

WG2 Finished and ongoing works

Numerical Studies

- Intercomparison
- Irrigation, precipitation and soil dynamics
- LES

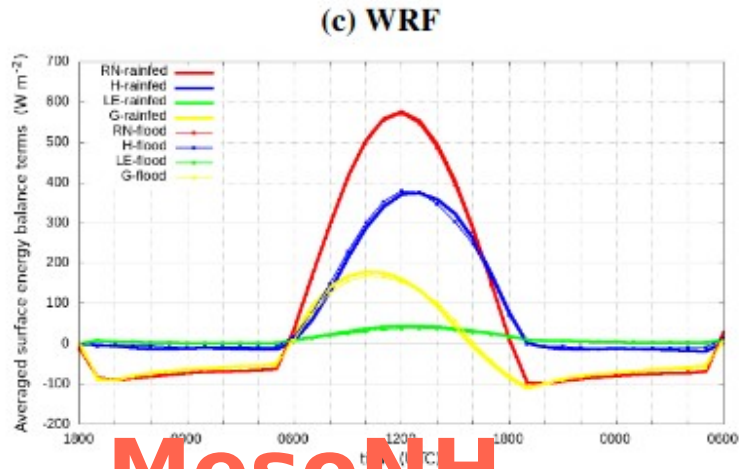
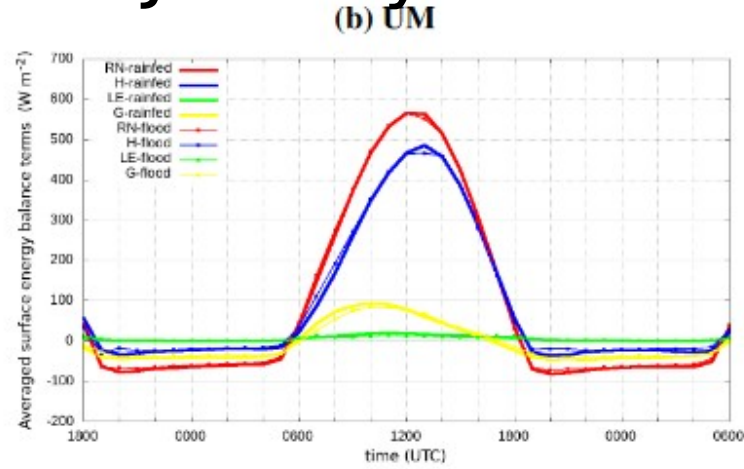
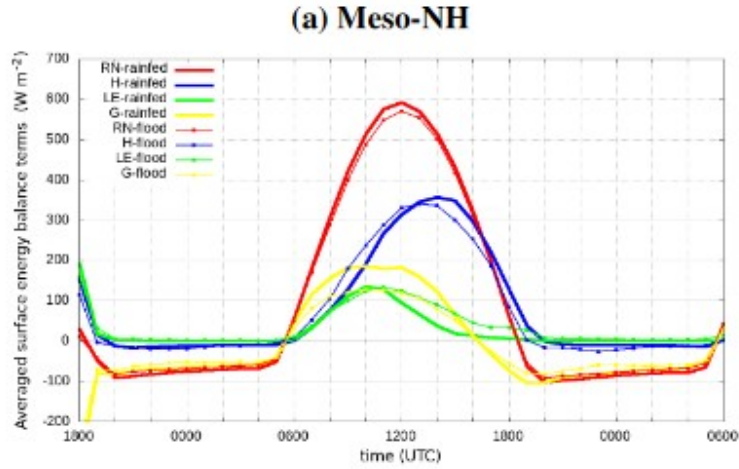
Observations

- Lidar
- Boundary layer height
- Mosai campaign
- Precipitation



Jiménez et al (2024) 1st model Intercomparison of LIAISE

Submitted in January 2024 to QJRMS



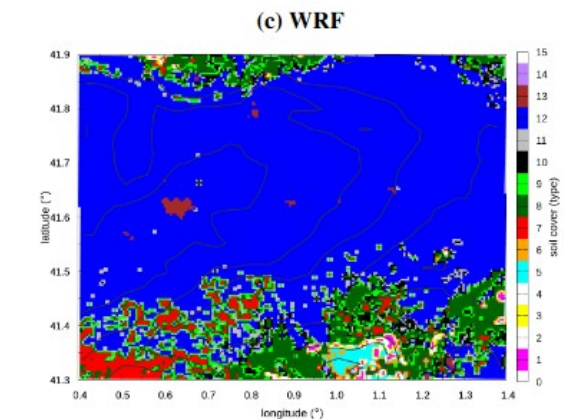
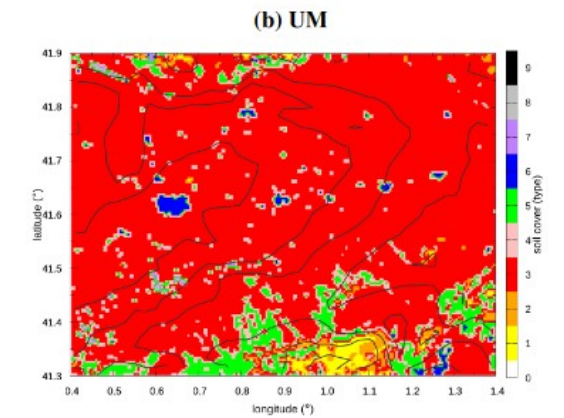
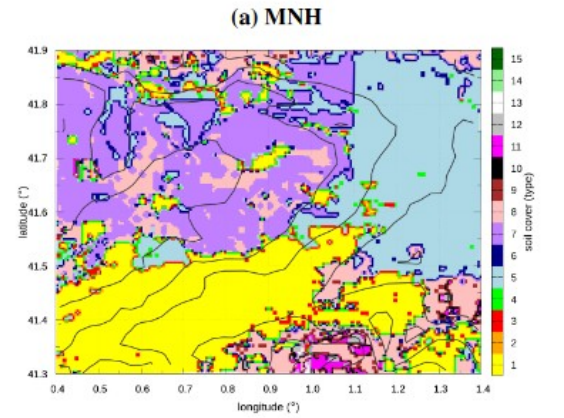
MesoNH
UM
WRF

Models do not contain the observed surface variability (model database and parameterizations)

Limitations to capture variability of humidity (no irrigation activated)

Sensitivity tests: 3D turbulence and ECMWF for initialization produce better results

The organization of the flow at lower levels is well captured

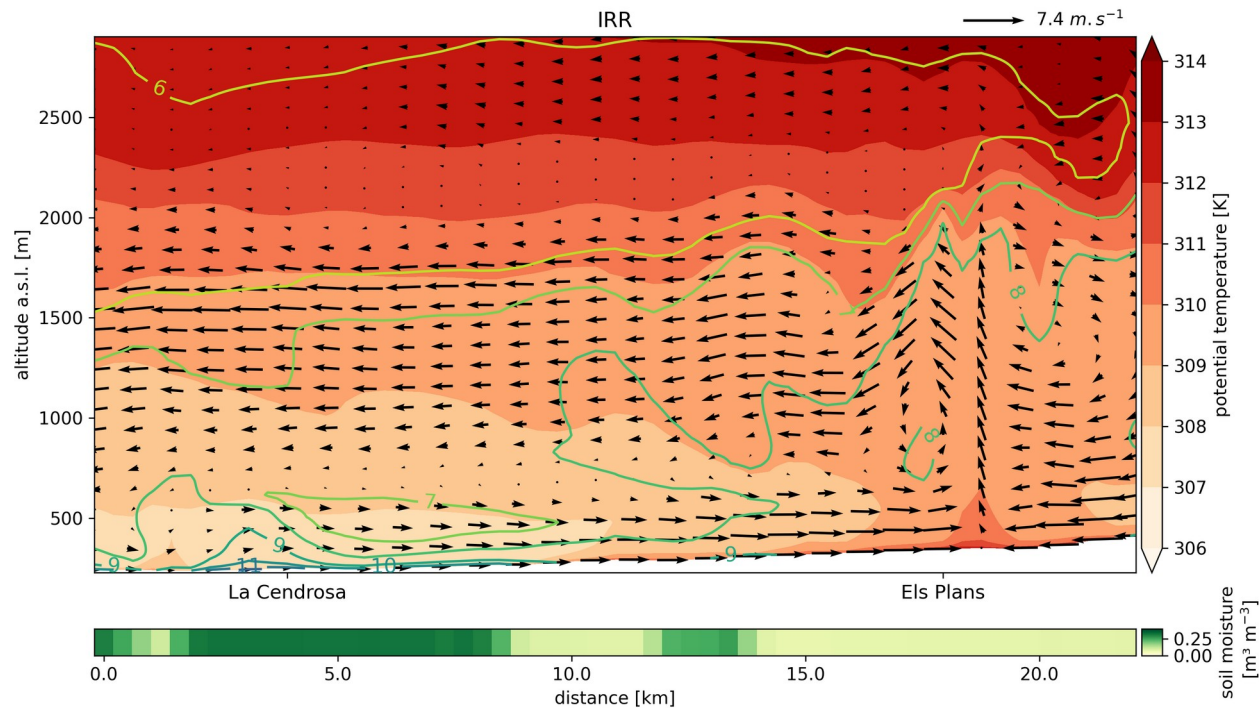


Influence of irrigation on ABL during daytime on 21 - 22 July:

- Strong humidification, cooling, and stabilization of the ABL
- Breeze circulation shown to be due to the irrigation

- Work presented at the Working Group 2 Meeting, on 19 Jan. 2023 – available on LIAISE website:
Influence of Irrigation on Surface - Atmosphere Interactions: Insights from simulations with irrigation,
Tanguy Lunel, Aaron A. Boone, and Patrick Le Moigne

- Article submitted to QJRMS:
Irrigation Strongly Influences Near-Surface Conditions and Induces Breeze Circulation: Observational and Model-Based Evidence
Tanguy Lunel, Aaron A. Boone, and Patrick Le Moigne



Cross-sections of the ABL on 22 July 2021, at 12:00 UTC, between La Cendrosa and Els Plans, at the peak of the irrigation breeze. The colormap represents the potential temperature. The arrows represent the projection of the wind vectors. The isolines represent the specific humidity in g/kg. The lower colored strip represents soil moisture.

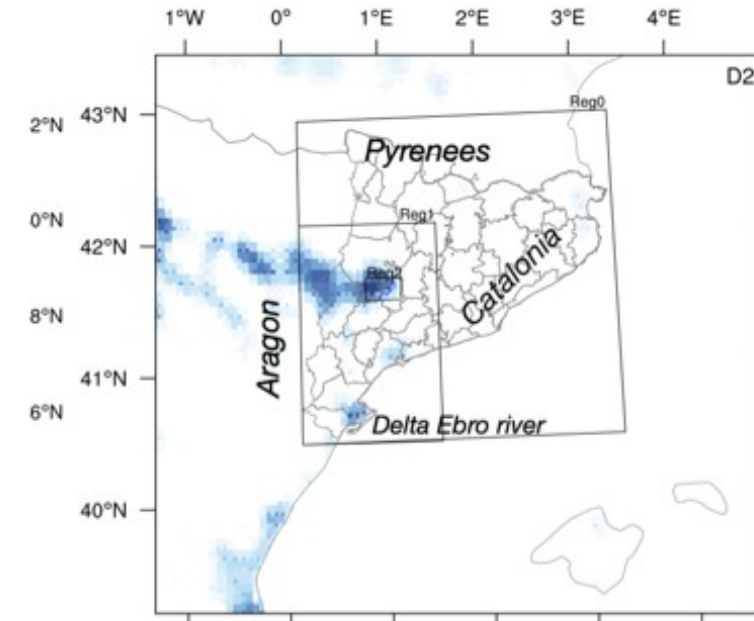
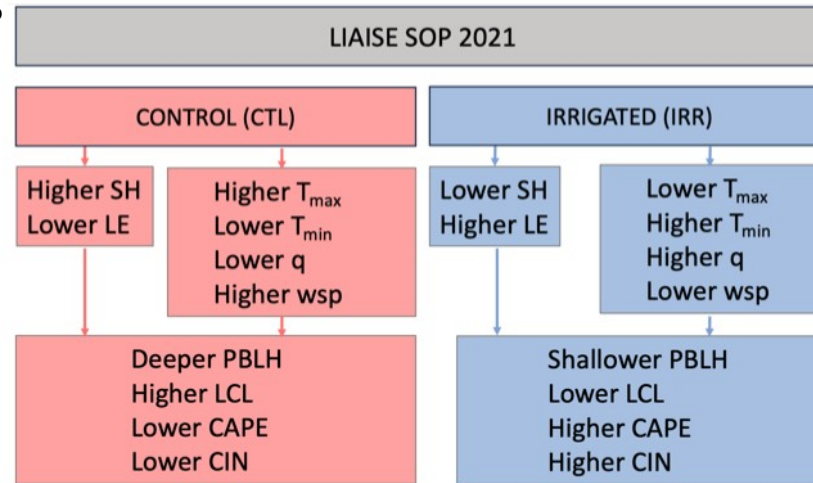
Irrigation impact on boundary layer and precipitation characteristics in WRF model simulations during LIAISE-2021

Mireia Udina^{1*} | Eric Peinó¹ | Francesc Polls¹ | Jordi Mercader² | Iciar Guerrero² | Arianna Valmassoi³ | Alexandre Paci⁴ | Joan Bech^{1,5}



In review

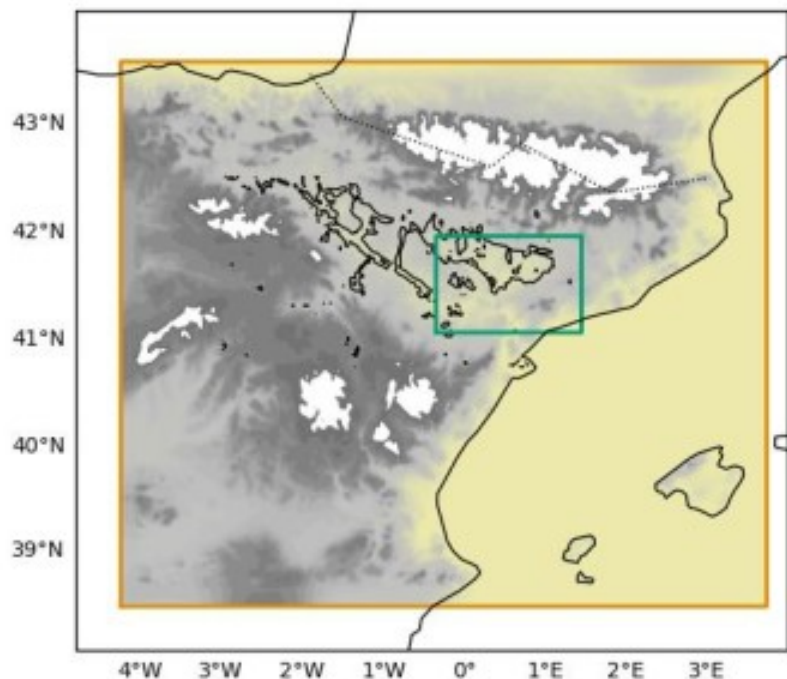
- Adding water to the soil in the WRF model leads to an **improved model forecast**: reducing the warm and dry bias of air at 2 m over irrigated areas
- Impact of irrigation in WRF:



- **Sea-breeze delay** entrance when irrigation is present due to a lower horizontal temperature gradient
- Impact of irrigation upon precipitation depends on the treatment of the **convection** parameterization:
 - ↳ For convection-parameterized runs -> **negative feedback** (precipitation decreases with irrigation)

↳ Relatively **limited influence of land-atmosphere processes upon precipitation** systems during LIAISE-2021 SOP

UM 2.2km model domain for evaluation study



Current research & plans

- Model evaluation paper of the existing irrigation scheme currently implemented in Unified Model focused on July 2021 (Jenn Brooke).
- Scoping study of the soil moisture dry-down in May-June 2022 at the rainfed Els Plans site. Study will compare observations with Unified Model evapotranspiration & response to rainfall on dry soil (Simon Osborne).
 - Need local soil properties for additional offline JULES sensitivity experiments.

Possible future plans

- Contribution to LIAISE (2nd) model inter-comparison project planned (TBC) will give insights into performance of different irrigation schemes, including sensitivity tests within schemes.

Publications to date

Brooke et al. (2023) Irrigation contrasts through the morning transition. *Q. J. Roy. Meteorol. Soc.*, 1-25. [DOI:10.1002/qj.4590](https://doi.org/10.1002/qj.4590)

Jiménez et al. (submitted QJRMS) Land surface Interactions with the Atmosphere over the Iberian Semi-arid Environment (LIAISE): 1st mesoscale modelling intercomparison.

Sensitivity studies of WRF-ARW

4.3

The SMC has performed a series of sensitivity studies as a necessary first step towards a better initialization of soil moisture and temperature.

Work done:

- Implementation of different pedotransfer functions in the WRF code
- Different model configuration (parameterizations, nudging)
- Different land use map ([CORINE+ICGC](#)) and soil texture map ([soilgrids](#))

Future work:

- Different LAI, FVEG map
- Initialization of soil moisture and temperature through data assimilation

Jiménez et al. (2024) IJOC

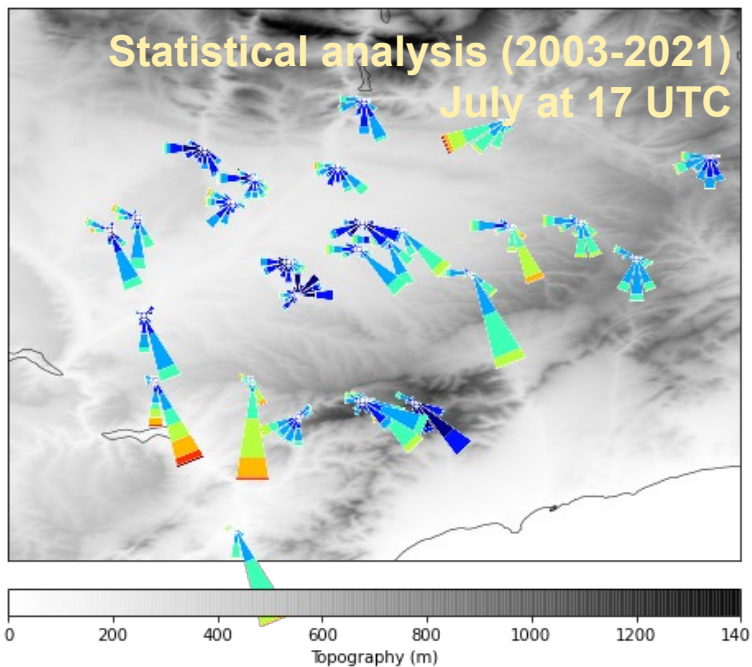
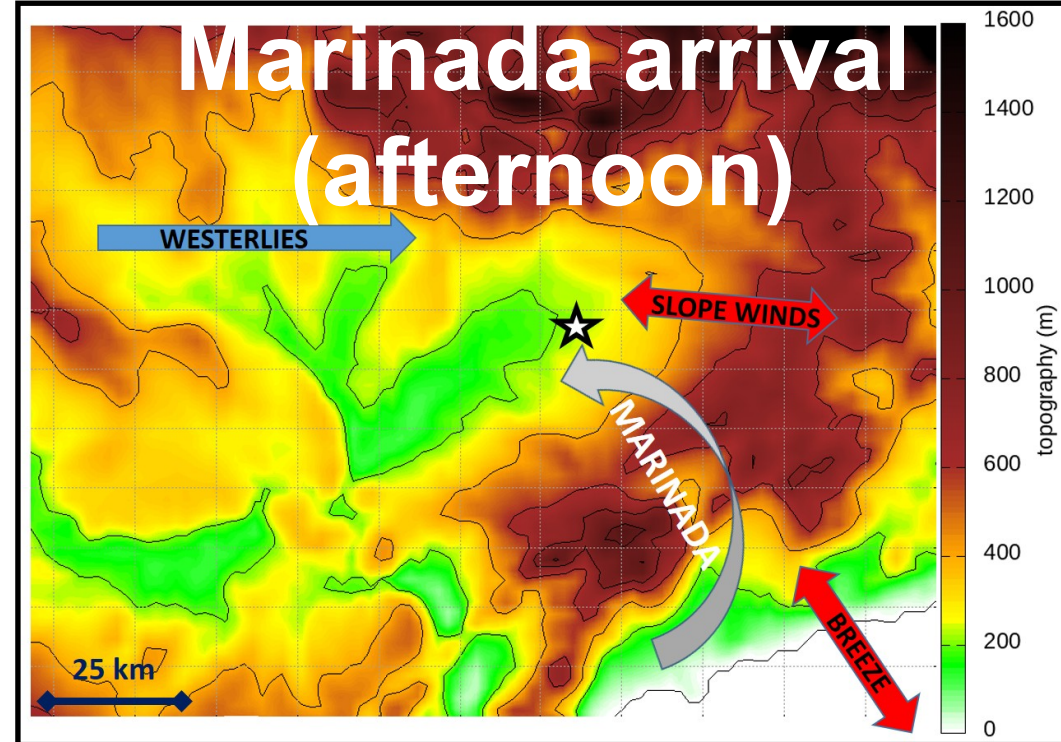
Characterization of the marine-air intrusion Marinada in the eastern Ebro sub-basin

<https://doi.org/10.1002/joc.8287>

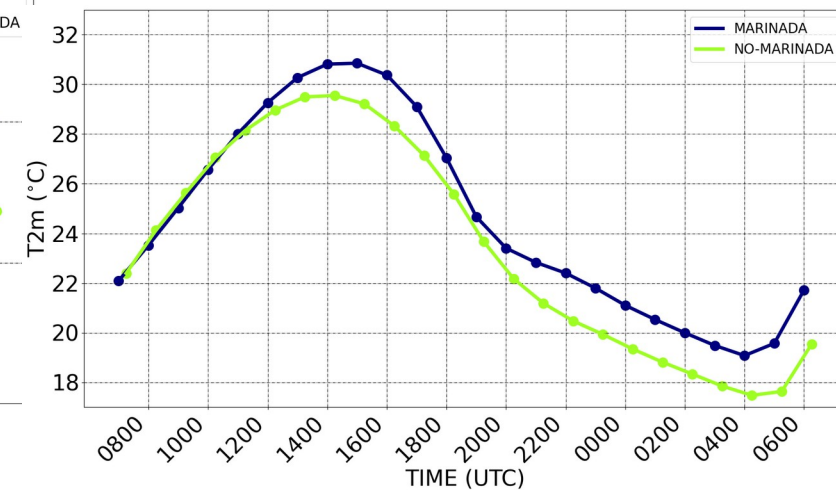
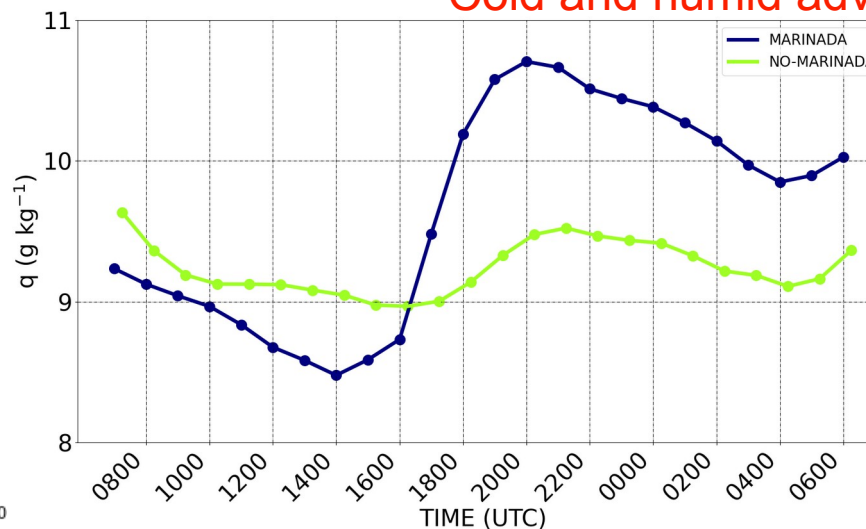
Entry of the marinada through the mountain range valleys

Different daily cycles under conditions with marinada and without

Wind patterns dominated by the orography



Cold and humid advection (maritime origin)

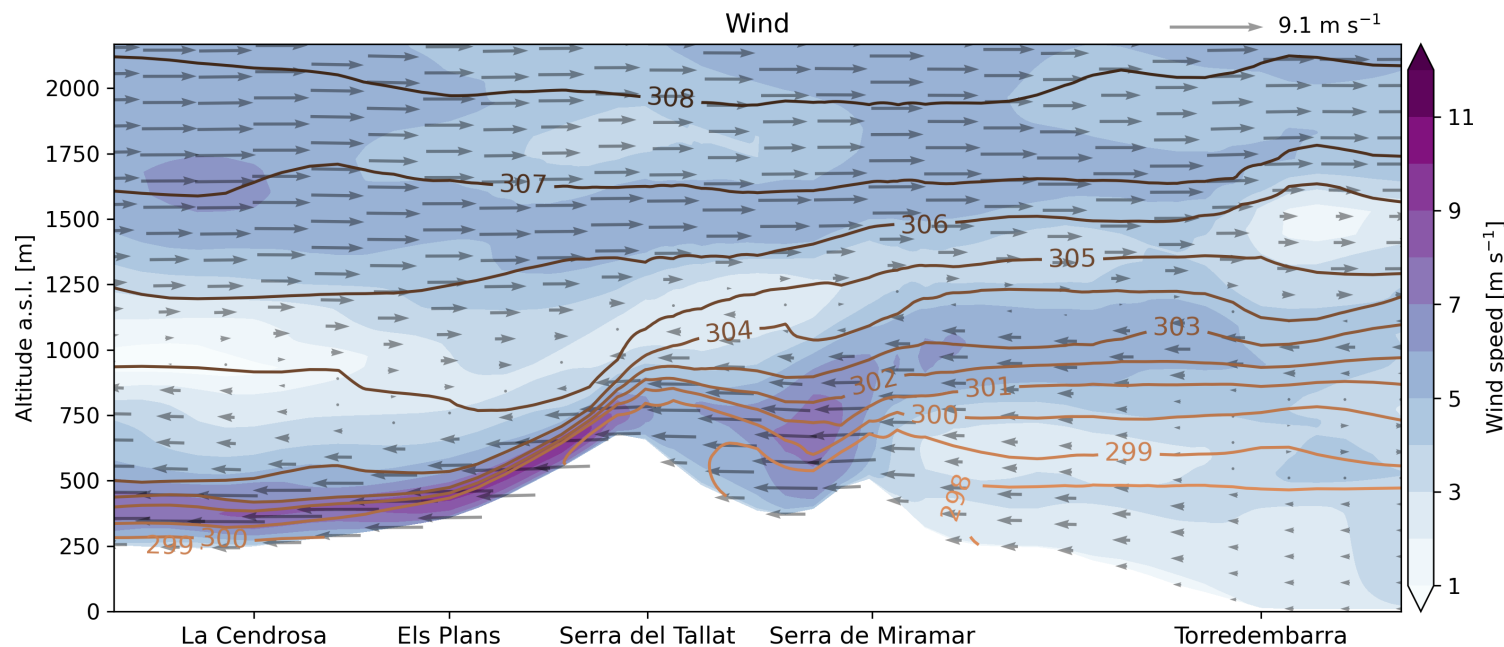


Marinada characterized as a fall wind:

- Cold air mass brought over the mountains by the sea breeze (16 July) or by thermal low circulation (21 July), and then flows into the Ebro basin.
- Irrigation delays and weakens the Marinada

Article submitted to ACP:

The Marinada Fall Wind in the Eastern Ebro Sub-basin: Physical Mechanisms and Role of the Sea, Orography and Irrigation.
Tanguy Lunel, Maria A. Jimenez, Joan Cuxart, Daniel Martinez-Villagrasa, Aaron A. Boone, and Patrick Le Moigne
available on EGU sphere: <https://egusphere.copernicus.org/preprints/2024/egusphere-2024-495/>



(a)

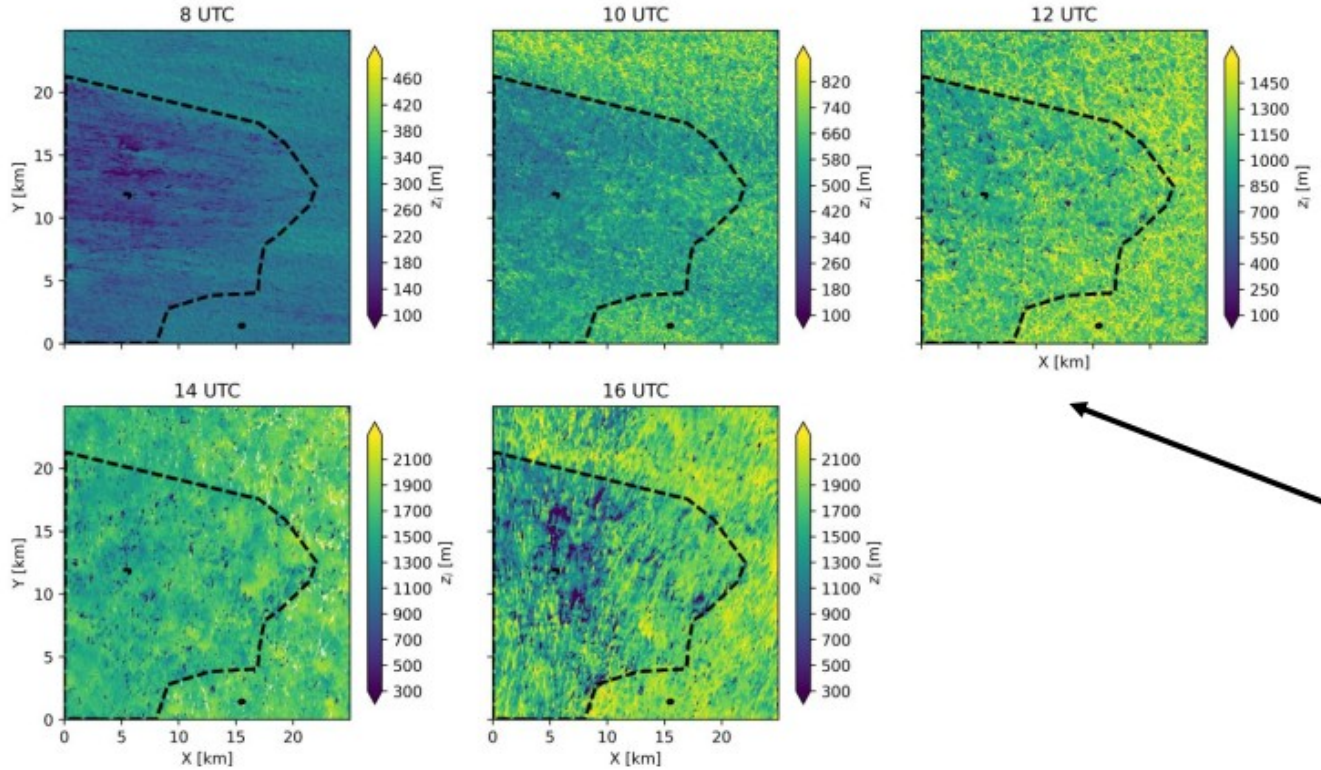
Cross-sections of wind on 16 July 2021, at 21:00 UTC.

The colormap represents the absolute wind speed.

The arrows represent the projection of the wind vectors.

The isolines represent the virtual potential temperature in Kelvin.

LIAISE Large-Eddy Simulation

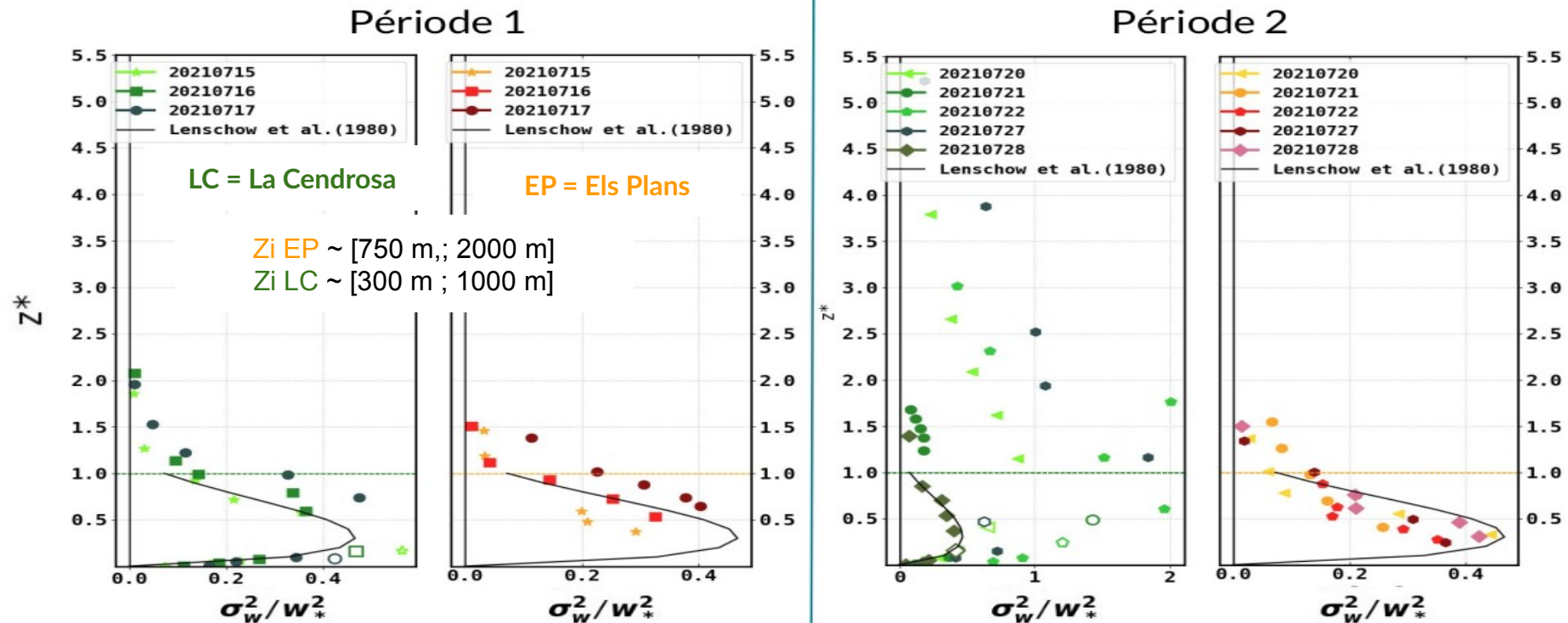


Mangan, M.R., et. al. (In Preparation). The Diurnal Evolution of Atmospheric Boundary Layers across Spatial Scales of Heterogeneity. JGR Atmospheres.



- Realistic LES with large-scale forcing from ERA5
- Prescribed Surface Fluxes (Offline):
 - How does the wet-dry heterogeneity impact the observed ABL in LIAISE?
- Modeled Surface Fluxes (Online):
 - How does the ABL and surface heterogeneity impact observed ET in LIAISE?

- Evidence of 2 distinct periods during the SOP with profiles of turbulent parameters
 - 15-17 july and 20-28 july
 - Turbulence stronger during the second period above the PBL at La cendrosa (skewness of $q > 0$, $TKE > 0$)
 - application for a research grant on the turbulent structure of CLA : negative in 2023 resubmission in 2024
- Dataset available on the aeris database
 - ATR42 mean and turbulent parameters
 - UHF Els Plan and La Cendrosa - mean wind (Z_i and complex CBL structure dataset to be deposited !)
 - Tethered balloon, turbulent parameters (new version)
 - Doppler lidar mean wind and tke (new version coming soon)



HILIAISE WG2 update at LMD

F. Gibert



Presentation of the lidar observatory performances in operation during HILIAISE:

- F. Gibert et al. , 2022: A wind, temperature, H2O and CO2 scanning lidar mobile observatory for a 3D thermodynamic view of the atmosphere, Proceedings of the 30th International Laser Radar Conference (ILRC30), Jun 2022, Big Sky, United States, <https://doi.org/10.48550/arXiv.2211.08765>

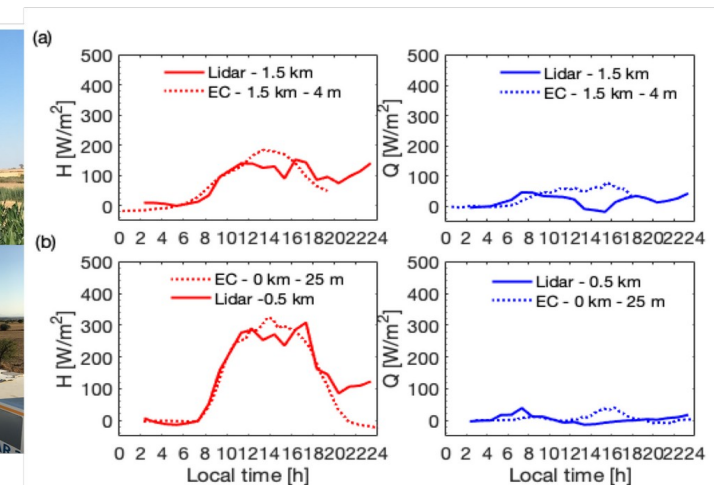
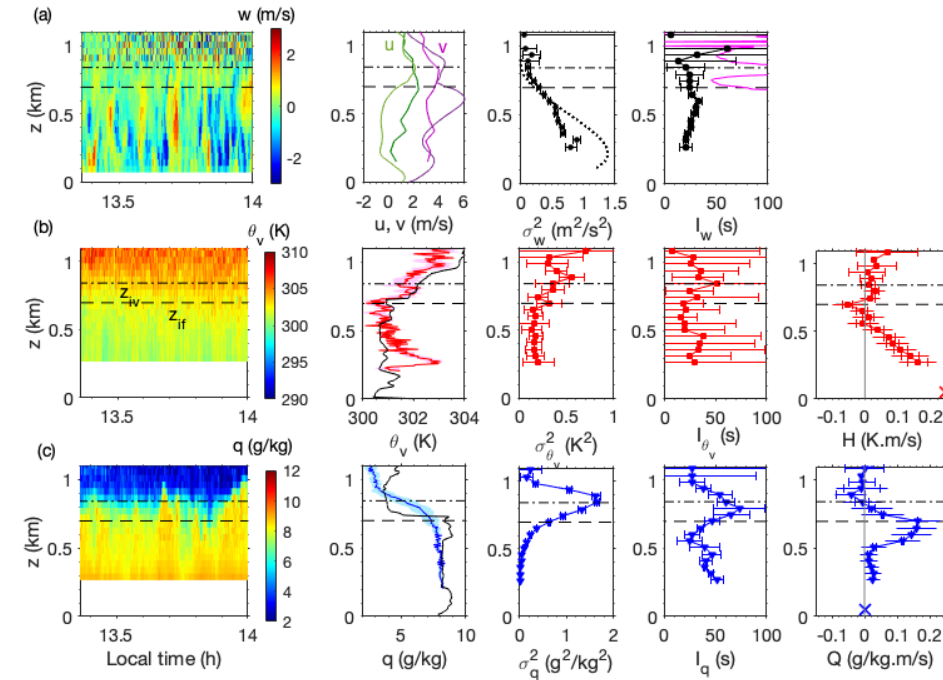
Study on scalar fluxes in the CBL interfacial layer and their scaling/ parametrization in arid and temperate region:

- F. Gibert et al. 2022: Convective boundary layer sensible and latent heat flux lidar observations and towards new model parametrizations , Proceedings of the 30th International Laser Radar Conference (ILRC30), Jun 2022, Big Sky, United States, <https://doi.org/10.48550/arXiv.2211.08785>

- F. Gibert et al. 2023: Scalar turbulent flux observations in the entrainment layer and assessment of current parametrizations , EGU, Vienna, <https://doi.org/10.5194/egusphere-egu23-5566>

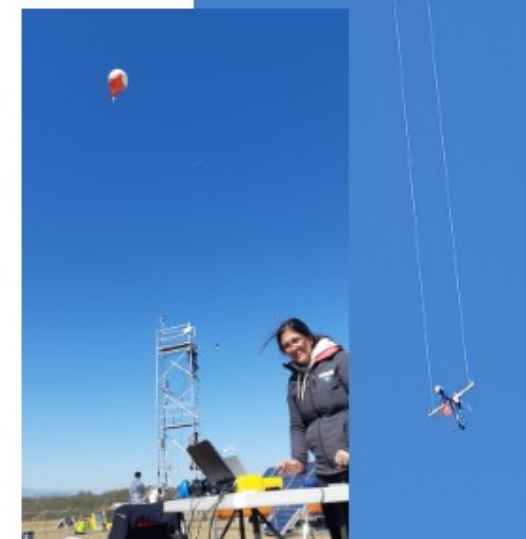
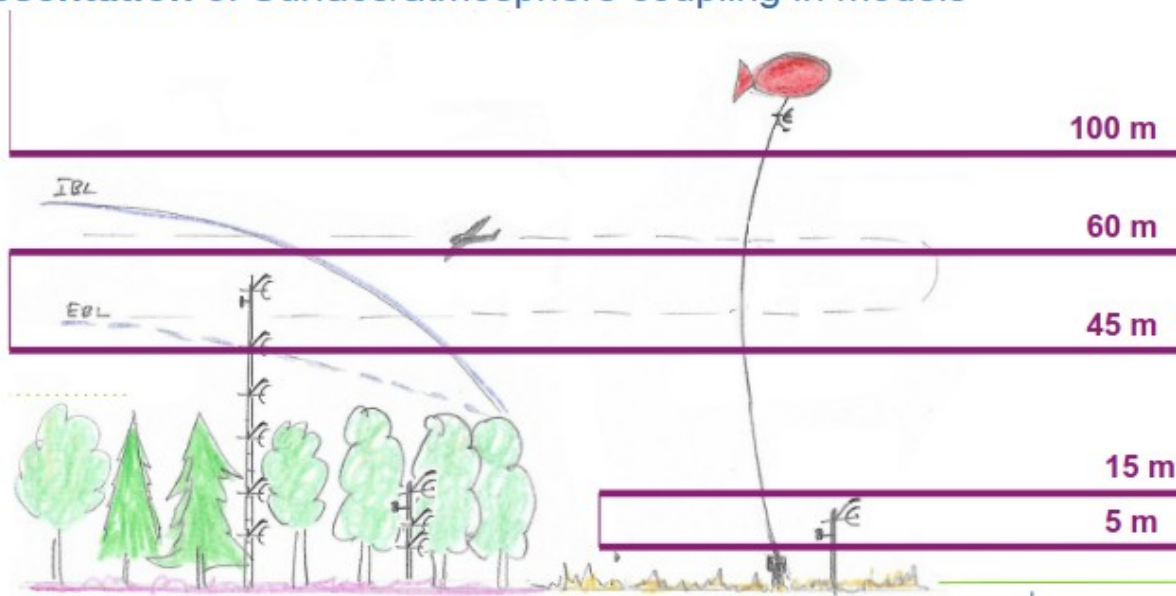
Study on the heterogeneity of surface energy fluxes in arid and temperate region:

Investigate modified MOST to derive surface flux with lidar measurement and scalar gradient (T and H2O)



of Enhanced Observations

- Third one-year EOP at P2OA-CRA (Lannemezan, near the Pyrénées)
... after Meteopole (Toulouse) and SIRTA (Paris) EOPs
- For this EOP specifically, three SOP within (April, August, December)
→ 18 IOP days in total
- Focus on heterogeneity transition
- Uniformly processed turbulent fluxes and parameters will be done
- QL and all data available at <https://mosai.aeris-data.fr/>
- Ongoing works on
 - (1) Long term measurements **representativity**
 - (2) Model **evaluation**, Model/Observation « fair » comparison
 - (3) **Better representation** of Surface/atmosphere coupling in models



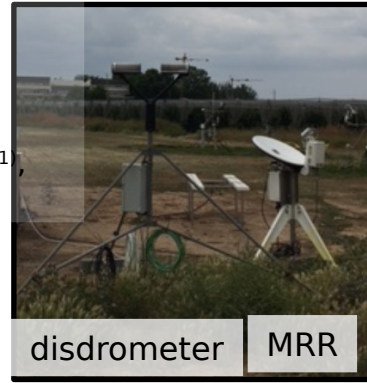
Analysis of Rainfall Characteristics and Evaporation Processes using Vertically Pointing Doppler Radars During the LIAISE Field Campaign

AMS2024-9C.3



Joan Bech ^(1,2), Albert García-Benadí ^(1,3), Francesc Polls ⁽¹⁾, Mireia Udina ⁽¹⁾, Eric Peinó ⁽¹⁾, Marta Balagué ⁽¹⁾, Alexandre Paci ⁽⁴⁾, Brice Boudevillain ⁽⁵⁾

<https://ams.confex.com/ams/104ANNUAL/meetingapp.cgi/Paper/433283>



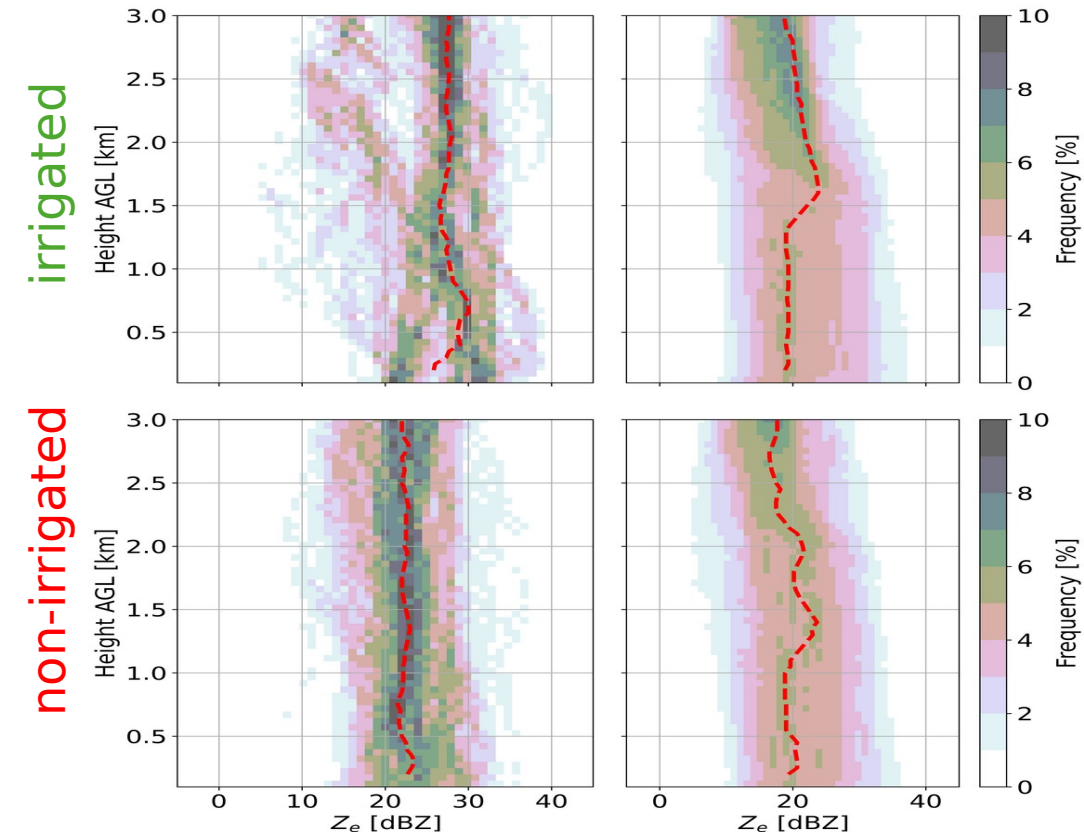
Contour Frequency Altitude Diagrams (CFAD) (20210504 to 20220614)

Candidate evaporation cases

AWS RH $\leq 65\%$ and Precipitation $\neq 0$
MRR-PRO $0.10 \text{ mm/h} \leq R \leq 10 \text{ mm/h}$
from 1stbin to 1kmAGL

All cases with precip & any SFC RH

MRR-PRO $0.10 \text{ mm/h} \leq R$
from 1stbin to 1kmAGL



- **Objective** To assess possible differences between irrigated and non-irrigated precipitation characteristics & microphysical processes (e.g. evaporation) during LIAISE-2021 LOP.
- **How?** Using precipitation profiles observed with high resolution Micro Rain Radar (MRR) observations and collocated surface disdrometers and AWS at both irrigated and non-irrigated sites.
- **Results** Similar Z profiles at both sites but higher proportion of non-irrigated candidate evaporation profiles vs. all rain profiles for different Rmin considered.

Final comments

2nd intercomparison to be starting soon

Possible interactions ?

Format of the next meetings ? People who would want to present ? Are we missing something ?

Thanks to everyone who sent their slides !

