Observing high-impact winter cyclones with coordinated multi-platform measurements during NAWDIC

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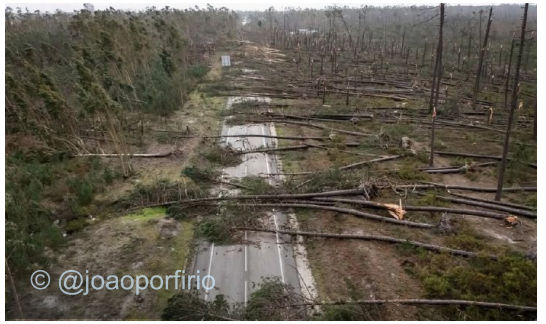
2nd Observational Campaigns Workshop
Reading (UK), 1 July 2026

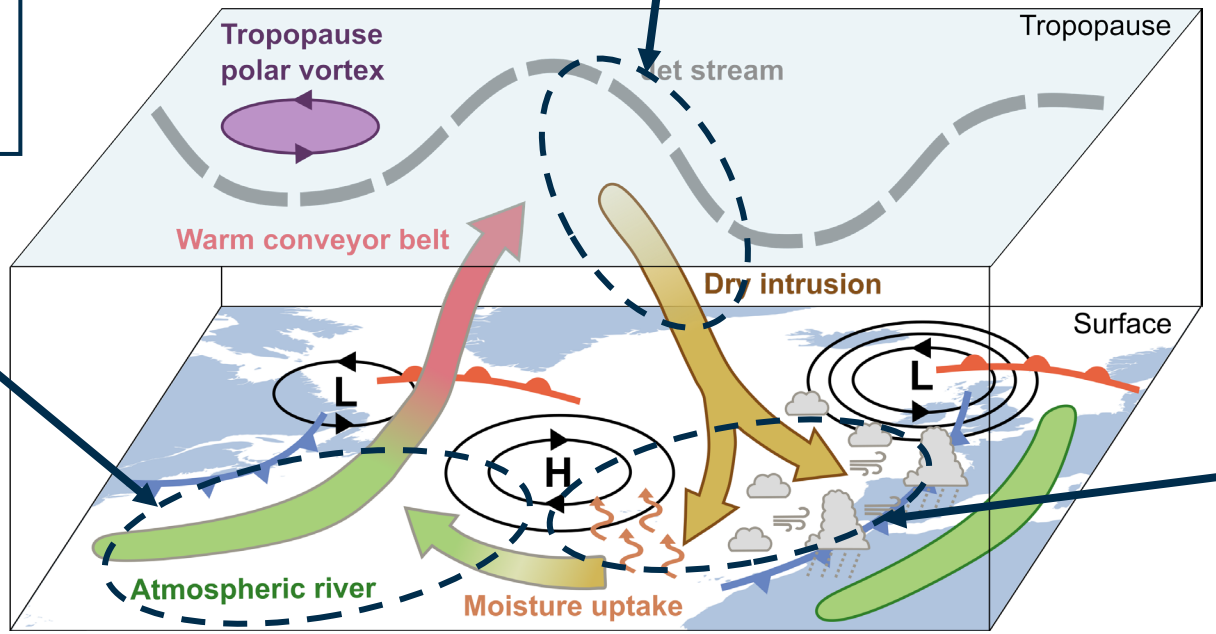
NAWDIC 2026
North Atlantic Waveguide, Dry Intrusion and Downstream Impact Campaign

NAWDIC: Research Foci & Observation Targets



1) DI inflow & descent
- Origin & chemical composition
- Mixing processes at UTLS
- Downward transport

3) Air mass boundaries & warm-sector processes
- Mesoscale variability near fronts and in atmospheric rivers
- Relevance of DI outflow for clouds and precipitation



4) High-impact weather
- Relevance of upstream processes for HIW
- Upstream dynamics of Mediterranean cyclones

2) Cold-sector processes*
- DI–PBL interaction
- Turbulent surface fluxes & moisture uptake
- Mesoscale moisture-cycling structures
- Cloud distribution

NAWDIC aims to advance our understanding of atmospheric phenomena and processes leading to high-impact weather (severe wind gusts, heavy precipitation, cold air outbreaks) related to winter cyclones over the North Atlantic

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North Atlantic Waveguide, Dry Intrusion and Downstream Impact Campaign

*in line with future targets identified during 1st ECMWF Campaigns Workshop in 2019

See also Quinting et al. (2026), BAMS

NAWDIC: Modules & Observation Strategy

NURTURE
Tropopause dynamics

Research aircraft NASA G3

NAWDIC-HALO
Dry instrusions, cold-sector procceses, and fronts

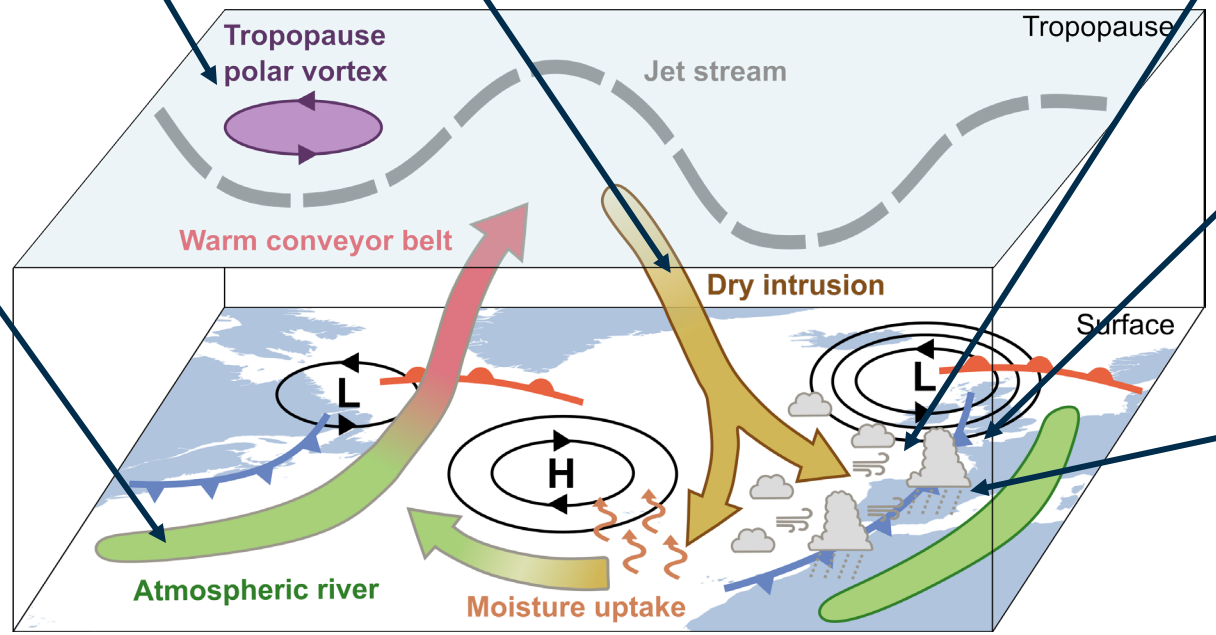
Research aircraft HALO

NAWDIC-DICHOTOMI
Wind gusts and cloud heads

Research aircraft SAFIRE ATR42 and TUBS Cessna

AR-Recon/GARRP
Atmospheric rivers

Several aircraft, drifters and radiosondes



NAWDIC-KITcube
Boundary layer processes

KITcube at French Atlantic coast

NAWDICiso
Moist-diabatic processes

Airborne and ground-based isotope measurements

EUROP
Atmospheric background

Radiosonde launches by European unis and partners

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NAWDIC 2026

North Atlantic Waveguide, Dry Intrusion and Downstream Impact Campaign

Airborne Observations in Jan/Feb 2026

Aircraft & Instrumentation

HALO (D-ADLR) German Aerospace Center

- WV and O_3 lidar
- Doppler 3-D wind lidar
- Multi-sensor dropsonde system
- Imaging cloud spectrometer
- In-situ air chemistry sensors
- Airborne radio occultation

13 Jan – 20 Feb

4 Feb – 4 Mar

Shannon, Ireland

8 – 15 Feb

Morlaix, France

25 Jan – 7 Feb

ATR-42 (F-HMTO) SAFIRE (FR)

- Triple-wavelength dual-pol lidar
- Downward and sideward Doppler cloud radar
- Infrared radiometer
- In-situ microphysics probes
- Cavity ring-down spectrometer

Cessna F406 (D-ILAB) TU Braunschweig (DE)

- Multi-beam Doppler wind lidar
- Cavity ring-down spectrometer
- Visible camera system
- Up- and downward radiation sensors
- In-situ turbulence probe

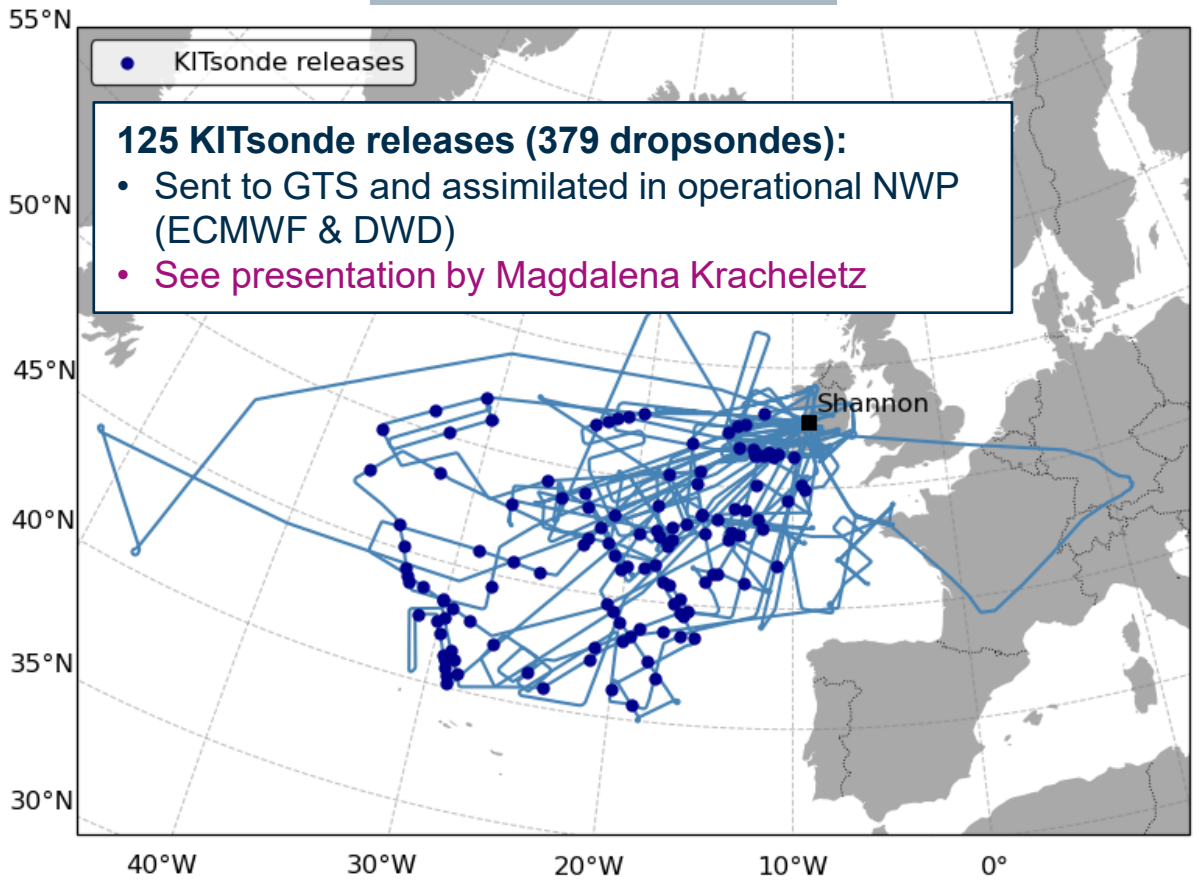
Airborne Observations in Jan/Feb 2026

Flight Activity & Dropsondes

HALO
19 flights, 149 flight hours

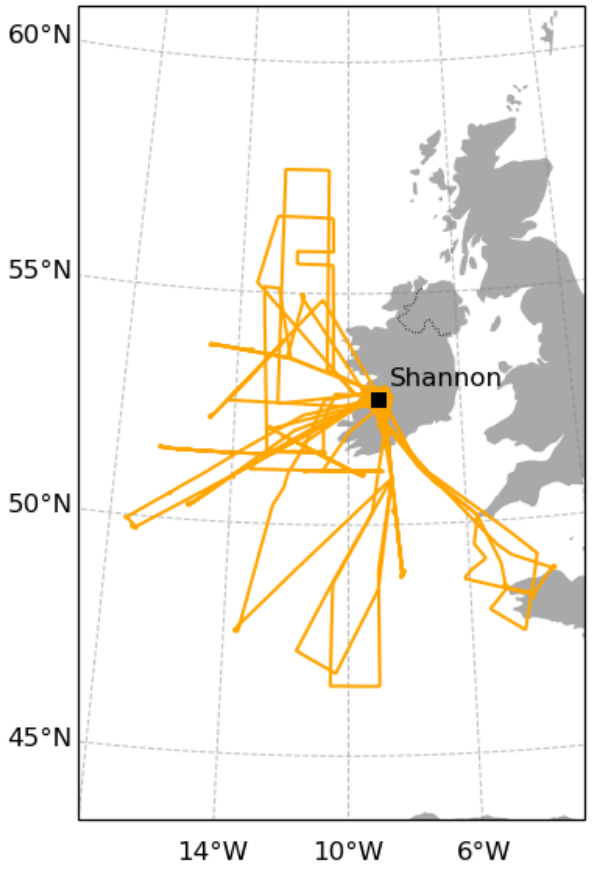
ATR-42
16 flights, 63 h

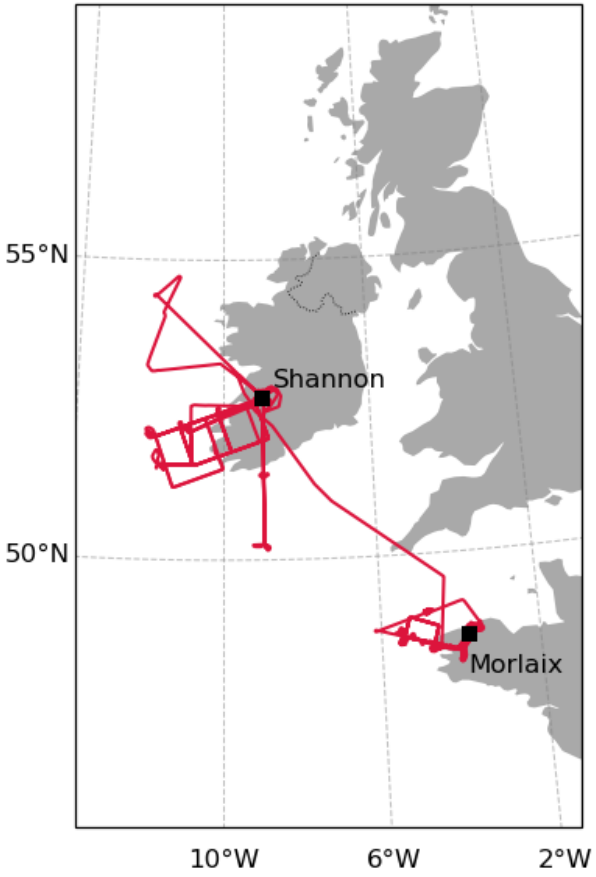
Cessna F406
18 flights, 51 h



125 KITsonde releases (379 dropsondes):

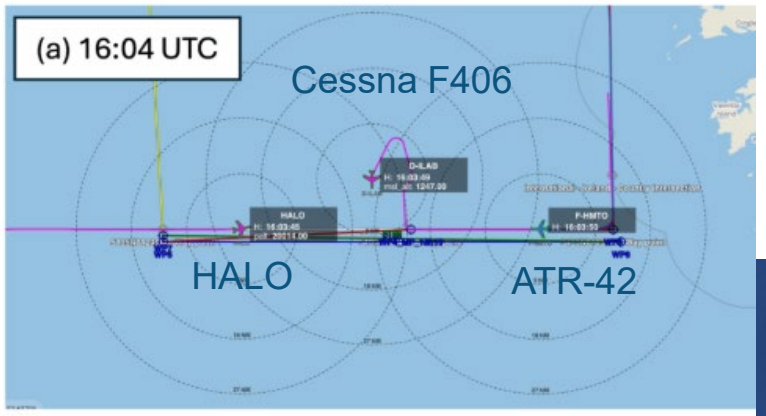
- Sent to GTS and assimilated in operational NWP (ECMWF & DWD)
- See presentation by Magdalena Kracheletz



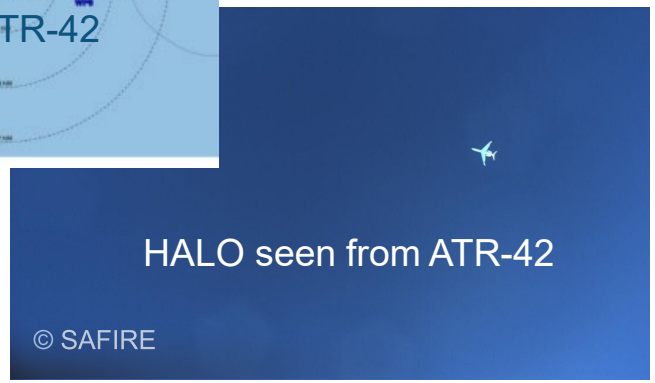


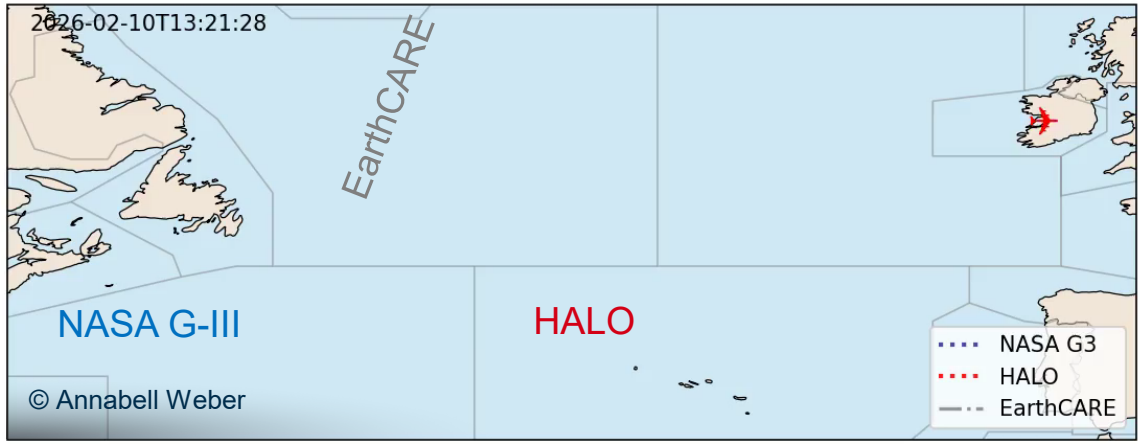
Airborne Observations in Jan/Feb 2026
Coordinated Multi-Platform Measurements

- Coordinated flight legs (HALO – ATR-42 – Cessna F406)
- Ground stations overflights (KITcube, Valentia Observatory)
- EarthCARE satellite under-flights
- Coordinated flight with NASA G-III (NURTURE)
- Contribution to GARRP coordination



IOP "Fermoy" (13 Feb 2026)

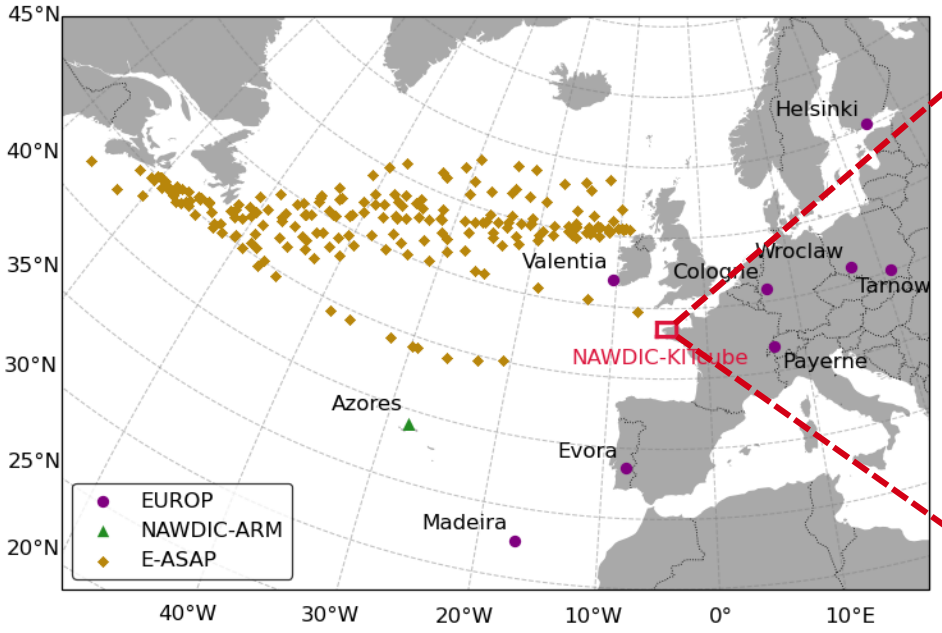




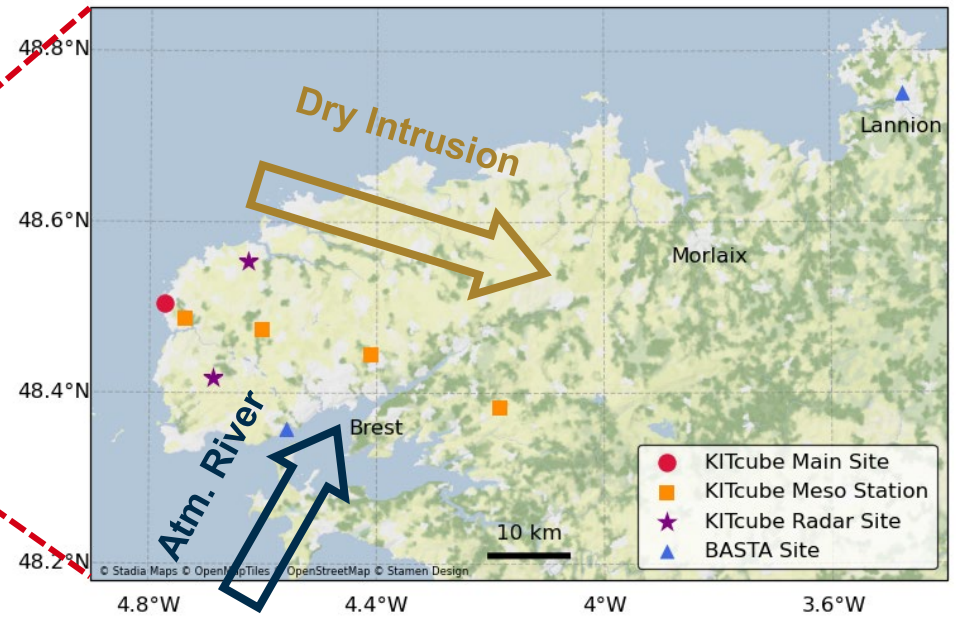
IOP "Ballina" (10 Feb 2026):

Ground-Based Observations
Synoptic Background & Mesoscale Network

Radiosonde launches during NAWDIC IOPs



NAWDIC-KITcube in Brittany (France)
Oct 2025 – Mar 2026



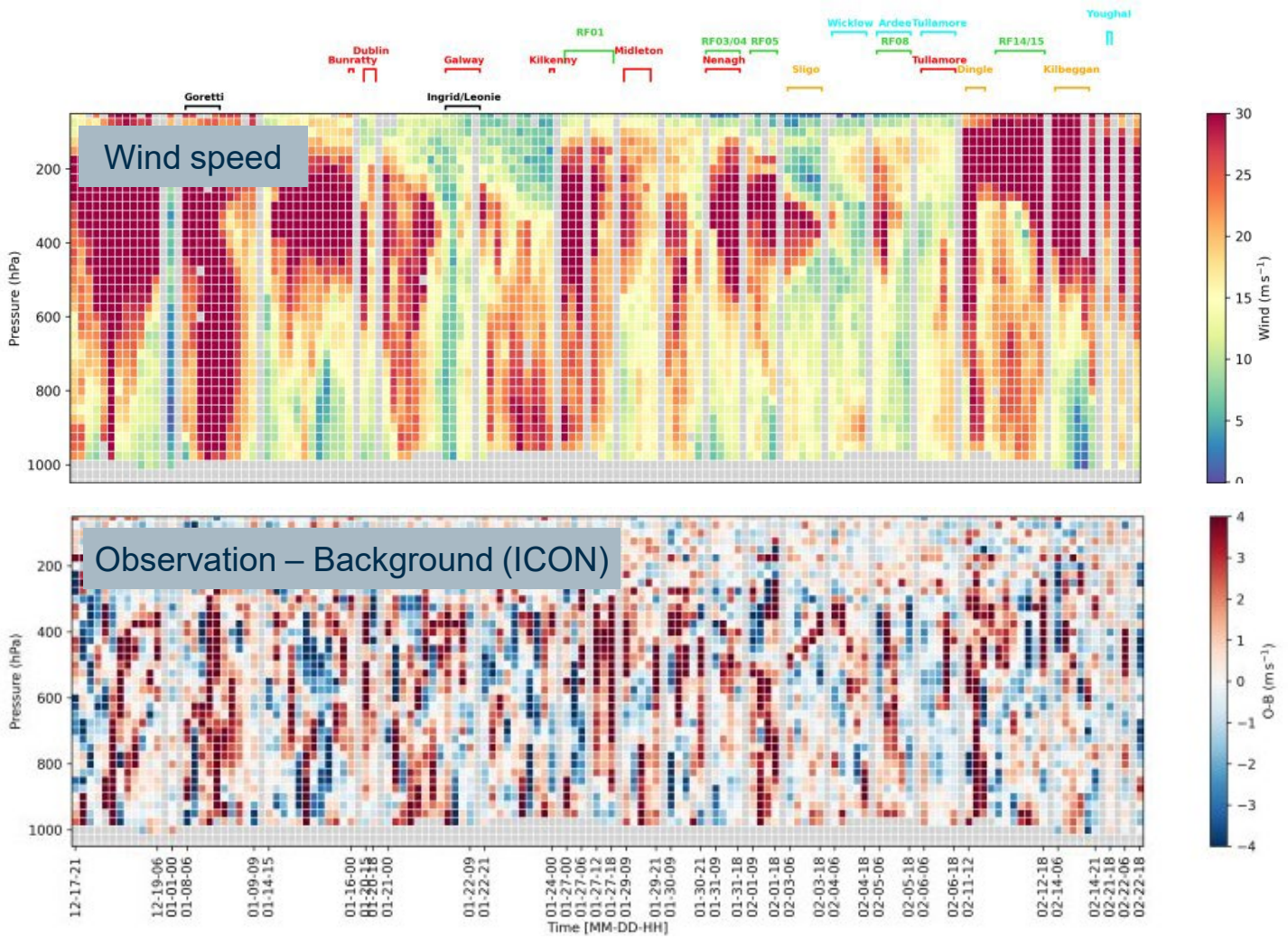
- **EUROP**: European universities and weather services

→ see poster by Alexandre Ramos et al.

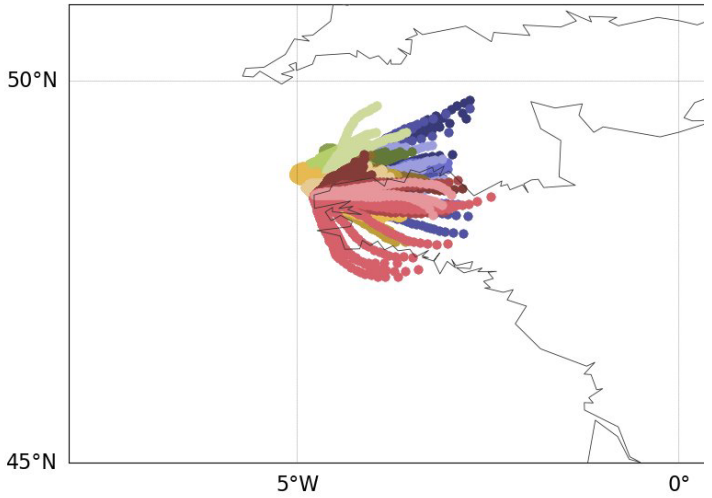
- **E-ASAP:** Merchant ships (EUMETNET)
- **NAWDIC-ARM:** ARM-ENA facility on the Azores
- **NAWDIC-KITcube:** Mobile observation facility of KIT

Observation foci:
1. Transition of high-wind features from ocean to land
2. Vertical structure and temporal evolution of DIs, cold fronts, and cloud heads

Ground-Based Observations
Assimilation of Radiosonde Measurements



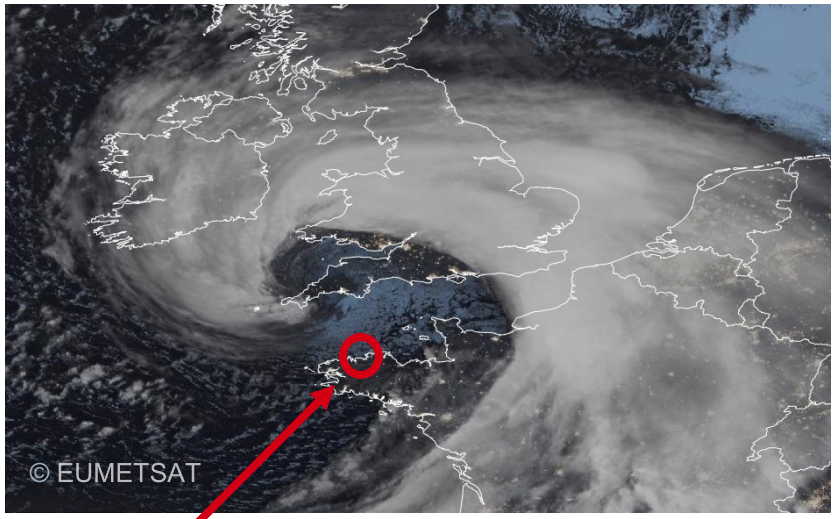
150+ KITcube radiosonde profiles assimilated in operational NWP (ECMWF & DWD)



Figures: Viktoria Dürlich

NAWDIC Highlights
Strong Wind Events

Storm "Goretti" (8 Jan 2026)



BASTA radar at Lannion

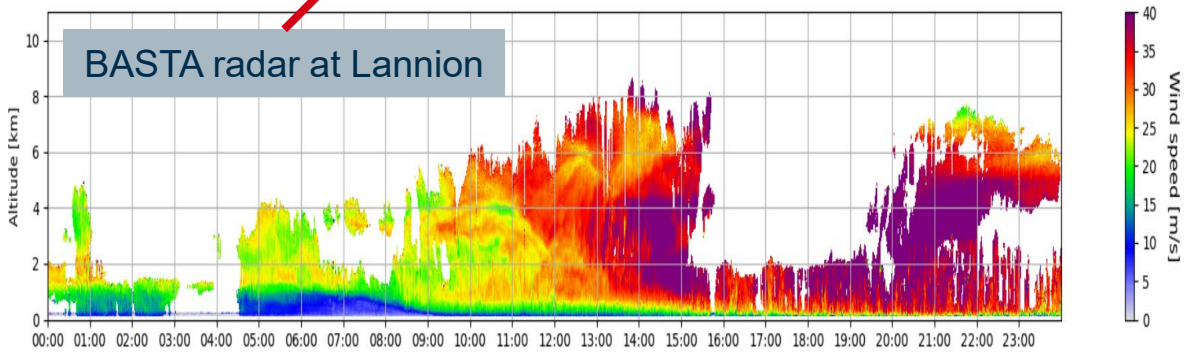
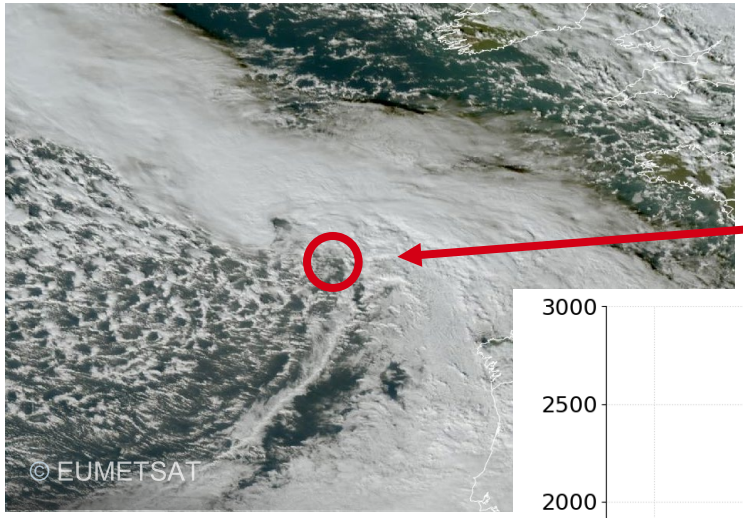
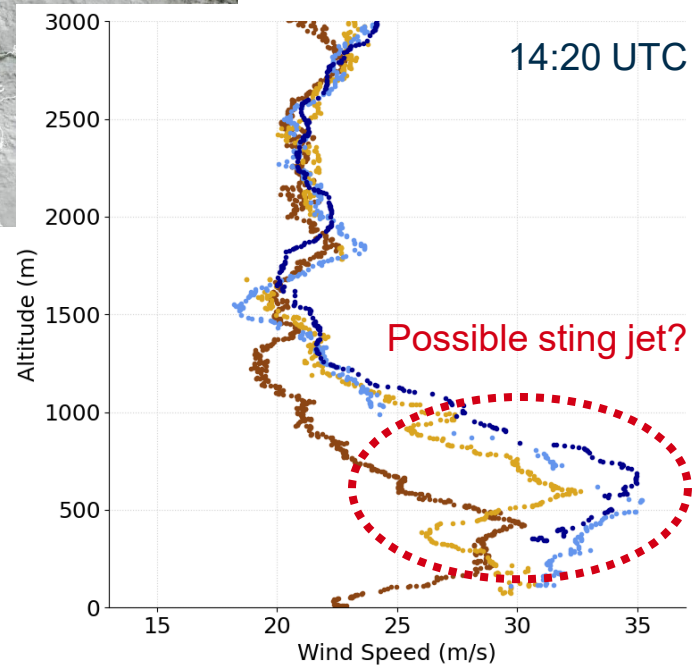


Figure: Camille Jarrousse

Storm "Ingrid" (22 Jan 2026, IOP "Galway")



KITsonde profiles from HALO



NAWDIC Highlights

Quasi-Lagrangian Observations of DI Inflow & Outflow

IOP "Nenagh" (31 Jan 2026): Previous DI outflow air becomes WCB inflow

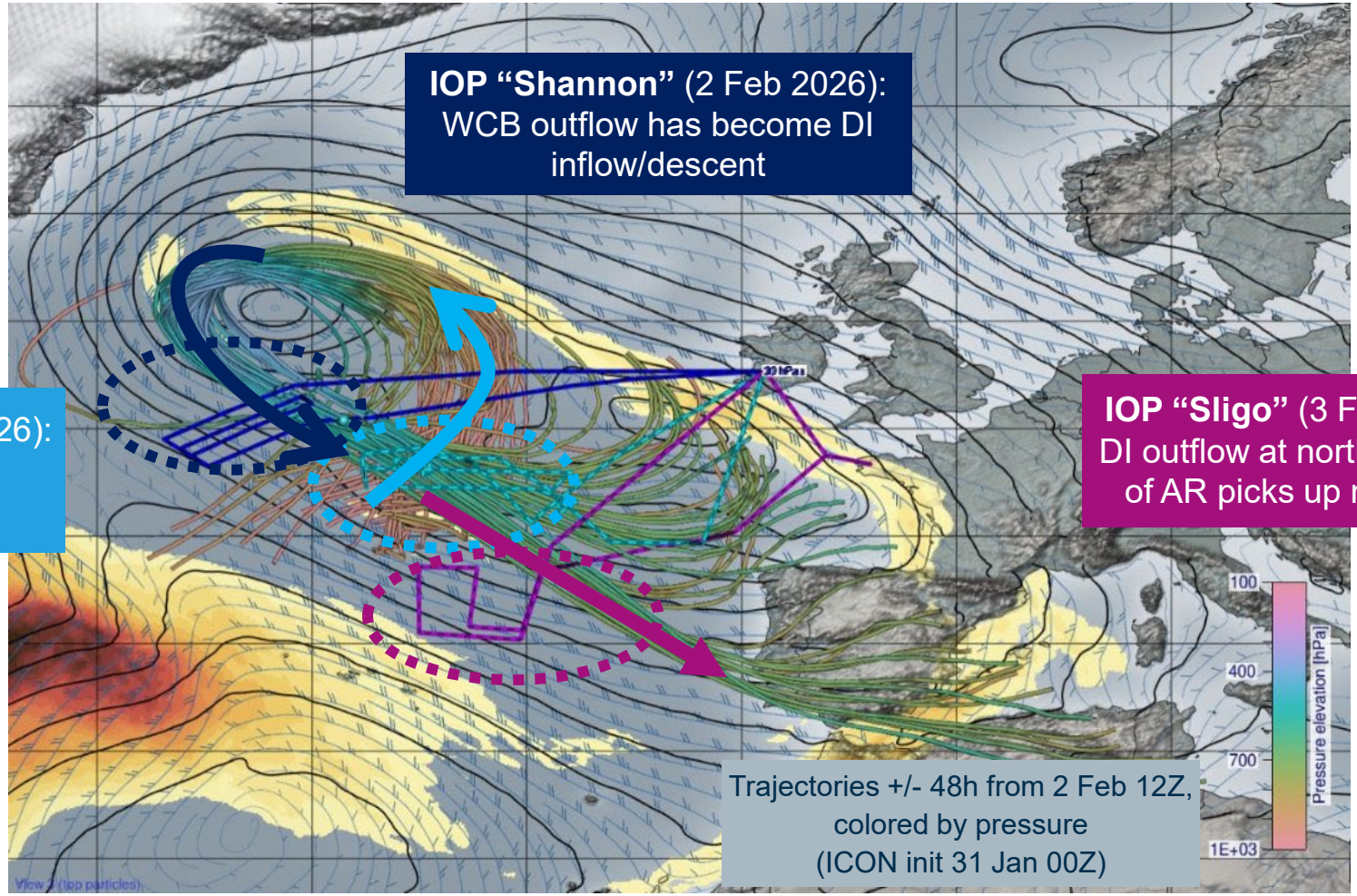


Figure: Christoph Fischer/Met.3D

See Quinting et al. (2026), BAMS

NAWDIC Highlights

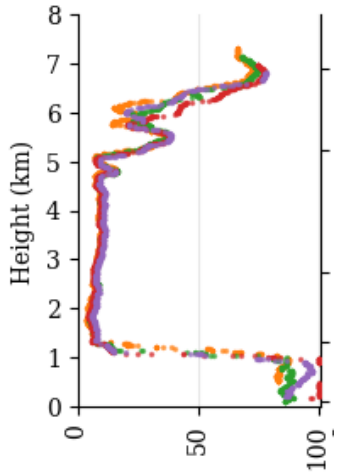
Mesoscale Variability Across a Cold Front

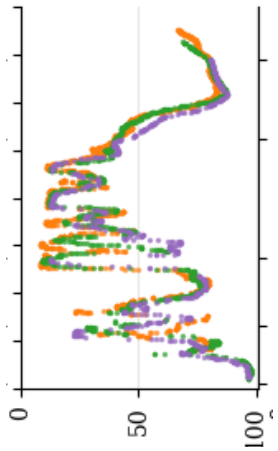
IOP “Killaloe” (17 Feb 2026)

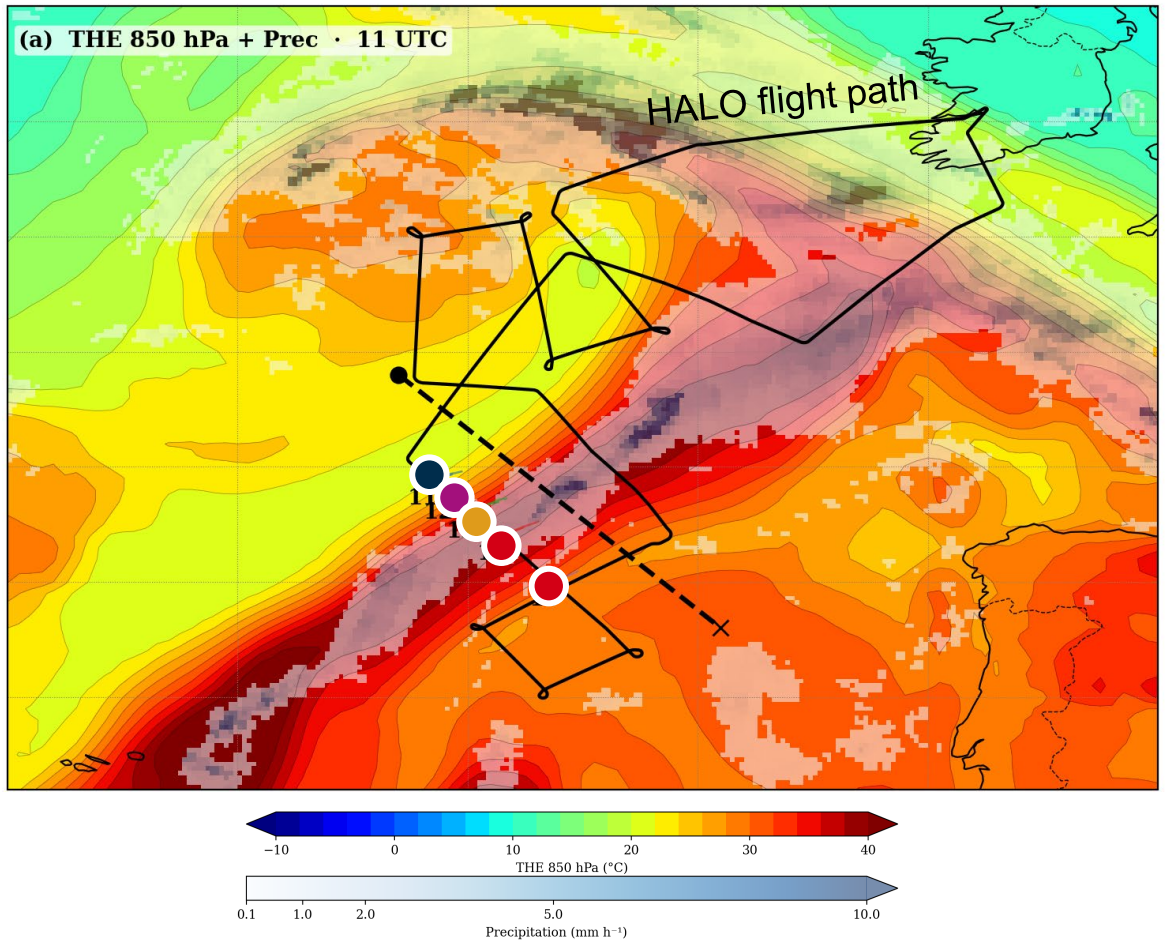
Cold sector / DI outflow

RH profiles from KITsonde releases

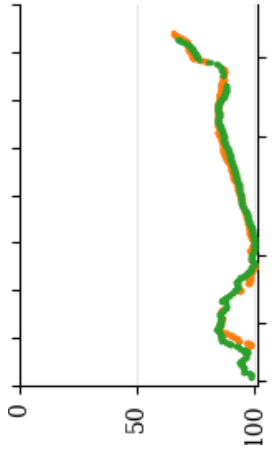
DI – CF interface



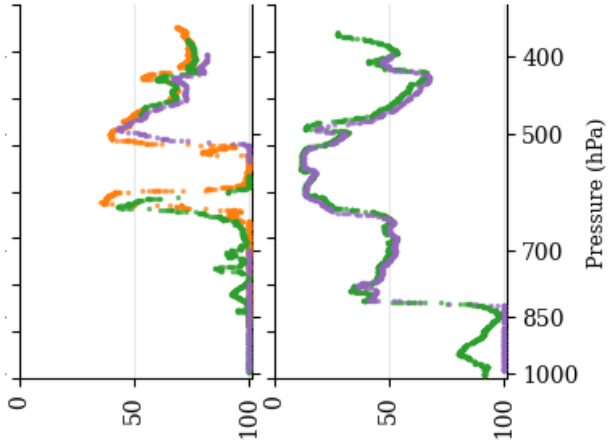




Precipitation



Warm sector



Figures: Kam Lam Yeung

Summary & Outlook

- NAWDIC was successfully conducted in winter 2025/2026.
- Focus on multi-scale dynamics of North Atlantic winter storms leading to high-impact weather
- Coordinated aircraft and ground-based observations sampled several examples of DI airstreams, moisture cycling, frontal systems, ARs, and strong wind events.
- Ongoing analysis on added value of assimilated campaign observations for NWP and improvement of model deficiencies.
- **Access to (preliminary) data via Earth Data Portal: Link on NAWDIC website → Data**

More NAWDIC-related presentations:
- Wed at 15:50h: **Magdalena Kracheletz**
- Thu at 14:40h: **Annabell Weber**
- Thu at 16:10h: **Andreas Schäfler**
- Poster by **Alexandre Ramos** et al.

A big “Thank you” to all partners and supporters of NAWDIC!

NAWDIC Workshop 2026
12 – 14 Oct in Karlsruhe & online
→ Register by 15 July!

www.nawdic.kit.edu

NAWDIC 2026

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