes during NAWDIC (obs – first guess)

SAFIRE ATR42

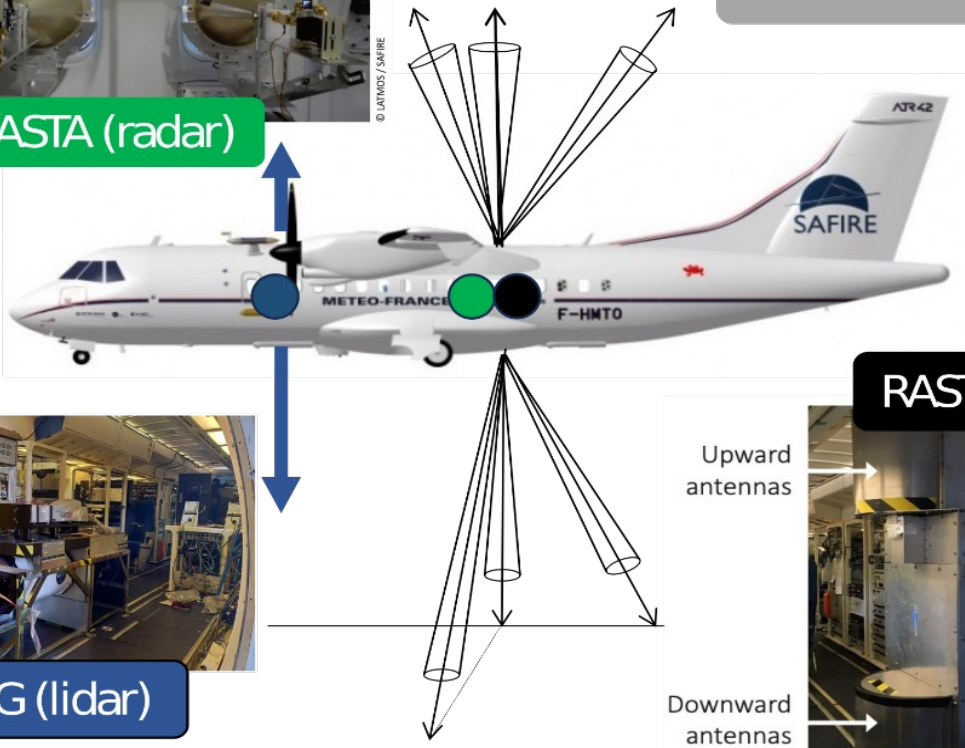
FCDP (1) CDP (2) 2DS (3)
HVPS (4) ROBUST (5) NPIP (6)
CVI-TWC (7) UHSAS (8)

PMA (cloud probes)

In-situ



BASTA (radar)



LNG (lidar)

Remote sensing

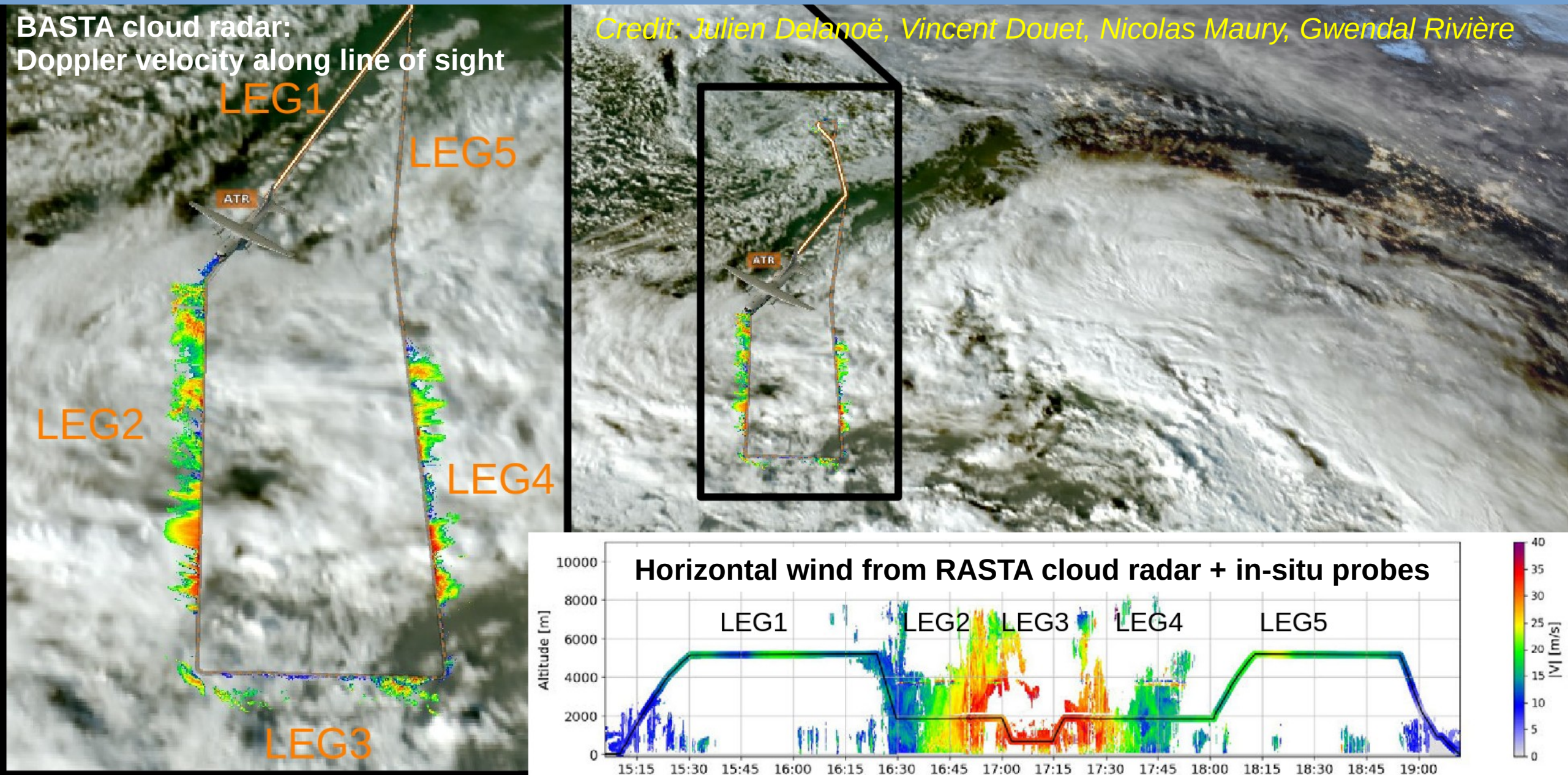
RASTA (radar)

+ FastWave (turbulence)

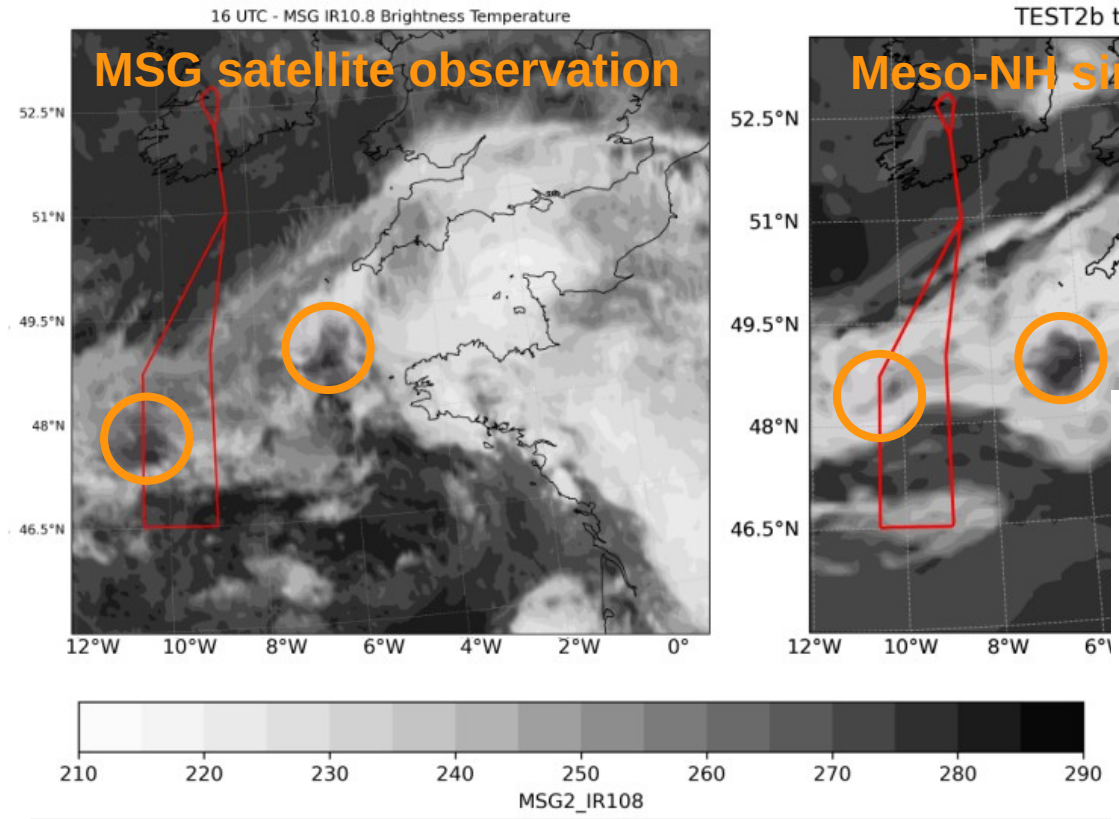
+ Picarro (isotopes)

Collaboration Harald Sodemann, Franziska Aemisegger

ATR42 wind measurements: Storm Nils (11 Feb)



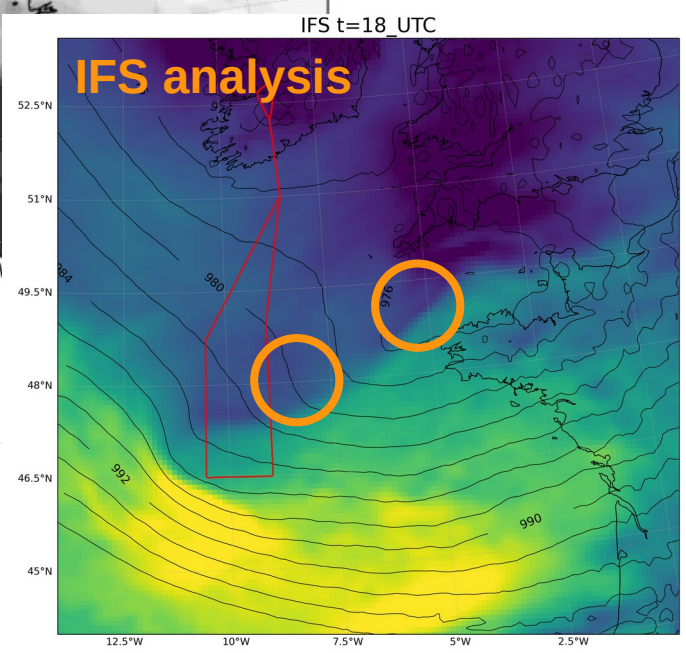
Presence of mesoscale vortices in Storm Nils

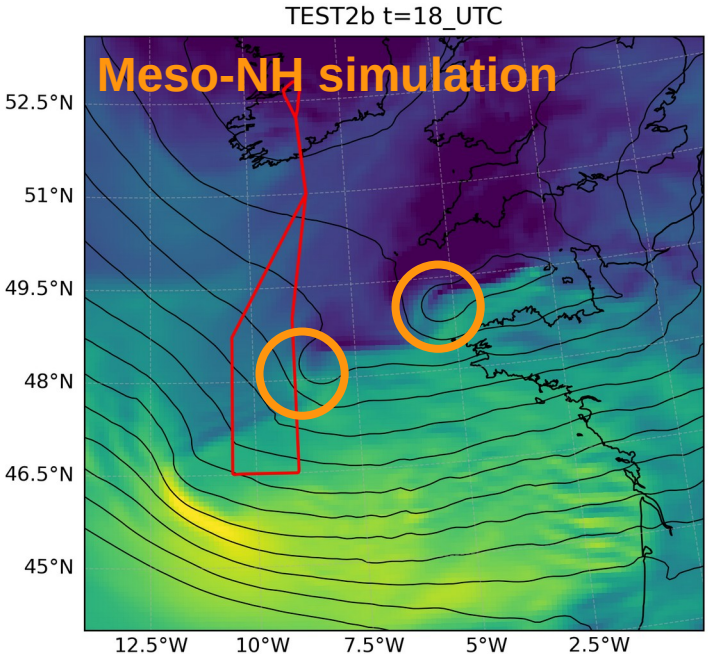


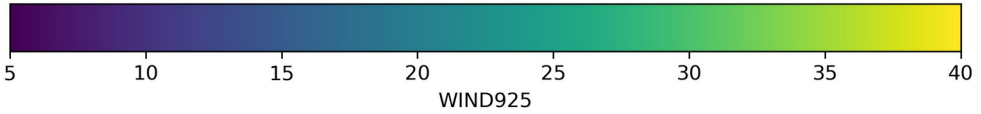
Ongoing work @LAERO (Ferran Lopez Marti)

Investigate dynamics of mesoscale vortices with numerical simulations

Meso-NH
mesoscale non-hydrostatic model



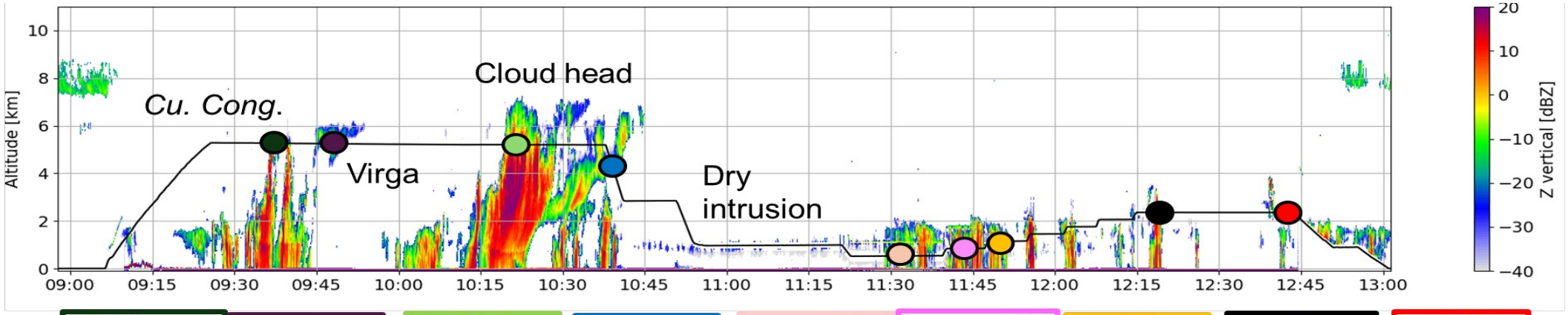




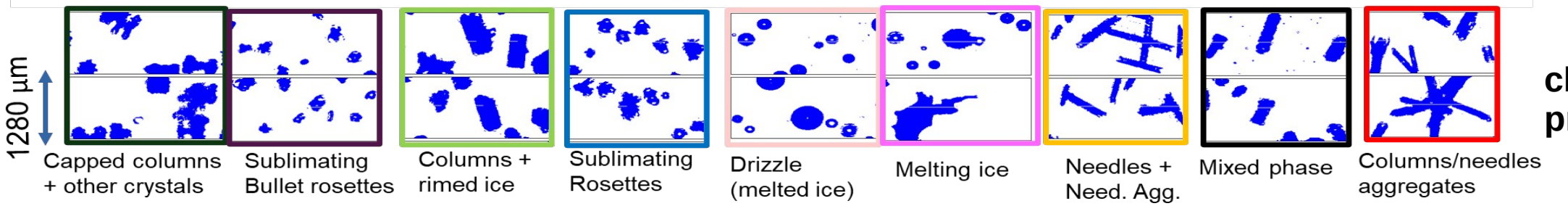
Mesoscale vortices missed by IFS

→ *very challenging for planning flights!*

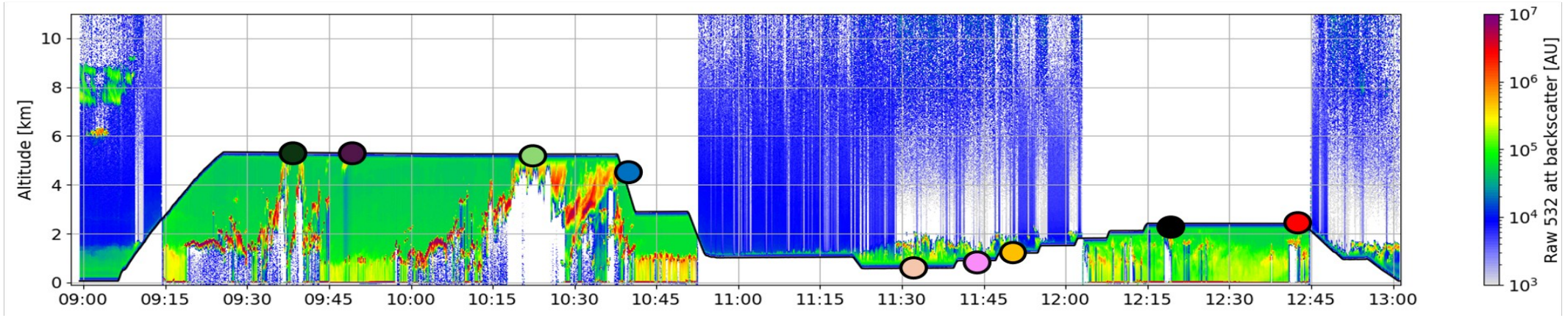
ATR42 cloud measurements: example 2 March 2026



RASTA radar



cloud probes



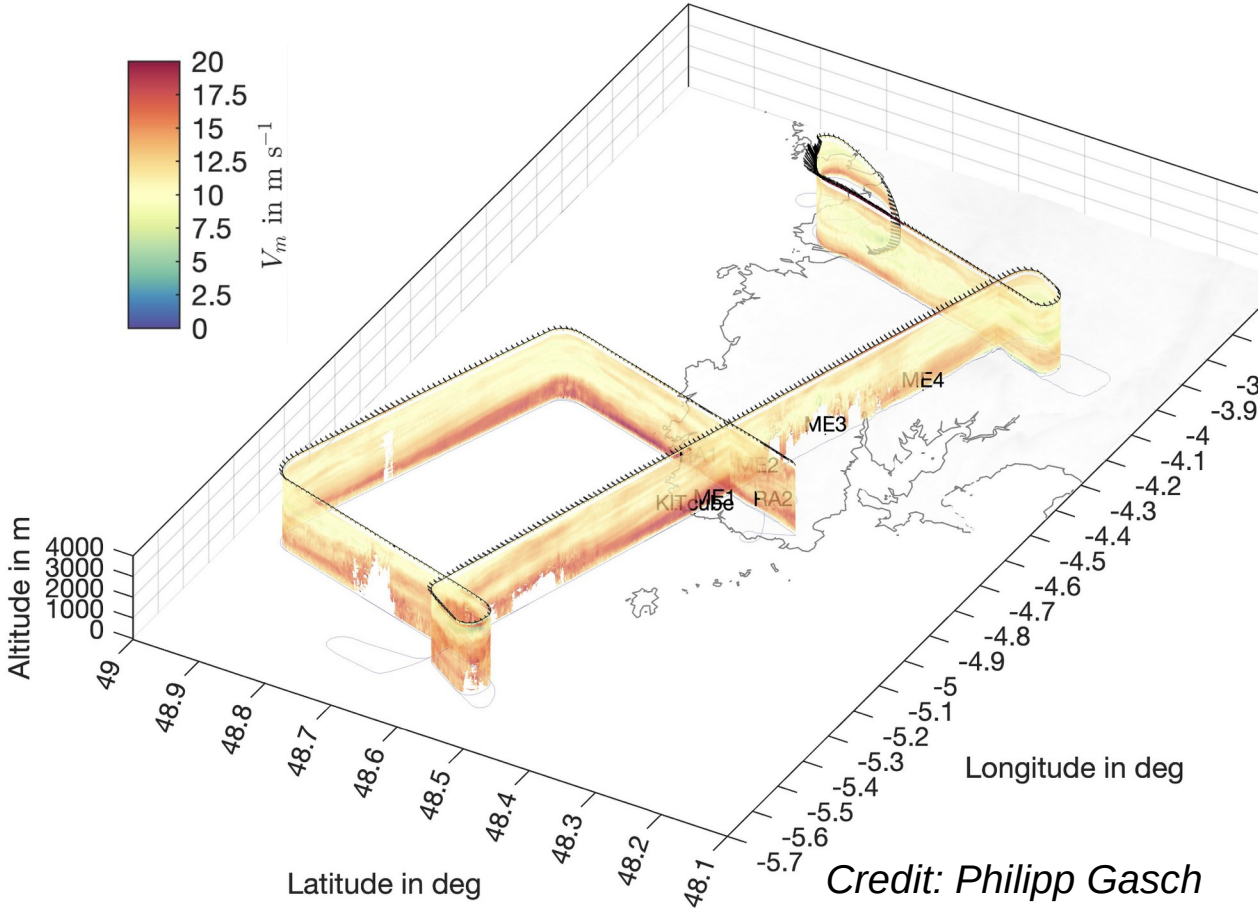
LNG lidar

Credit: Julien Delanoë, Antoine Baudoux, Aymeric Dziduch, Pierre Coutris, Gwendal Rivière

TUBS Cessna F406

Payload

- **Novel KIT AIRflows fixed-beam airborne Doppler lidar system (100 m resolution)**
- 100 Hz in-situ turbulence probe
  → boundary-layer heat & momentum fluxes
- radiation & surface temperature sensors
  → link with surface characteristics
- PICARRO for water vapor isotopes
  (coll. H. Sodemann and F. Aemisegger)

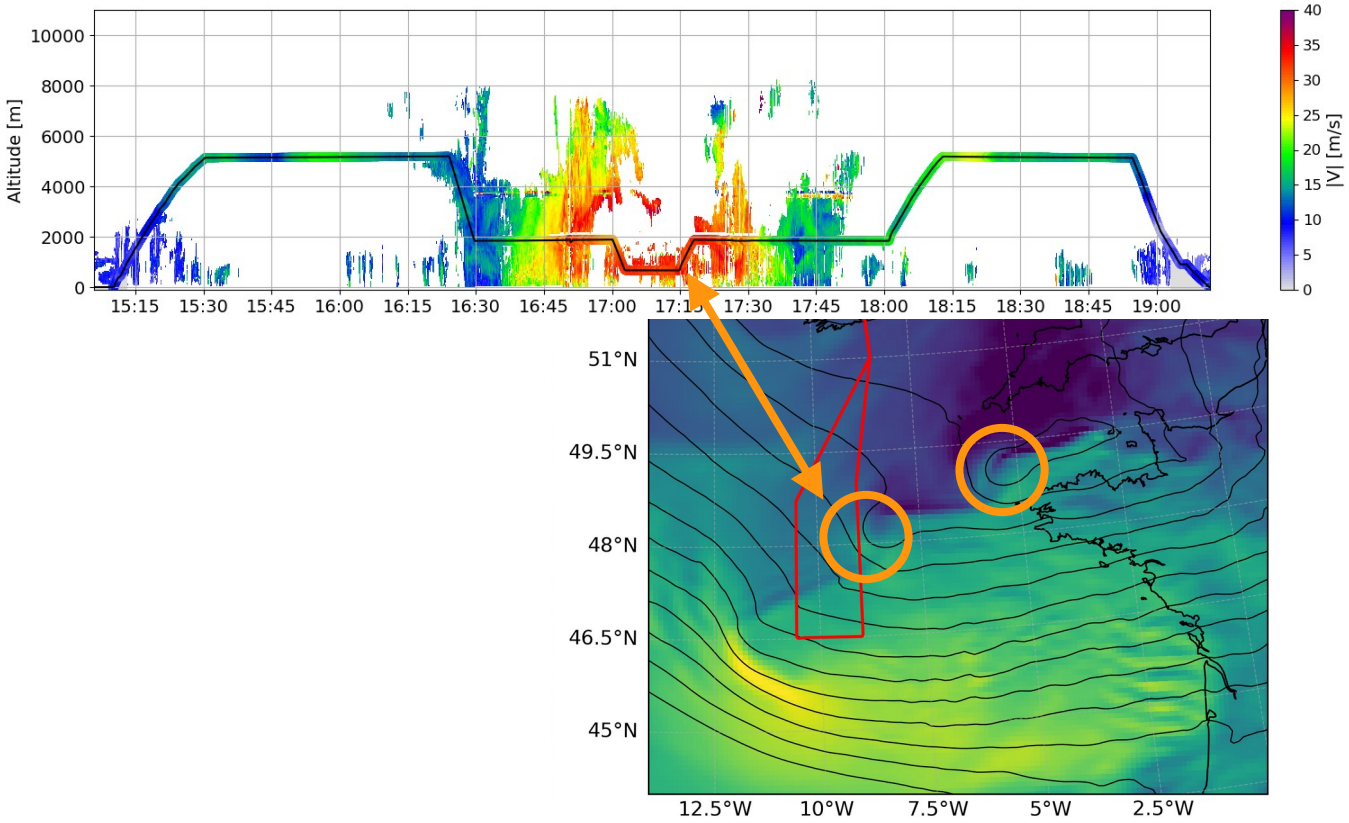


Credit: Philipp Gasch

Open position: 2 year post-doc at Univ Toulouse

https://www.toulouse-tourisme.com/

Topic Modeling windstorms observed during the NAWDIC field campaign



Contact: florian.pantillon@cnrs.fr

Summary

French-German project DICHOTOMI (2025–2029)

- NAWDIC component focused on the formation of strong winds
- ATR42 including Doppler radars and cloud probes (& more)
- Cessna F406 including AIRflows Doppler lidar system (& more)
- Ground-based instruments including Doppler radars and lidars
- Ongoing modelling work from climate to large-eddy simulations
- Plenty of available data including storms Goretti and Nils: https://observations.ipsl.fr/aeris/nawdic/#/dataaccess