DIE TEAMX-MESSKAMPAGNE IN DEN ALPEN – ÜBERBLICK UND ERSTE ERGEBNISSE

Jahrestreffen Schwerewelle, 28.02.2026, DLR Göttingen

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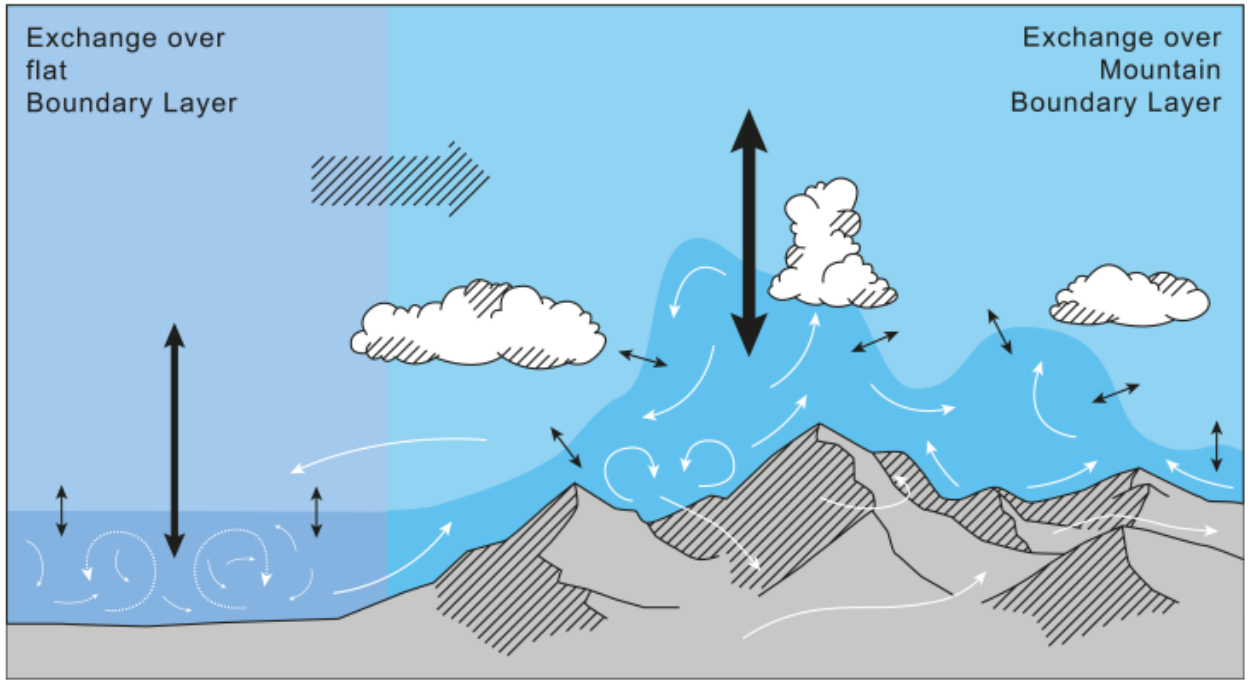
TEAMx - Überblick

Mountain Boundary Layer (MoBL)

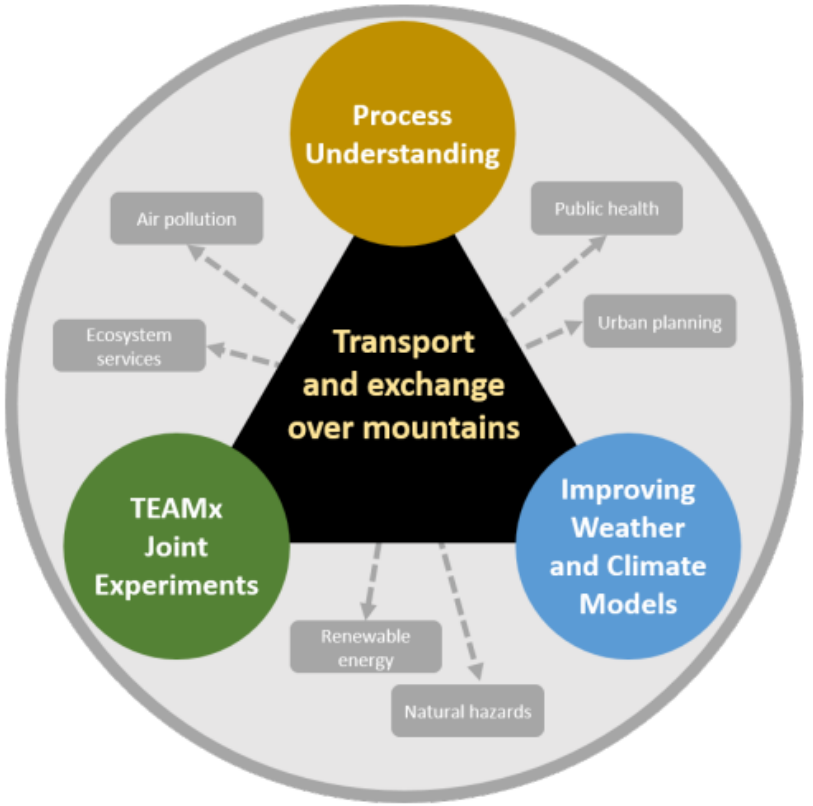


- Wide range of scales
- Process interact
- 3D spatial variability
- Processes that are difficult to measure/model
- Questionable applicability of measurement/modeling techniques

TEAMx - Überblick

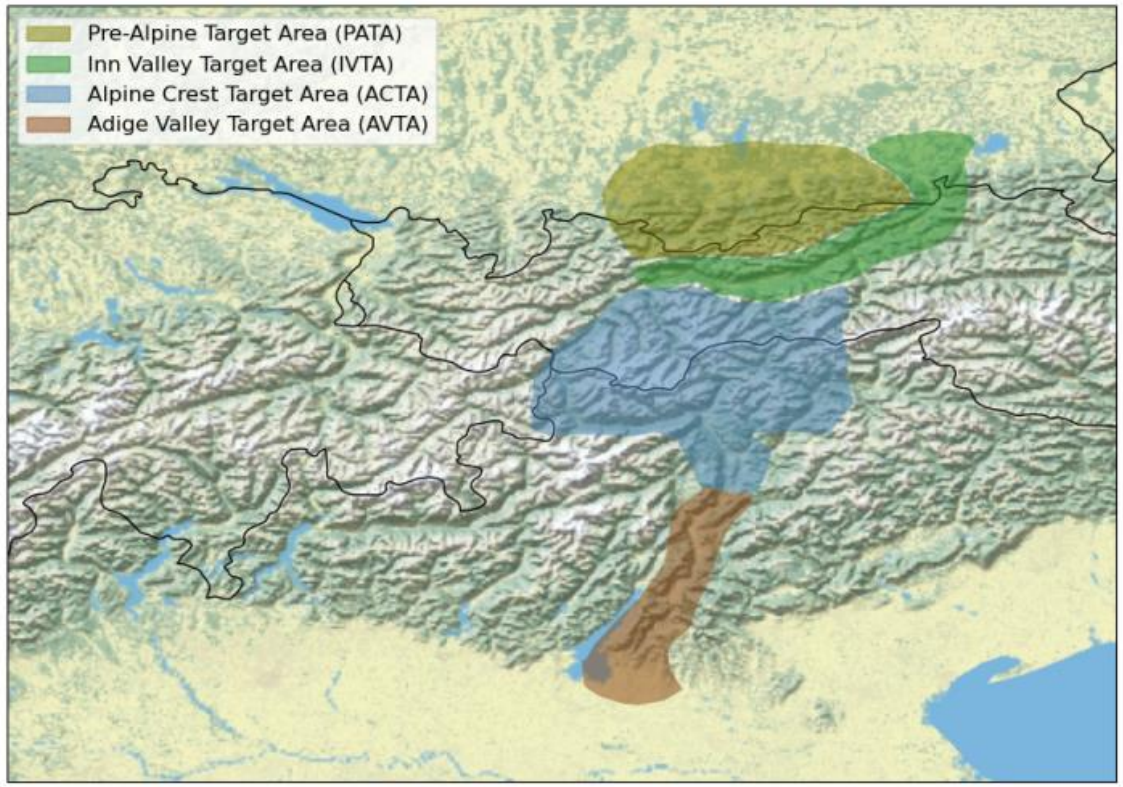
TEAMx Goals

- Improving our understanding of transport and exchange processes between the surface and the atmosphere and within the atmosphere
- Evaluating and improving weather and climate models over complex terrain
- Collecting a unique dataset to study the transport and exchange processes
- Supporting weather and climate service providers



TEAMx - Überblick

TEAMx Observational Campaign (TOC)

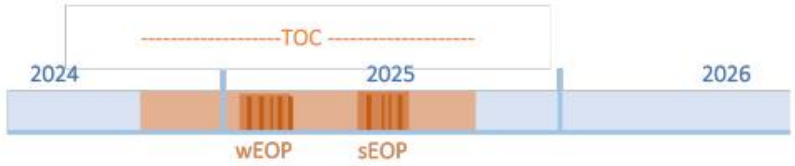


North–south transect through the Alps

- Pre-Alpine Target Area
- Inn Valley Target Area
- Alpine Crest Target Area
- Adige Valley Target Area

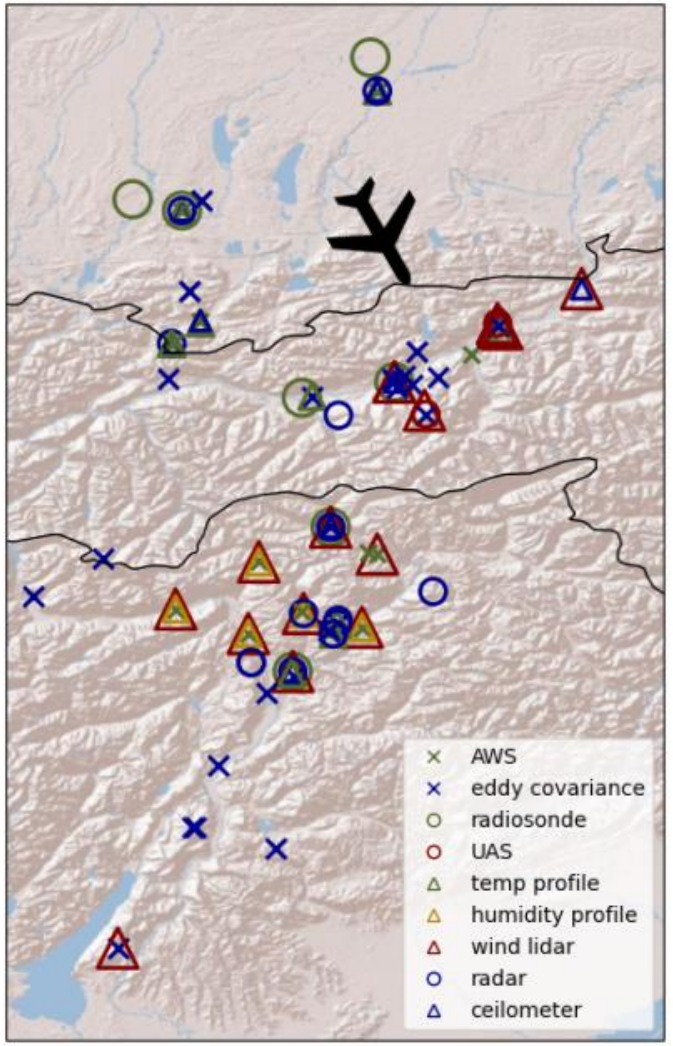
TEAMx - Überblick

TEAMx Observational Campaign (TOC)



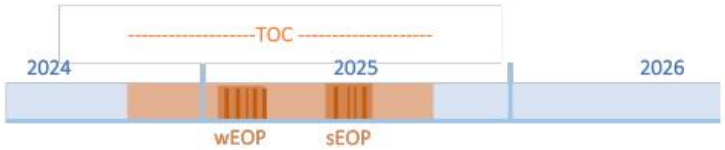
Extended Observational Periods

- Focus on individual processes
- Winter EOP (wEOP): 20 Jan–28 Feb
- Summer EOP (sEOP): 16 Jun–25 Jul



TEAMx - Überblick

TEAMx Observational Campaign (TOC)



Extended Observational Periods

- Focus on individual processes
- Winter EOP (wEOP): 20 Jan–28 Feb
- Summer EOP (sEOP): 16 Jun–25 Jul
- IOPs targeting specific weather conditions

3 research aircraft

- NCAS FAAM BAe146
- DLR Cessna Caravan
- TU Braunschweig Cessna F406

Photo: D. Anderson

IOP overview (24 IOPs in total)

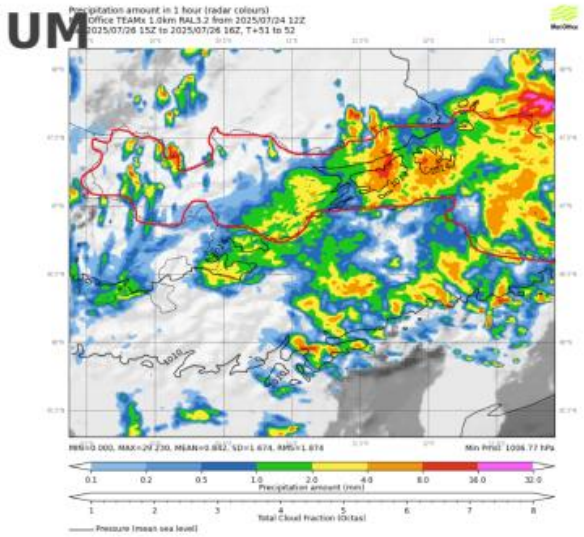
IOP type	Abbr.	IOP count	IOP number
Gravity waves	GW	2	IOP12, IOP22
Convection - ACTA	CON	8	IOP04, IOP08, IOP09, IOP11, IOP19, IOP21, IOP22, **IOP23**
MoBL (thermal) - IVTA	MoBL Inn	9	IOP07, IOP10, IOP15, IOP16, IOP18, IOP19, IOP20, IOP21, IOP22
MoBL (thermal) - ACTA	MoBL AC	8	IOP03, IOP06, IOP13, IOP14, IOP16; IOP17, IOP18, IOP21
MoBL (weak dynamic) - IVTA	MoBL weak	1	IOP13
Slope winds - AVTA	SLOw	2	IOP02, IOP05
Valley-exit jets - IVTA	JETx	2	IOP01, IOP18

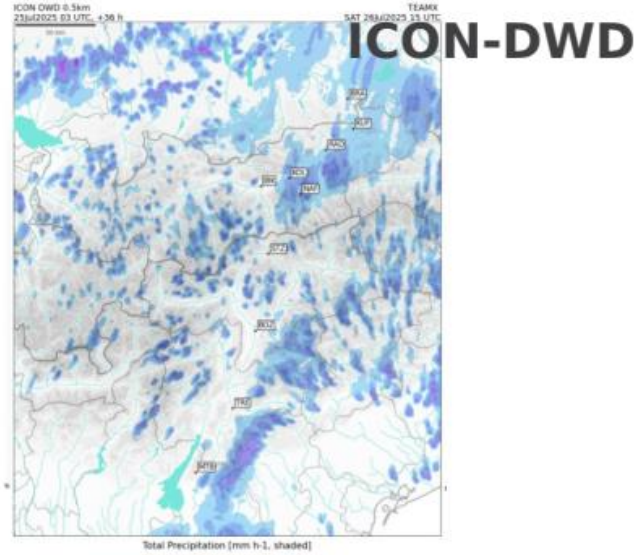
Modelldaten

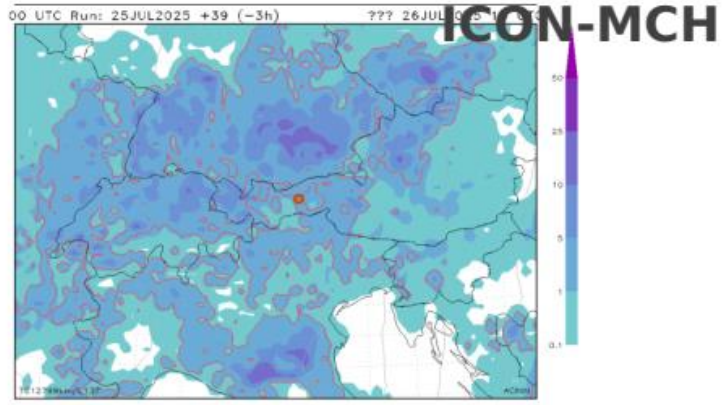
High-resolution NWP forecasts

Daily forecasts supported by

- 500-m ICON runs from DWD
- 1-km ICON runs from Meteo Swiss
- 1-km UM runs from the Met Office



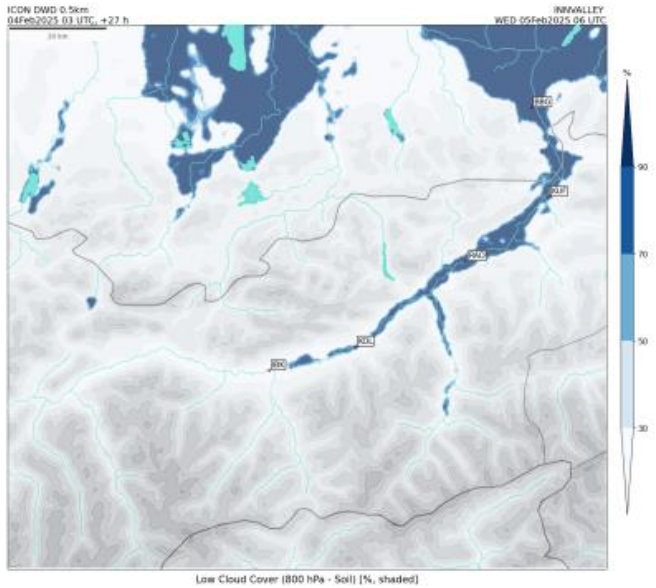




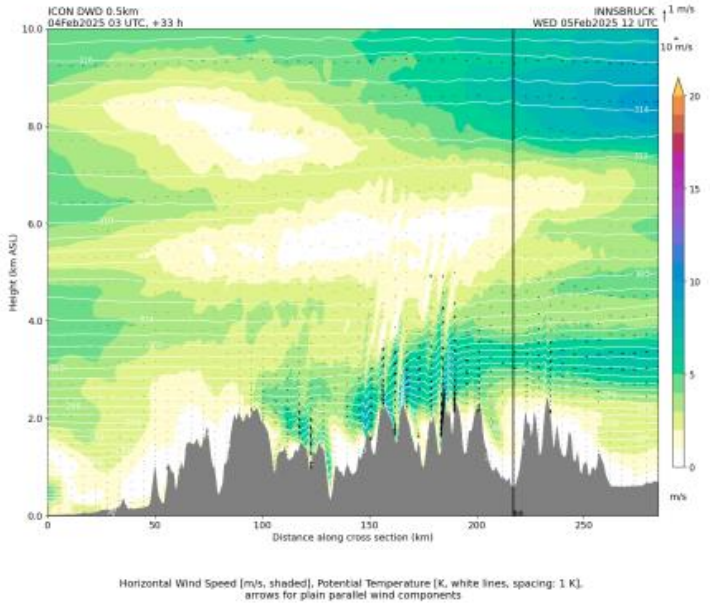
Modelldaten

High-resolution NWP forecasts

500-m DWD ICON runs during the wEOP for daily weather forecasts



Low-level clouds in the Inn Valley



Wind speed across the Alps (S–N)

Diese Vorhersage ist im experimentellen Modus weiterhin verfügbar: TEAMx Forecasts

Bodenbasierte Messungen

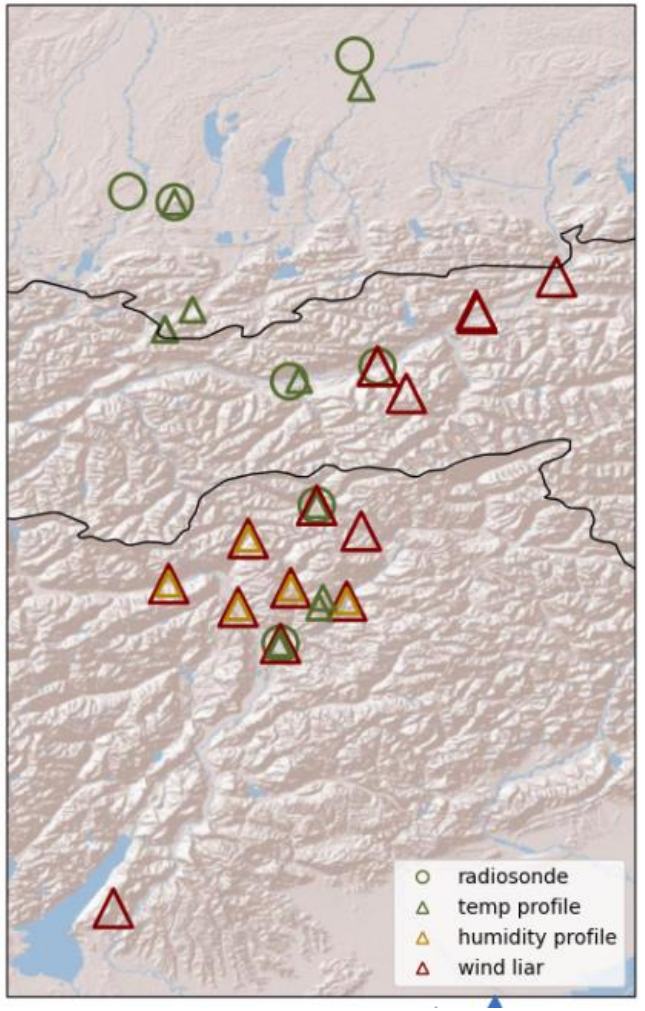
sEOP: MoBL + thermal winds

Spatially distributed vertical profiles

Radiosoundings

T/RH profilers

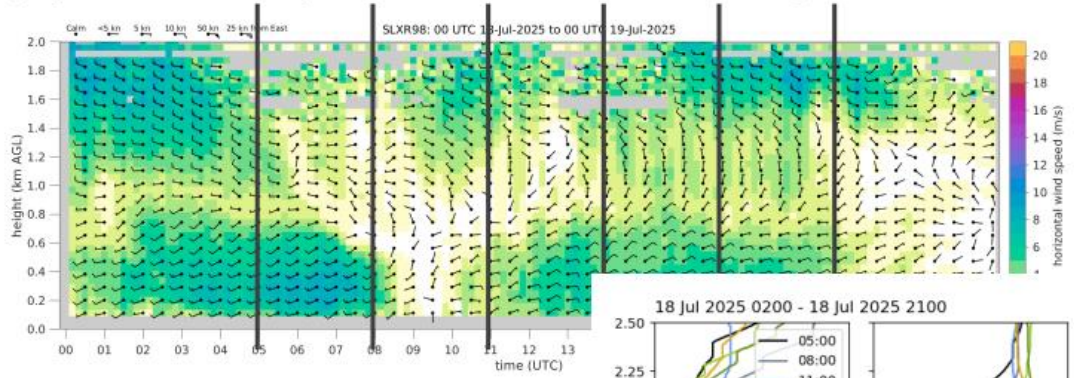
Wind lidars



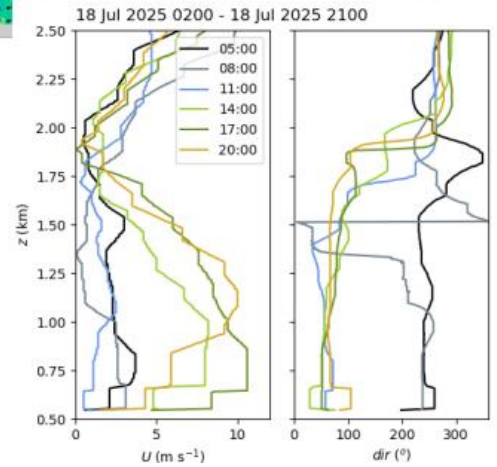
Bodenbasierte Messungen

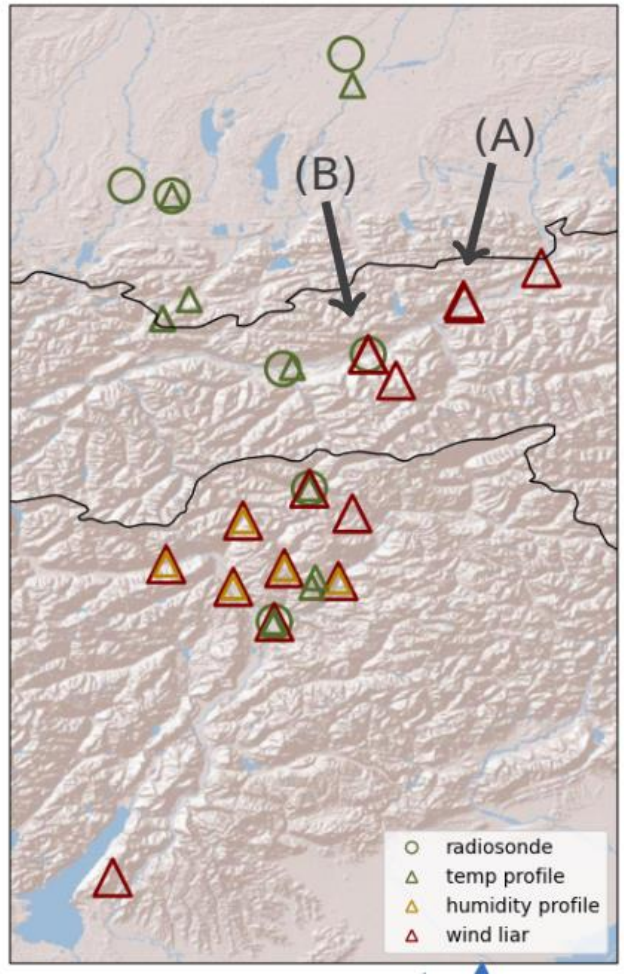
sEOP: MoBL + thermal winds

(A) Wind lidar (*Credit: Alexander Gohm*)



(B) Radiosounding





DLR CESSNA

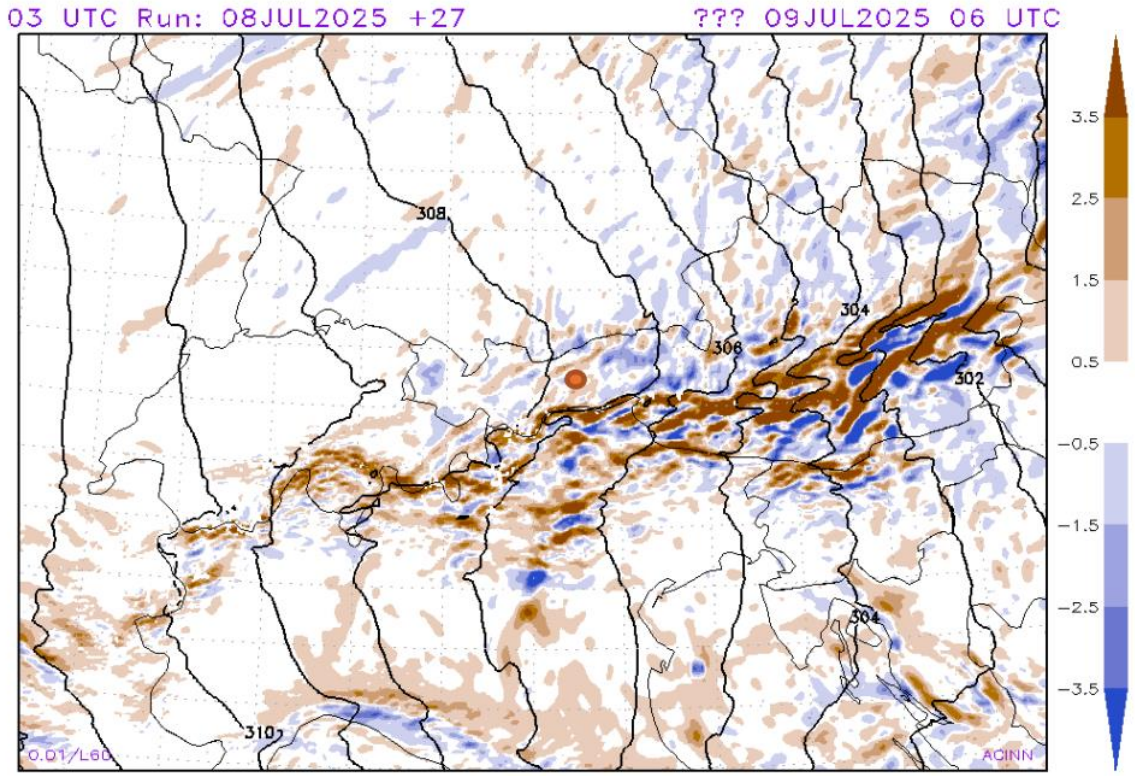
Christian Mallaun

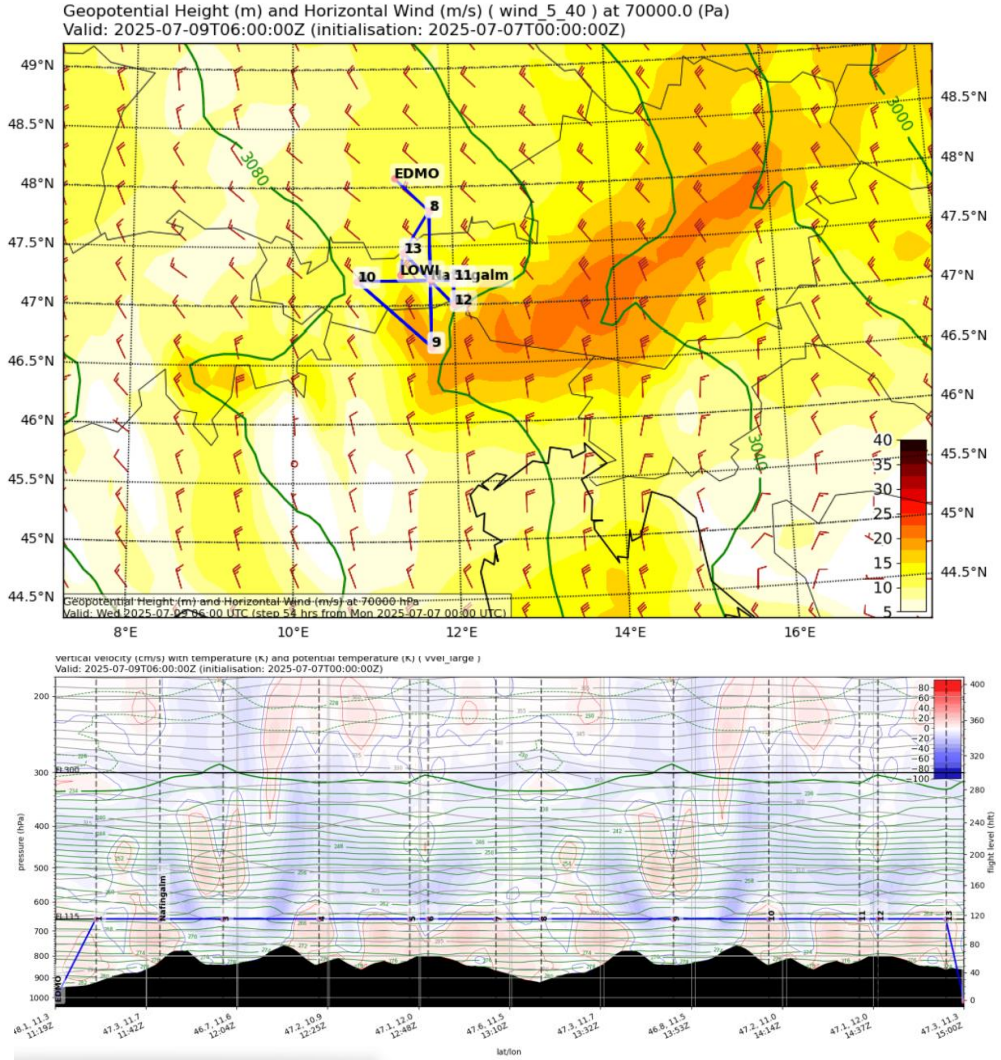
IOPs mit Schwerewellen

Date	IOP type	Aircraft	Flight times / UTC	
9 July	Gravity Wave 12 (ACTA, IVTA)	DLR Cessna; FAAM	RF01: 0500-0826, RF02: 1111-1457; 1046-1437,	Cloudy, humid, cold, northerly flow
10 July	Gravity Wave 12 (ACTA, IVTA)	DLR Cessna; FAAM	RF03: 0624-1019, RF04: 1230-1608; 0708-1010, 1219-1535,	Cloudy, northerly flow, decreasing RH
20 July	Thermal MoBL 20 (IVTA), but gravity wave activity forecasted	DLR Cessna; TUBS Cessna; FAAM	RF13: 0700-1052, RF14: 1258-1655; 0712-0959,1347-1649; 0755-1100, 1253-1601	Partly cloudy increasing, stronger southerly flow
23 July	Gravity Wave and Thermal MoBL 22 (IVTA) Convection (ACTA)	DLR Cessna; TUBS Cessna; FAAM	RF17: 0659-1058, RF18: 1259-1546; 0932-1119; 0814-1132	Increasing cloud cover, northerly flow, high humidity, temperature inversion and dissipation. Afternoon thunderstorms (with hail)

GW IOP12, 09.07.2025

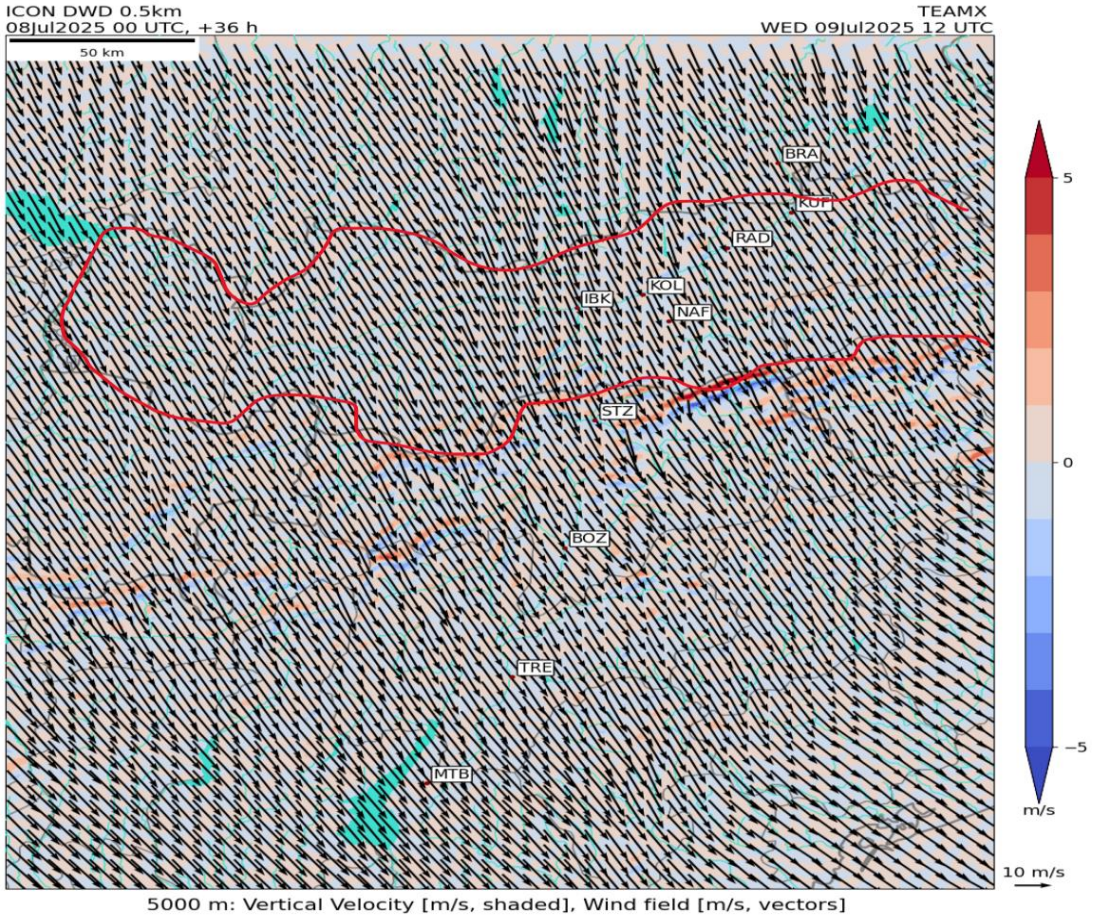
- Flight planning with model forecasts



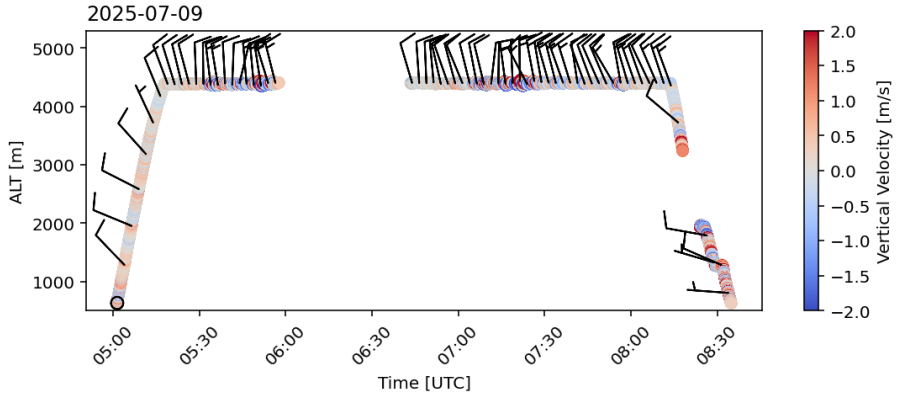


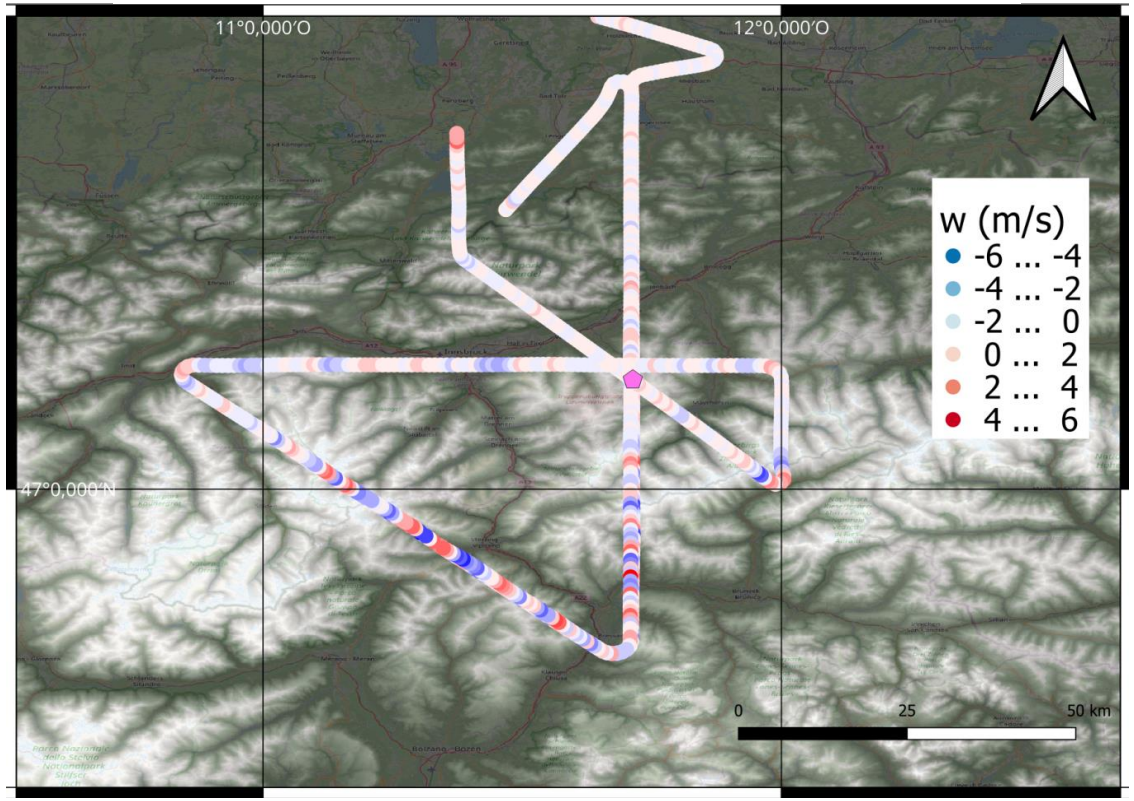
GW IOP12, 09.07.2025

- Validation with Cessna flight data



5000 m: Vertical Velocity [m/s, shaded], Wind field [m/s, vectors]





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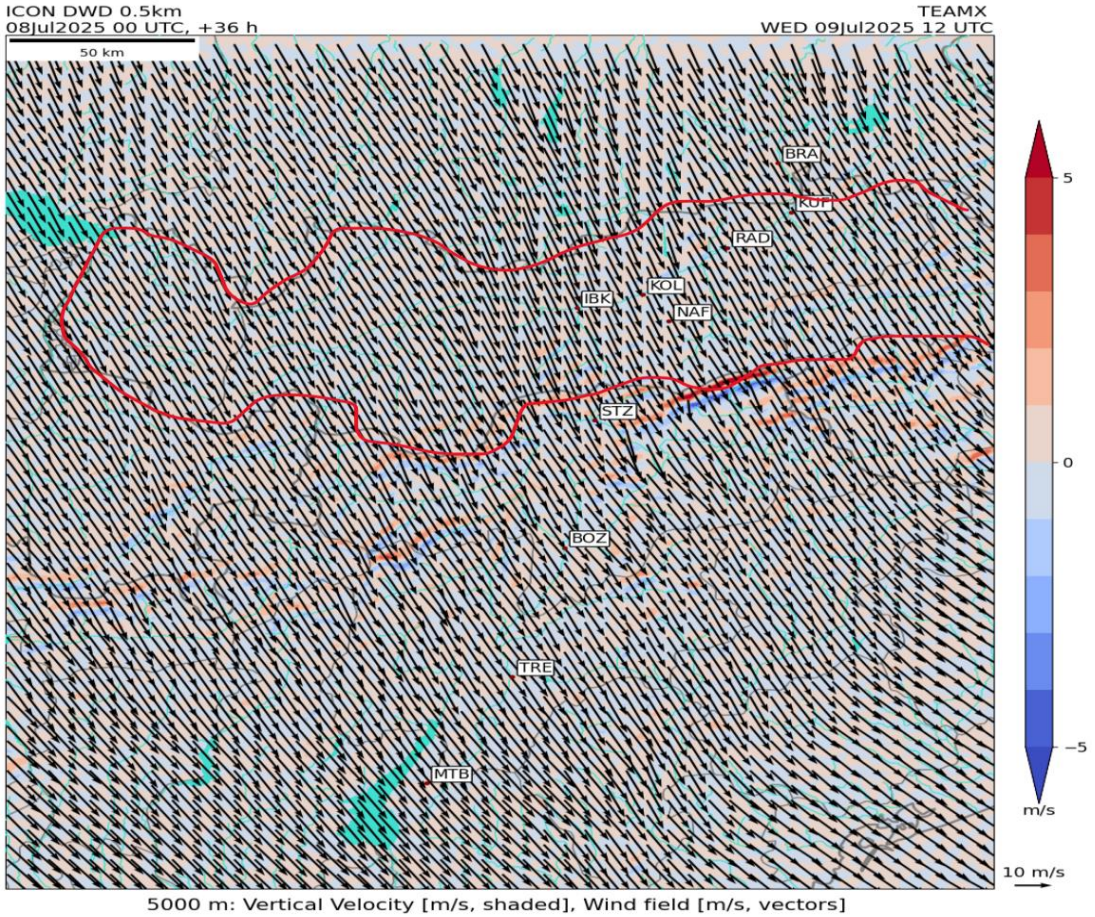

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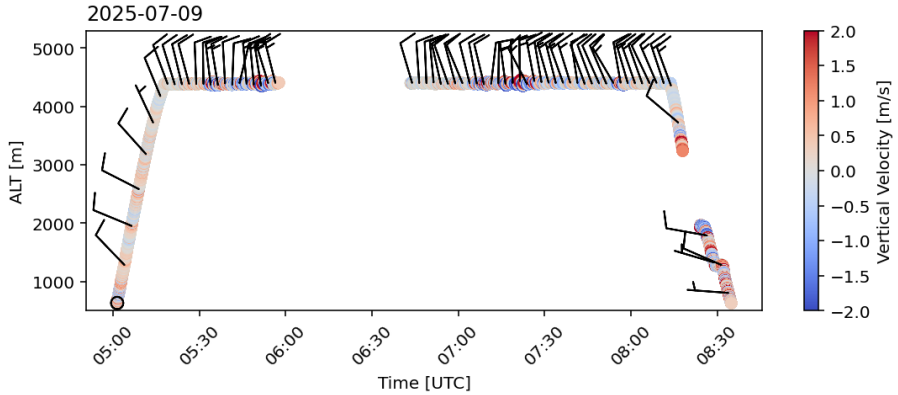
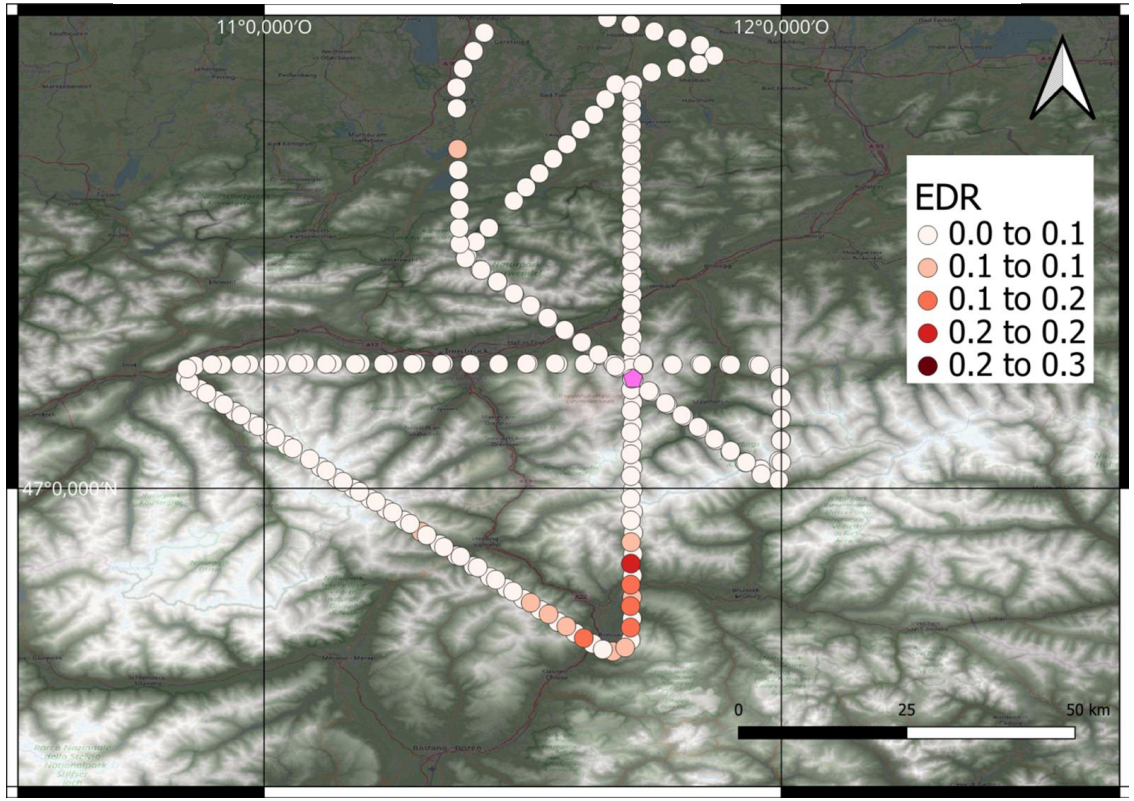




GW IOP20, 20. Juli 2025, Vorhersage 18. Juli

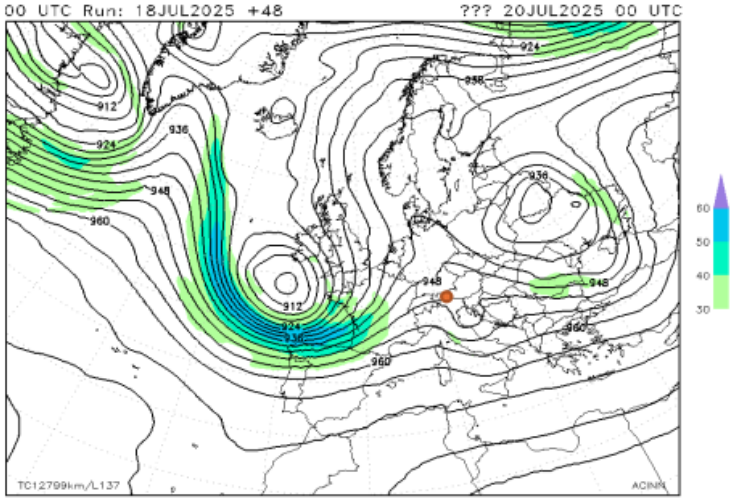
ECMWF IFS

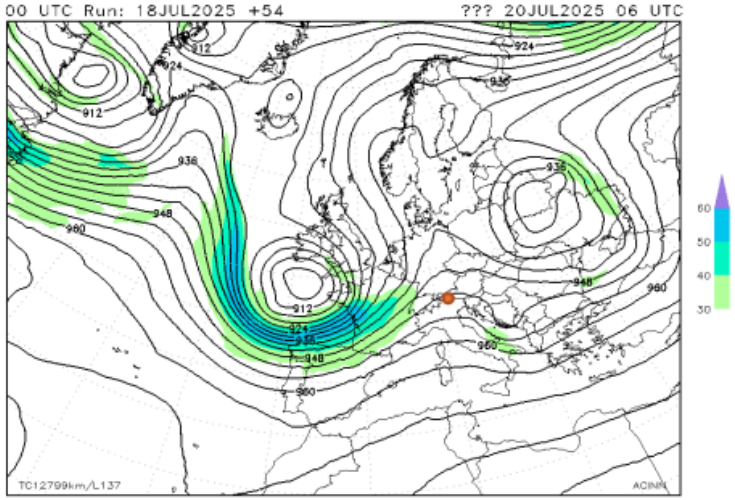
300 hPa, wind, Z

Sunday, 20 July 2025

00 UTC

Influence of a ridge

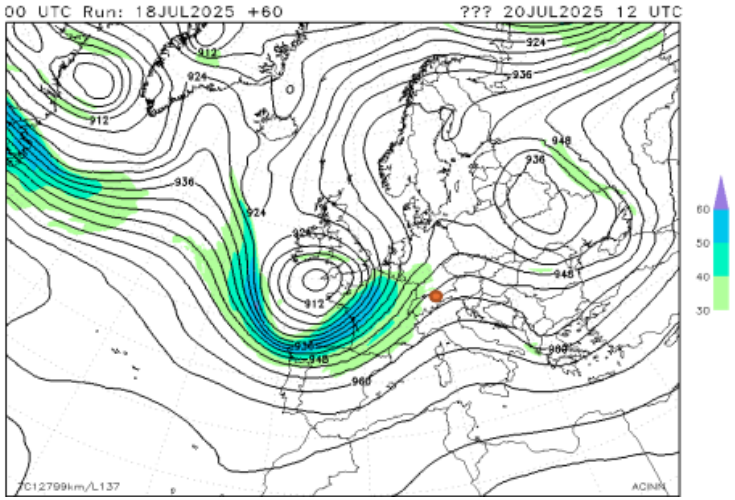


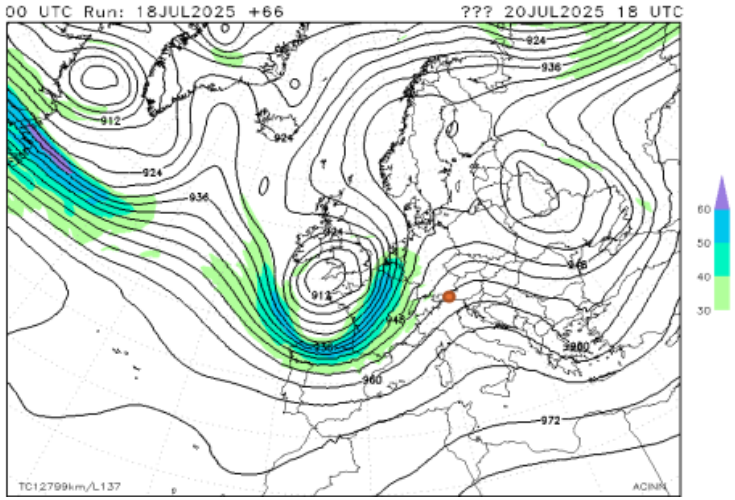


06 UTC

12 UTC

Shortwave trough





18 UTC

GW IOP20, 20. Juli 2025, Vorhersage 19. Juli

ECMWF IFS

300 hPa, wind, Z

Sunday, 20 July 2025

00 UTC

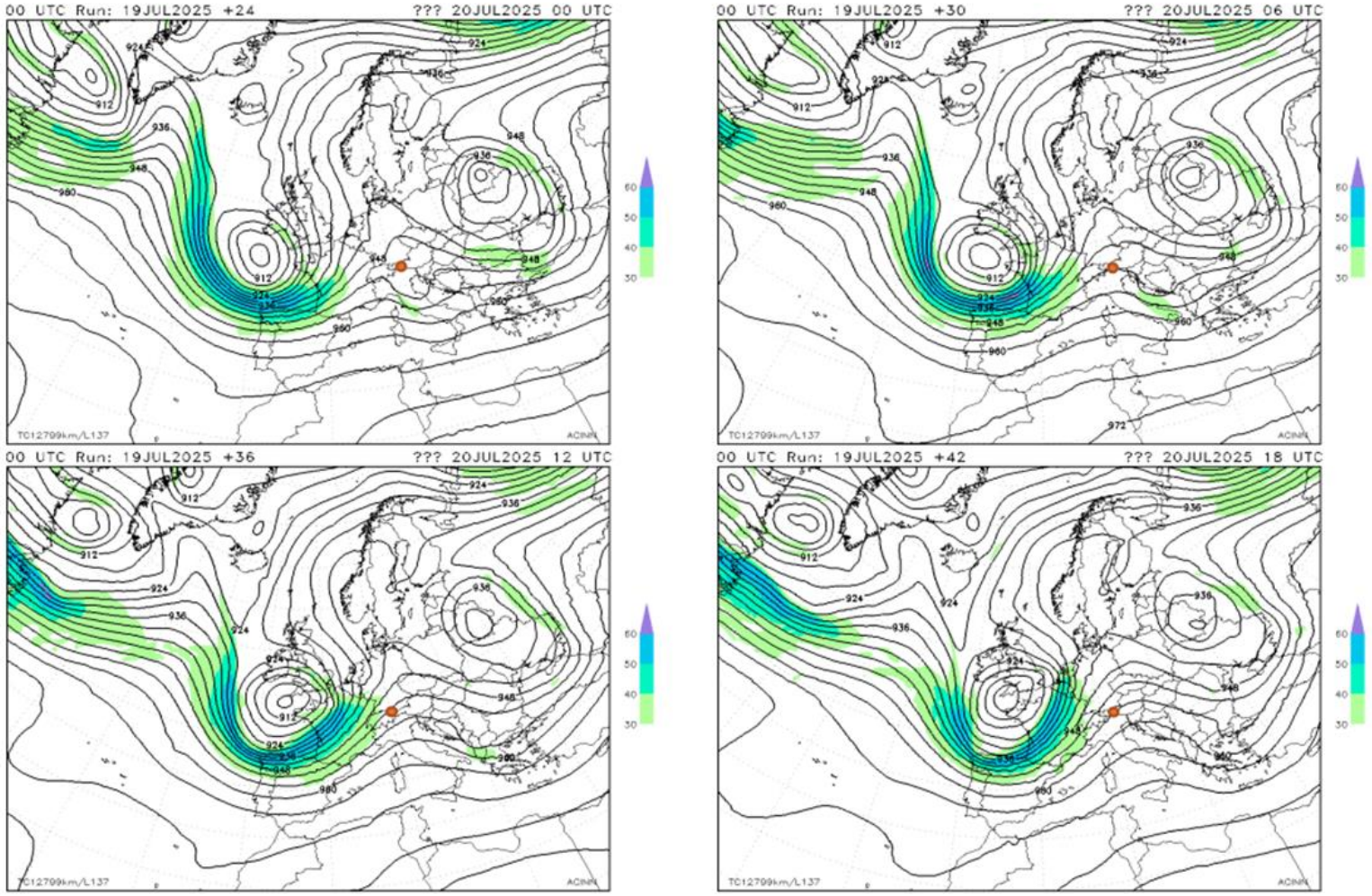
06 UTC

Influence of ridge

12 UTC

18 UTC

Behind ridge axis

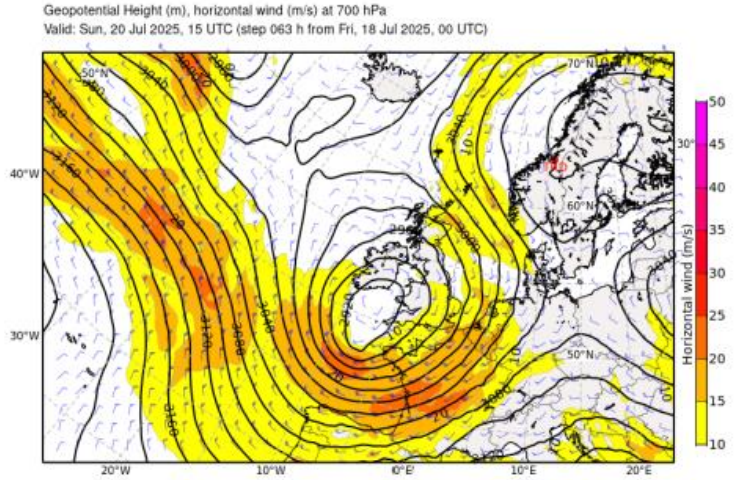


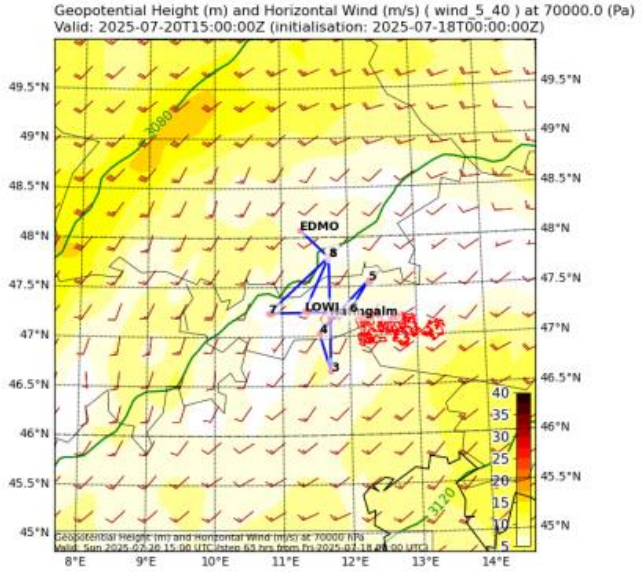
GW IOP20, 20. Juli 2025, Vorhersage 18. Juli

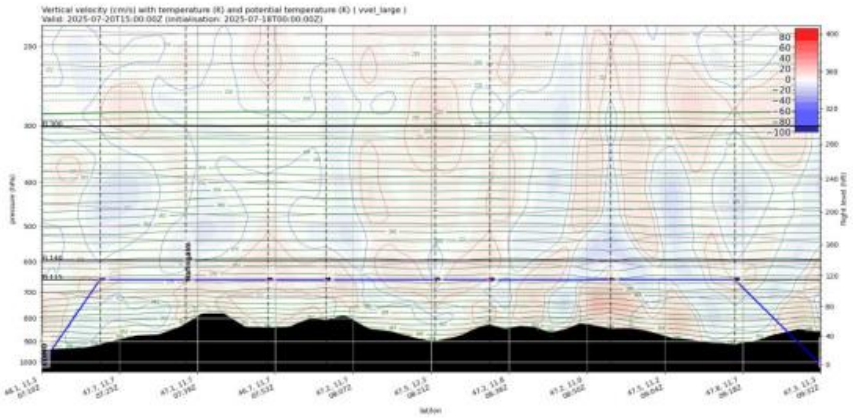
Outlook for 20. Jul 2025: south-westerly flow conditions
(flight pattern/cross section only once for better sideview)

700 hPa horizontal wind and geopotential height

15 UTC







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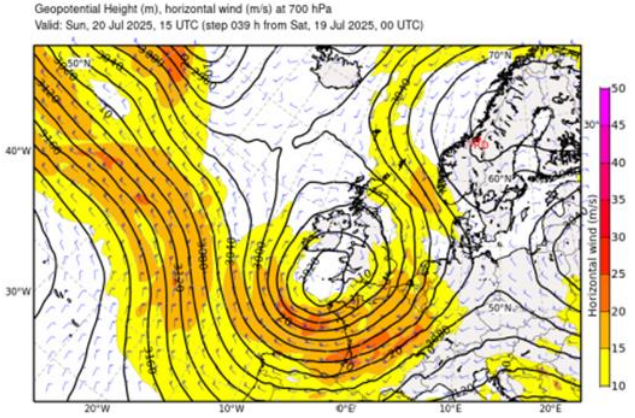
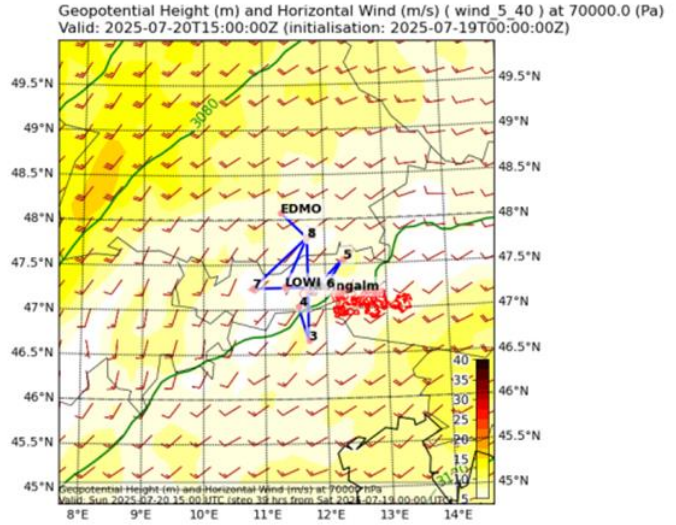
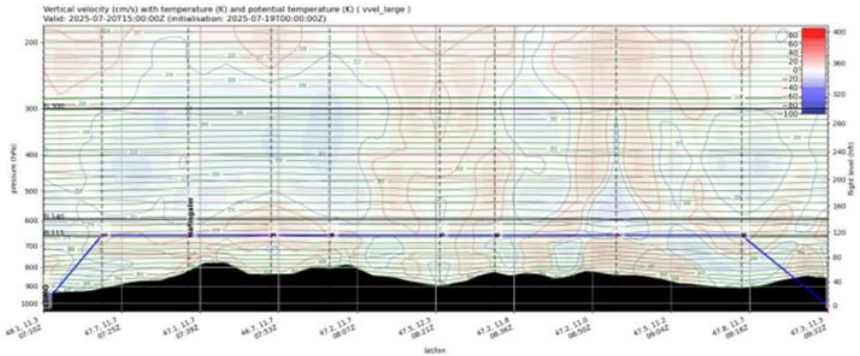






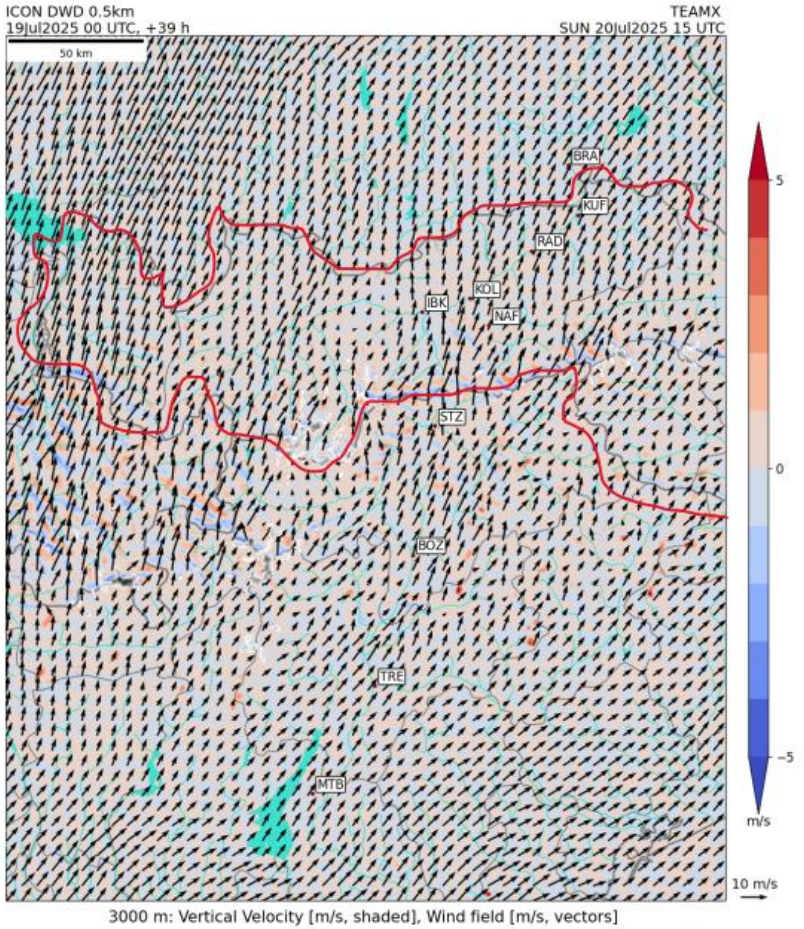
GW IOP20, 20. Juli 2025, Vorhersage 19. Juli

DWD ICON 500m

Sunday, 20 July 2025

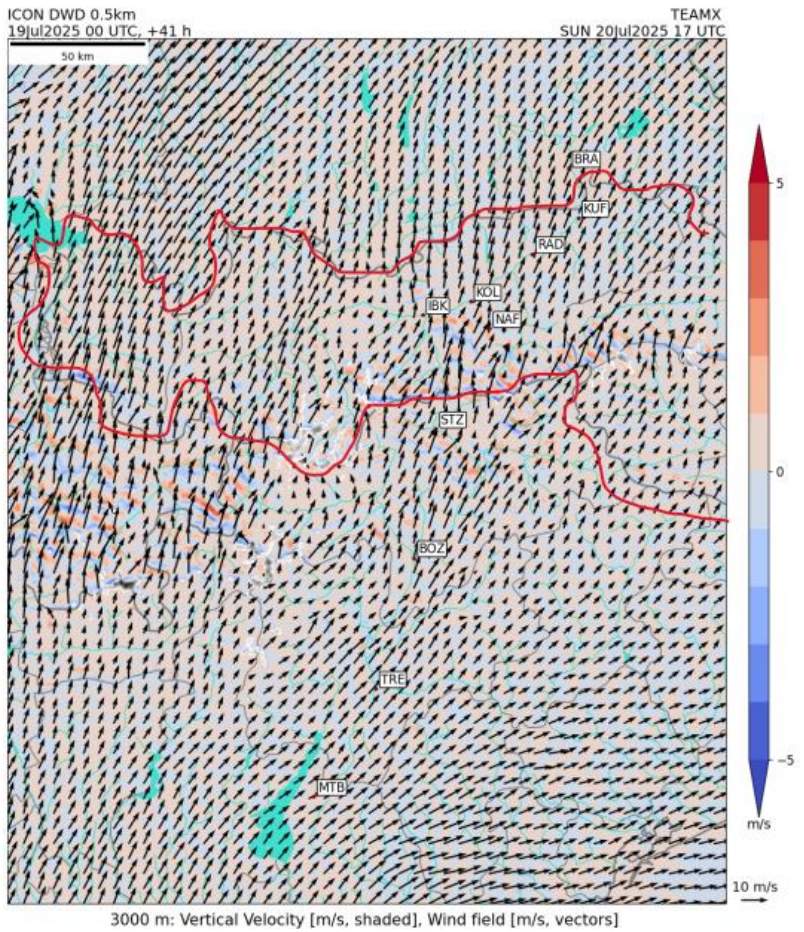
Vertical Wind 3 km

15 UTC



3000 m: Vertical Velocity [m/s, shaded], Wind field [m/s, vectors]

17 UTC



3000 m: Vertical Velocity [m/s, shaded], Wind field [m/s, vectors]

TEAMx

European Research Council
Established by the European Commission

DLR

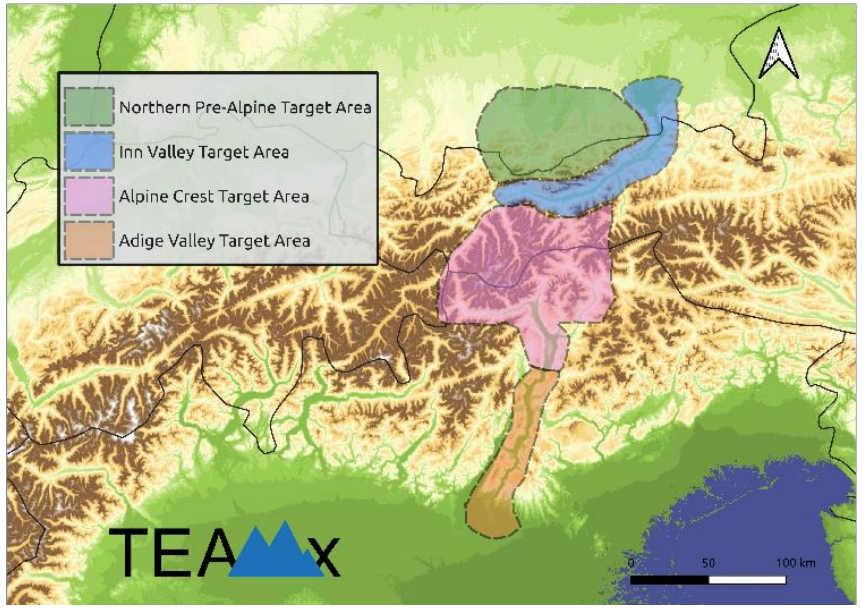
SWUF-3D DROHNENFLOTTE

https://establis-uas.eu

SWUF-3D DROHNENFLOTTE

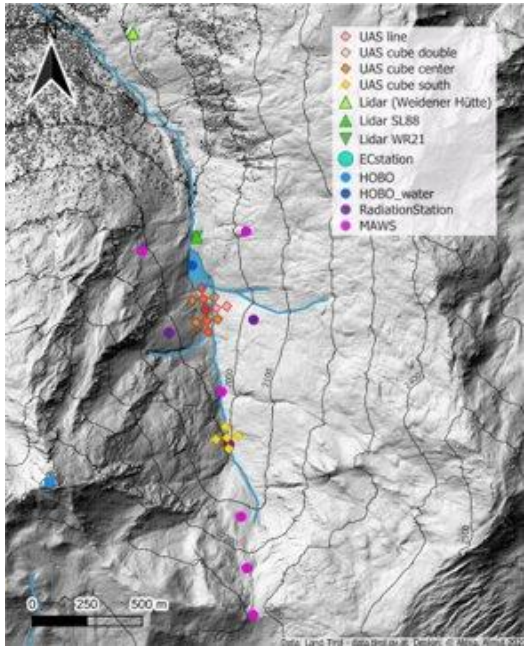
TEAMx Summer Observational Campaign

- June-August 2025
- Inn Valley Target Area
  - DLR and Tübingen UAS activities
- IOPs specific to valley flows, gravity waves, and deep convection



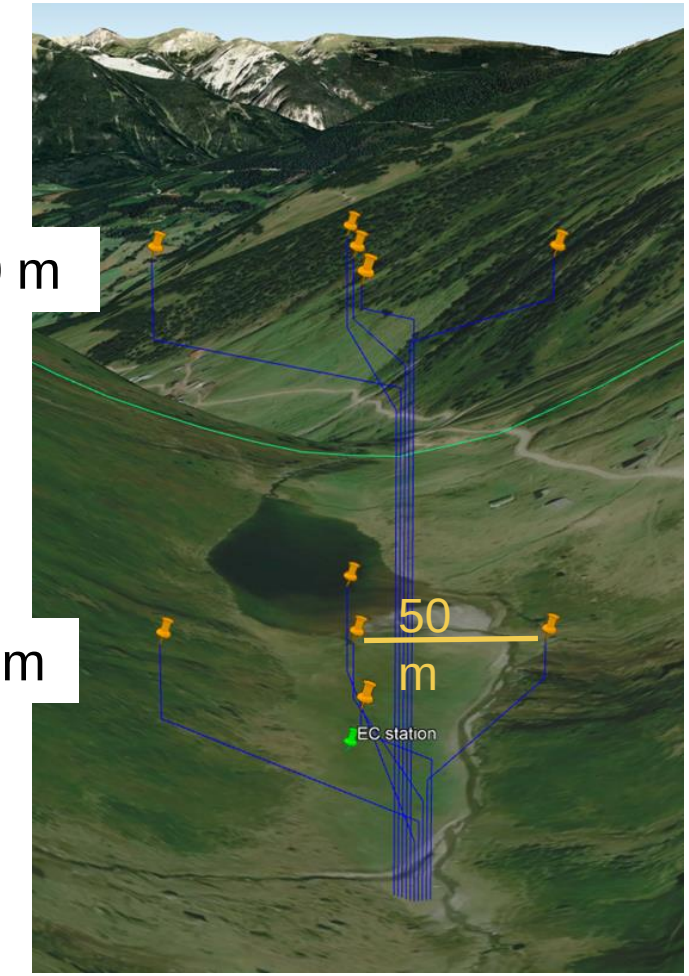
Inn Valley

Nafingalm



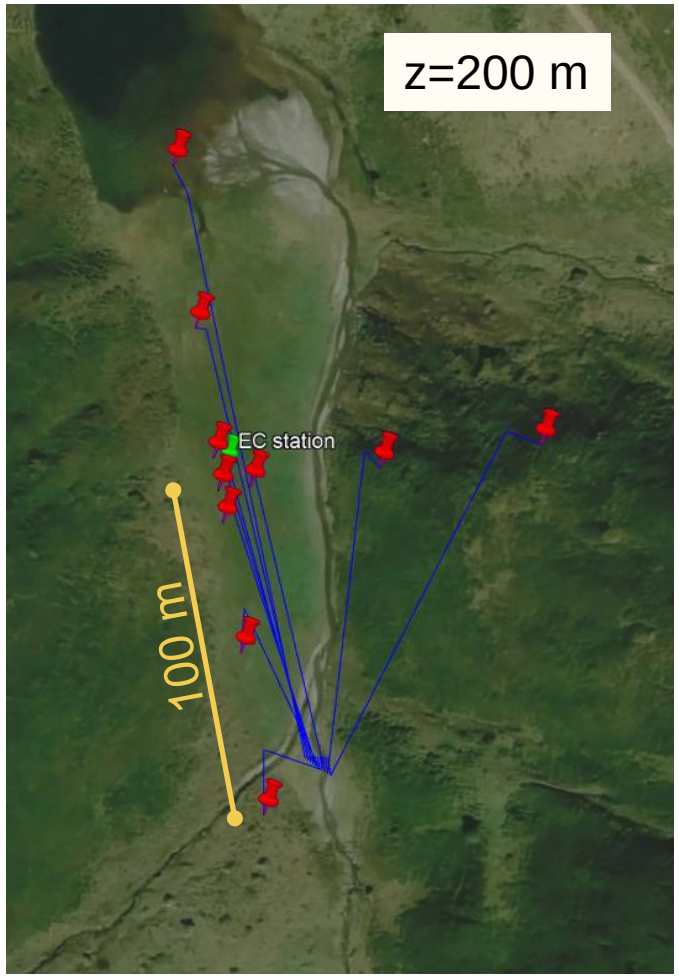
SWUF-3D Flight Patterns

QAV Cube



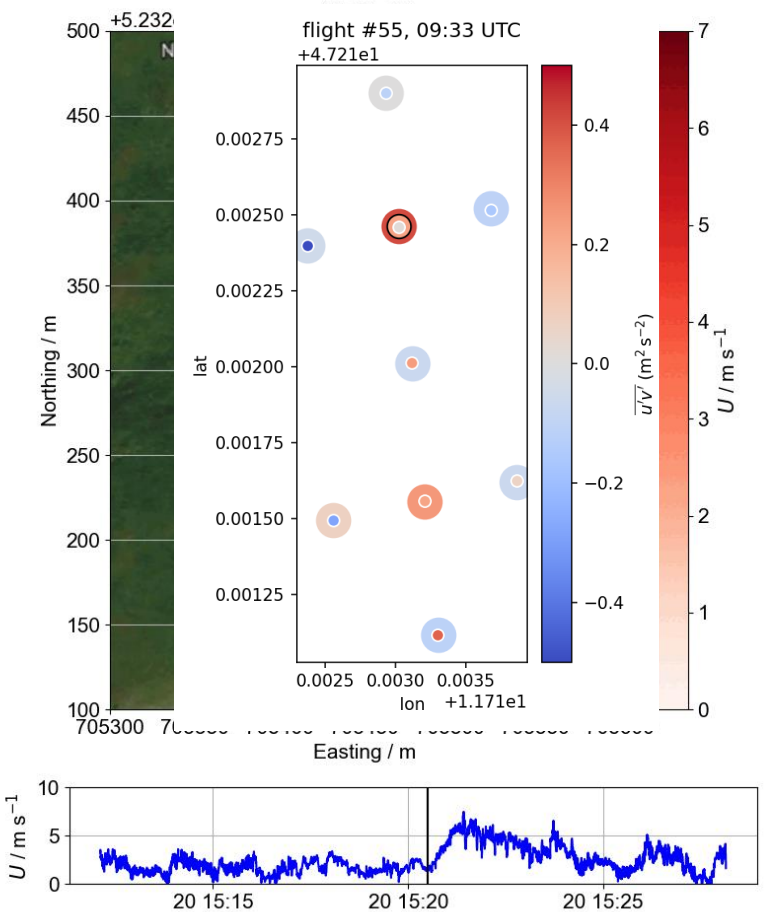
- Equilaterally placed 50 m apart at two levels
- Allows calculation of spatial gradients, advection, and stress tensor

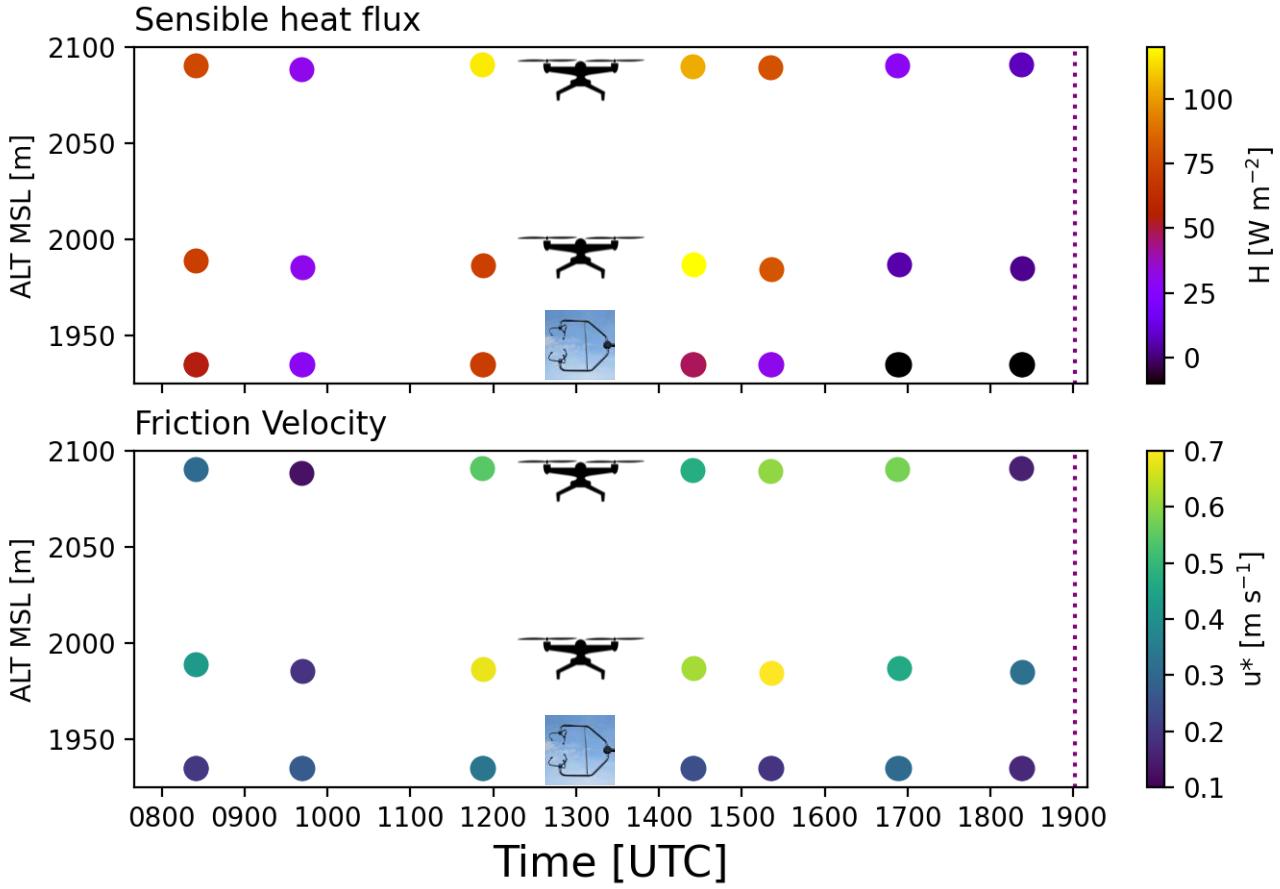
Endurance Line



- All flying at 200 m AGL
- Spaced logarithmically from center point over the EC station
- Allows calculation of coherence and structure functions

Preliminary Measurements





- More vertical variability in fluxes during the afternoon, unstable CBL period
- Elevated *H* fluxes seem to lag the surface

Zusammenfassung und Ausblick

- Während den TEAMx Kampagnen wurde die vielleicht **größte meteorologische Datenbasis im Alpenraum** gesammelt.
- Fokus liegt auf den IOP-Zeiträumen:
  - Winter: 20.01.2025 – 28.02.2025
  - Sommer: 16.06.2025 – 25.07.2025
- Bodenbasierte Messungen von Lidar, Radar, Ceilometern, Radiosonden
- Flugzeugmessungen von bis zu 3 Forschungsflugzeugen parallel.

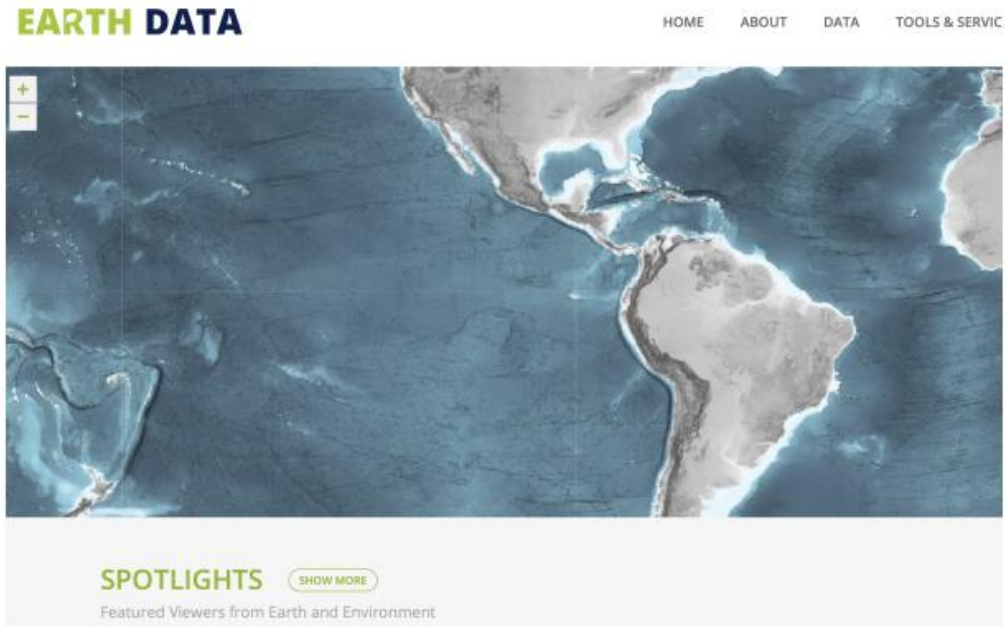
Frage: Können Segelflugdaten die Datenbasis weiter anreichern?

Ausblick

Data availability

TOC data will be ...

- made publicly available one year after the TOC
- published in public repositories (e.g., PANGAEA, zenodo, ...)
- accessible through the **Earth Data Portal**



https://earth-data.de

VIELEN DANK

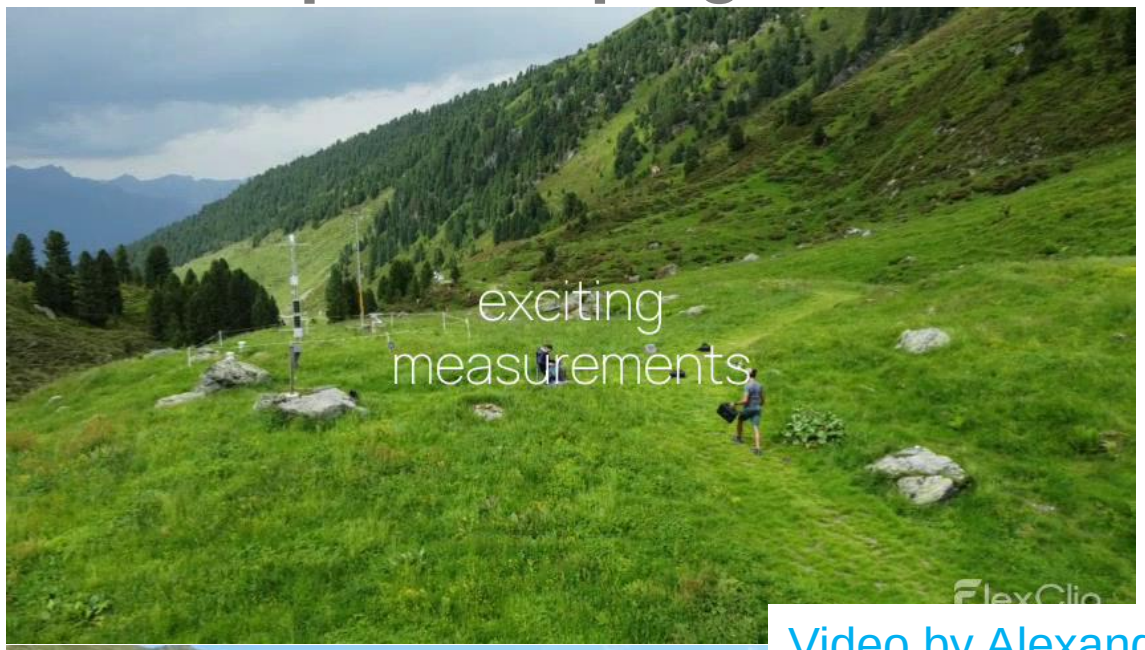
Christian Mallaun

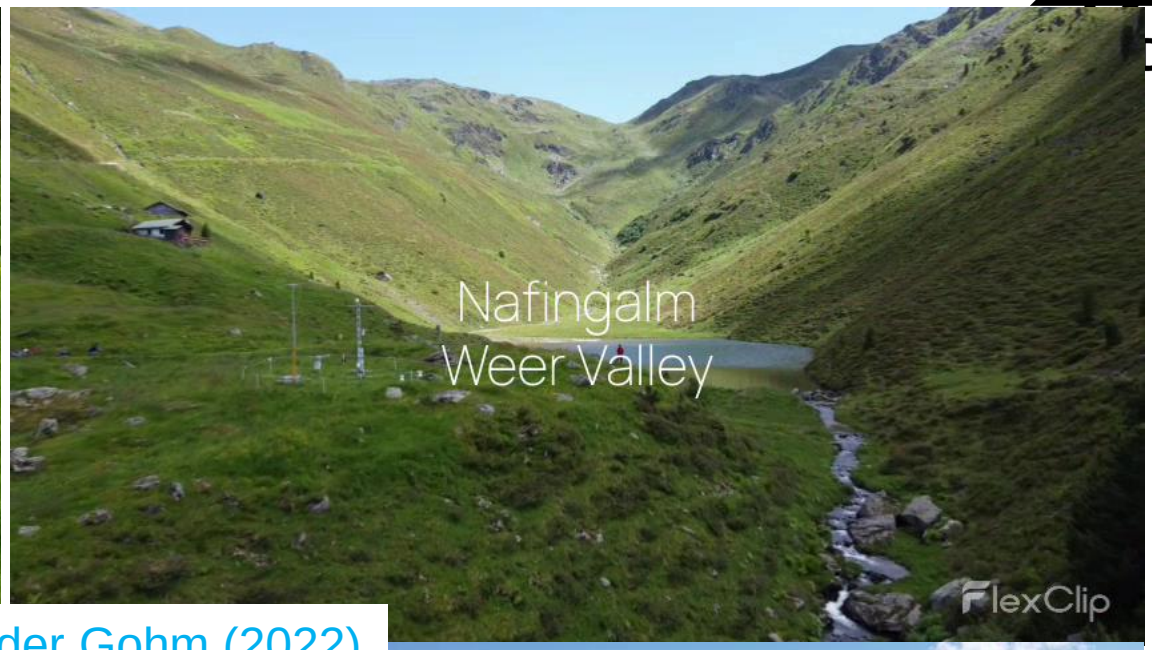
Impressum

Thema:	**Die TEAMx-Messkampagne in den Alpen** Überblick und erste Ergebnisse
Datum:	2026-02-28
Autor:	Norman Wildmann
Institut:	Institut für Physik der Atmosphäre
Bildquellen:	Alle Bilder „DLR (CC BY-NC-ND 3.0)“, sofern nicht anders angegeben

ESTABLIS-UAS / TEAMx

TEAMx pre-campaign 2022





[Video by Alexander Gohm (2022)]