



Vinar Meeting

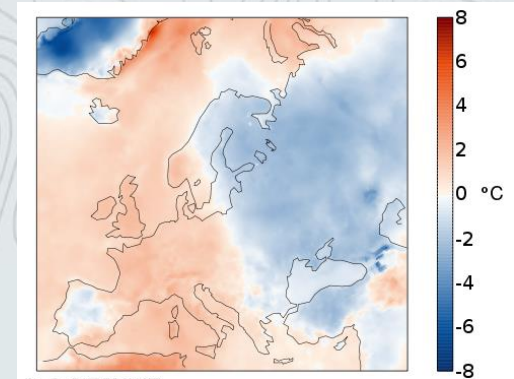
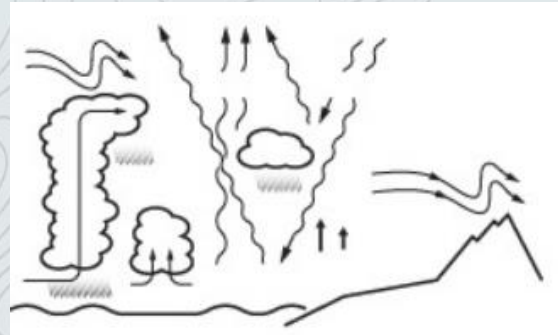
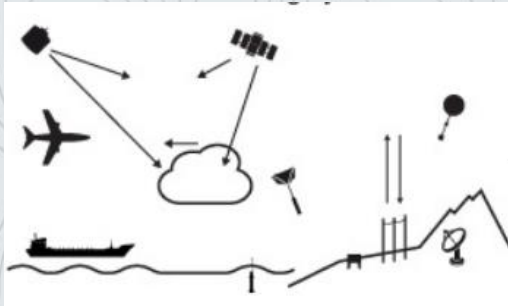
High resolution Austrian Re-analysis ensemble with AROME

Nauman K. AWAN, Christoph Wittmann, Stephanie Haas

The main goal of ARA project is to create first of its kind high resolution (2.5 km) re-analysis ensemble dataset for Austria by assimilating observations using the 3DVAR of the C-LAEF ensemble system based on the AROME model. This re-analysis will reconstruct spatially, temporally, and physically consistent 3D and 2D essential climate variables for Austria.



WHAT IS RE-ANALYSIS ?



01 Observations

Observations taken from all available sources can be considered. E.g. Station observations, Satellite, radiosondes, Ships, Aircrafts, radiosondes etc.

02 NWP Model equipped with ASSIMILATION system

NWP model like AROME equipped with 3D or 4D variational assimilation system

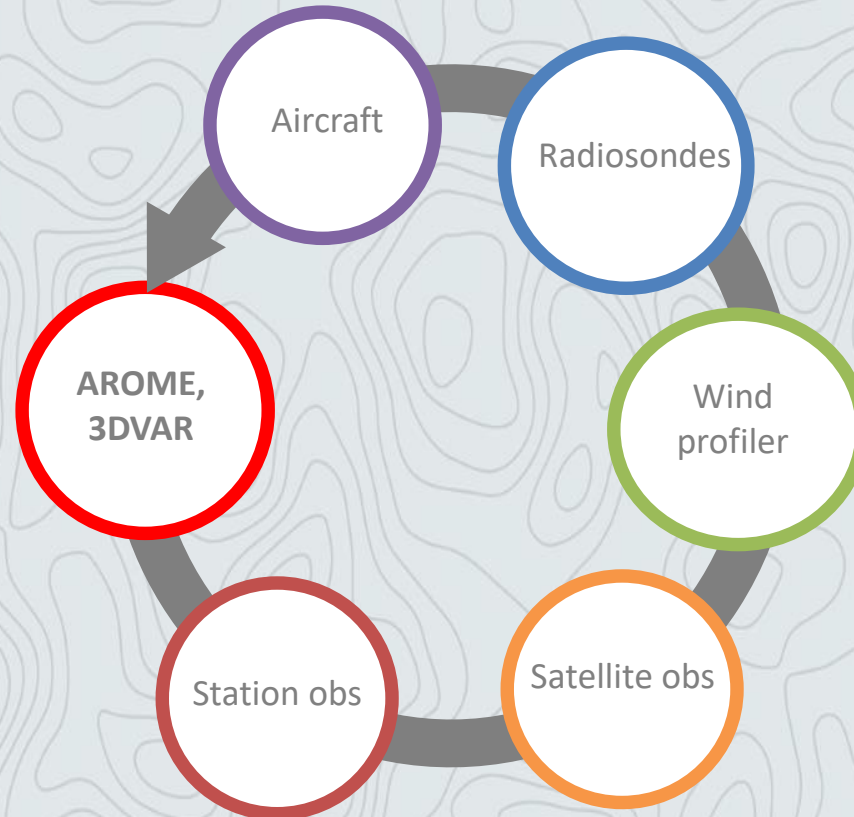
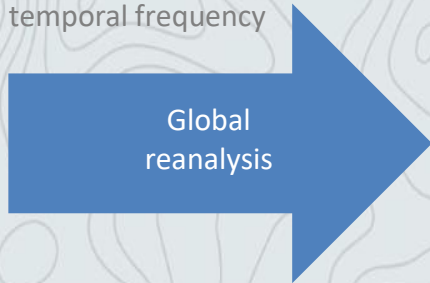
03 Reanalysis dataset

Physically consistent 3D and 2D information about the past state of atmosphere which has been corrected to compensate for inherent biases.

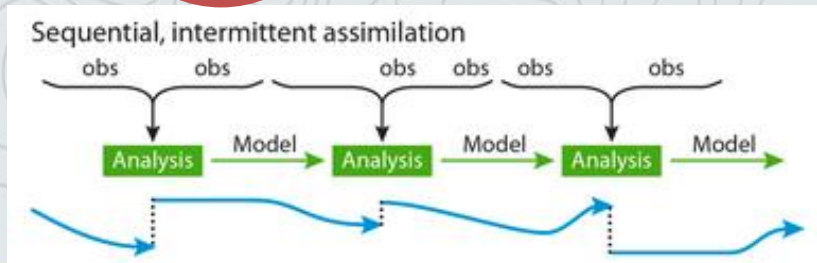
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conceptual outline

ECMWF ERA5
ECMWF ERA5 global reanalysis with 1h / 3h temporal frequency

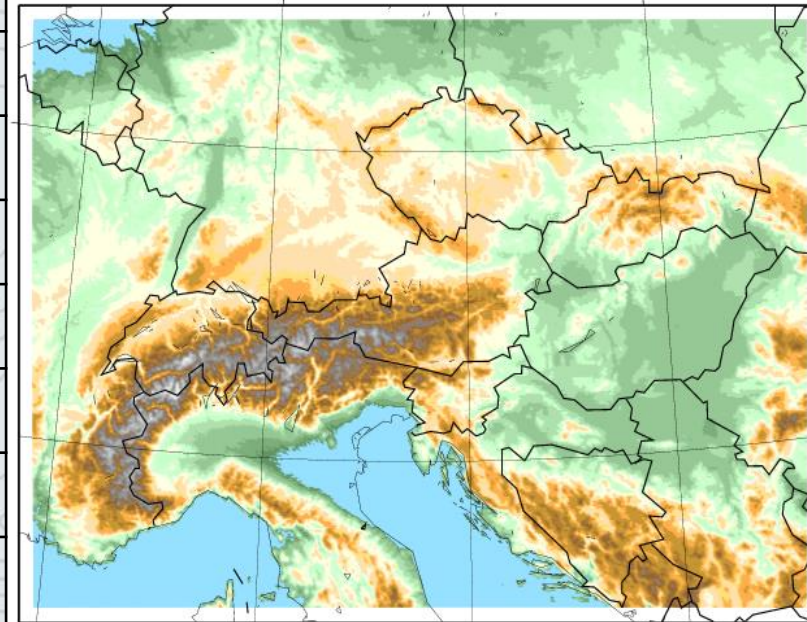


Austrian reanalysis
High resolution regional reanalysis for Austria



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ARA Ensemble system	
Currently running on the ECMWF HPC	
Ensemble size	1 + 10
Δx / vertical levels	2.5km / 90
Coupling	ECMWF-ERA5 (1-3-hourly coupling)
Runs per day / lead time	00, 03, 06, 09, 12, 15, 18, 21 UTC / +5hrs
Assimilation cycle	3h
Assimilation	Atmosphere (3D-VAR), surface (OI)
Perturbations	Observations (surface, atmosphere), LBC, model (stoch. physics)
Output	Hourly
Time	2012 - 2022



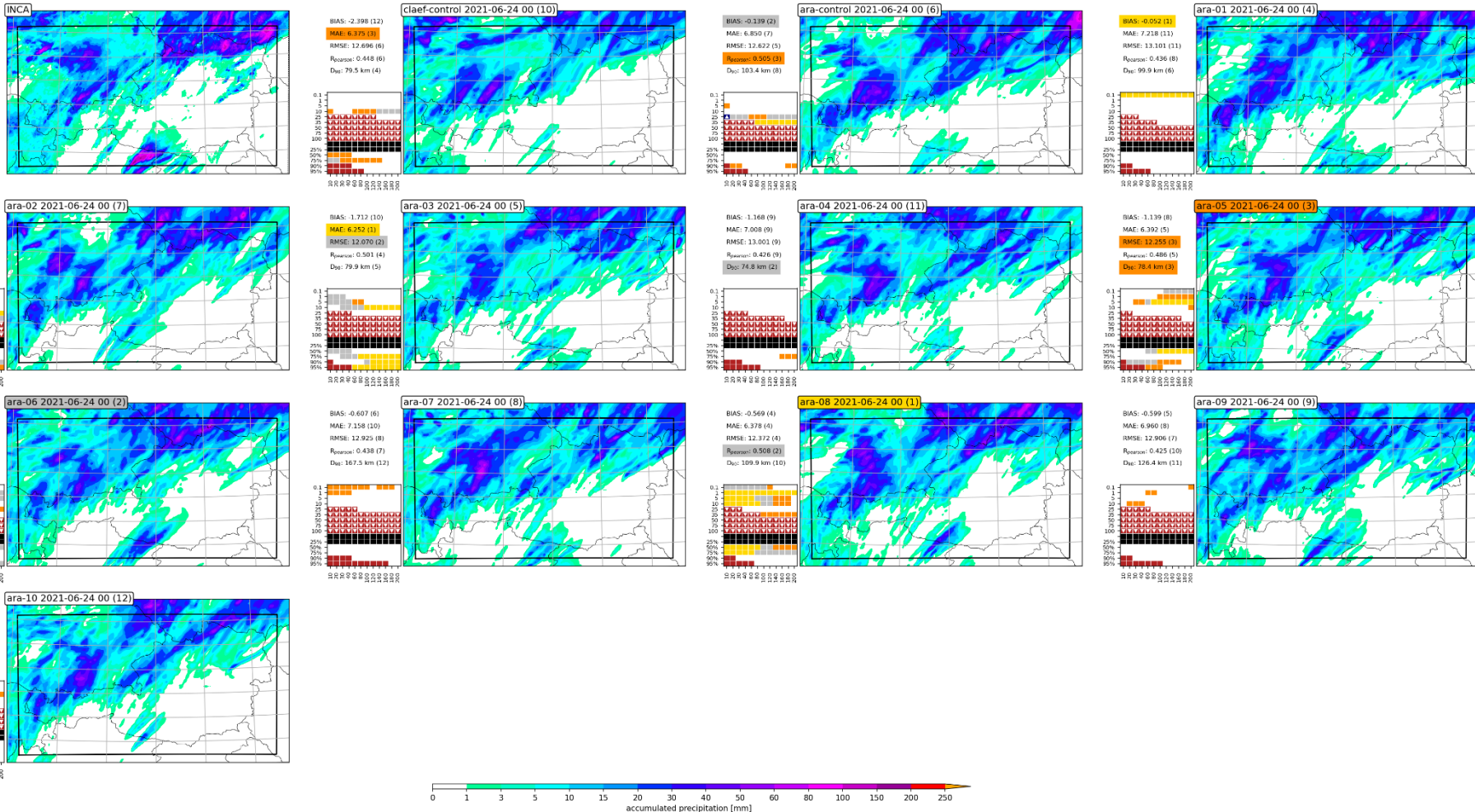
Event	Short description	Focused region
20210624	Extreme precipitation event	Northern Alps
20210630	Local convection	Feldbach/WegenerNet
20210718	Thunderstorm event	Feldbach/WegenerNet
20211218	Fog event	Feldbach/WegenerNet
20220112	Freezing event	Feldbach/WegenerNet
20220131	Snow event	Austrian Alps
20220217	Storm event	WegenerNet
20220527	Thunderstorm event	Fedbach/WegenerNet

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CASE STUDIES
2021-06-24



Acc. Precip. [mm] from 20210624 00 to 20210625 00 UTC



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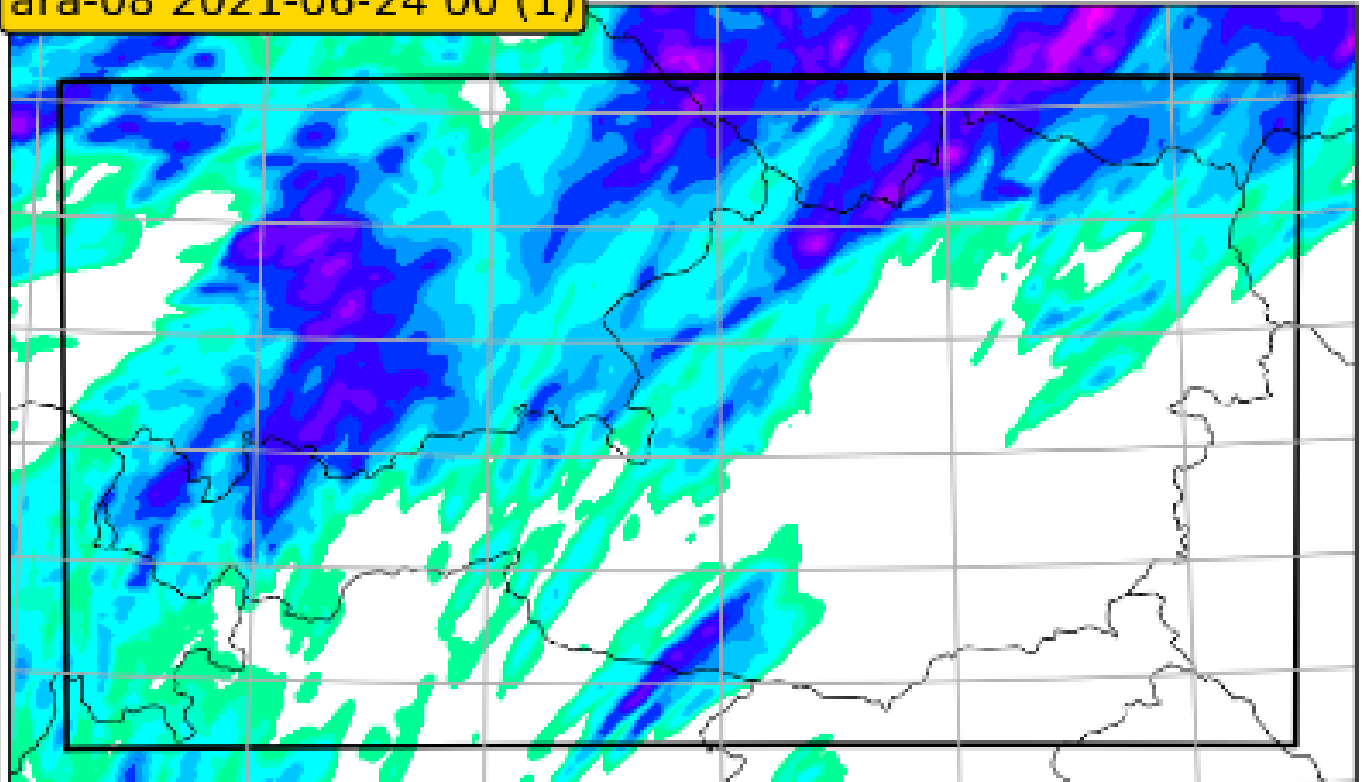
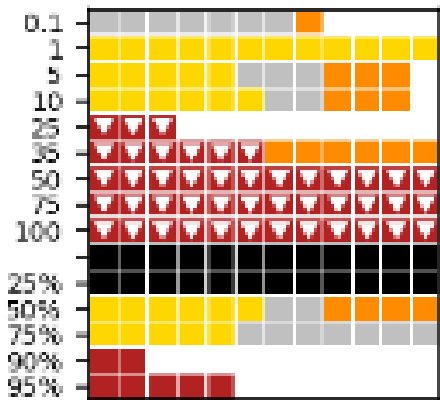
CASE STUDIES

2021-06-24



ara-08 2021-06-24 00 (1)

BIAS: -0.569 (4)
MAE: 6.378 (4)
RMSE: 12.372 (4)
 R_{pearson} : 0.508 (2)
 D_{90} : 109.9 km (10)

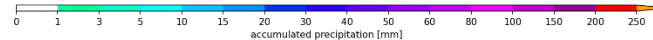
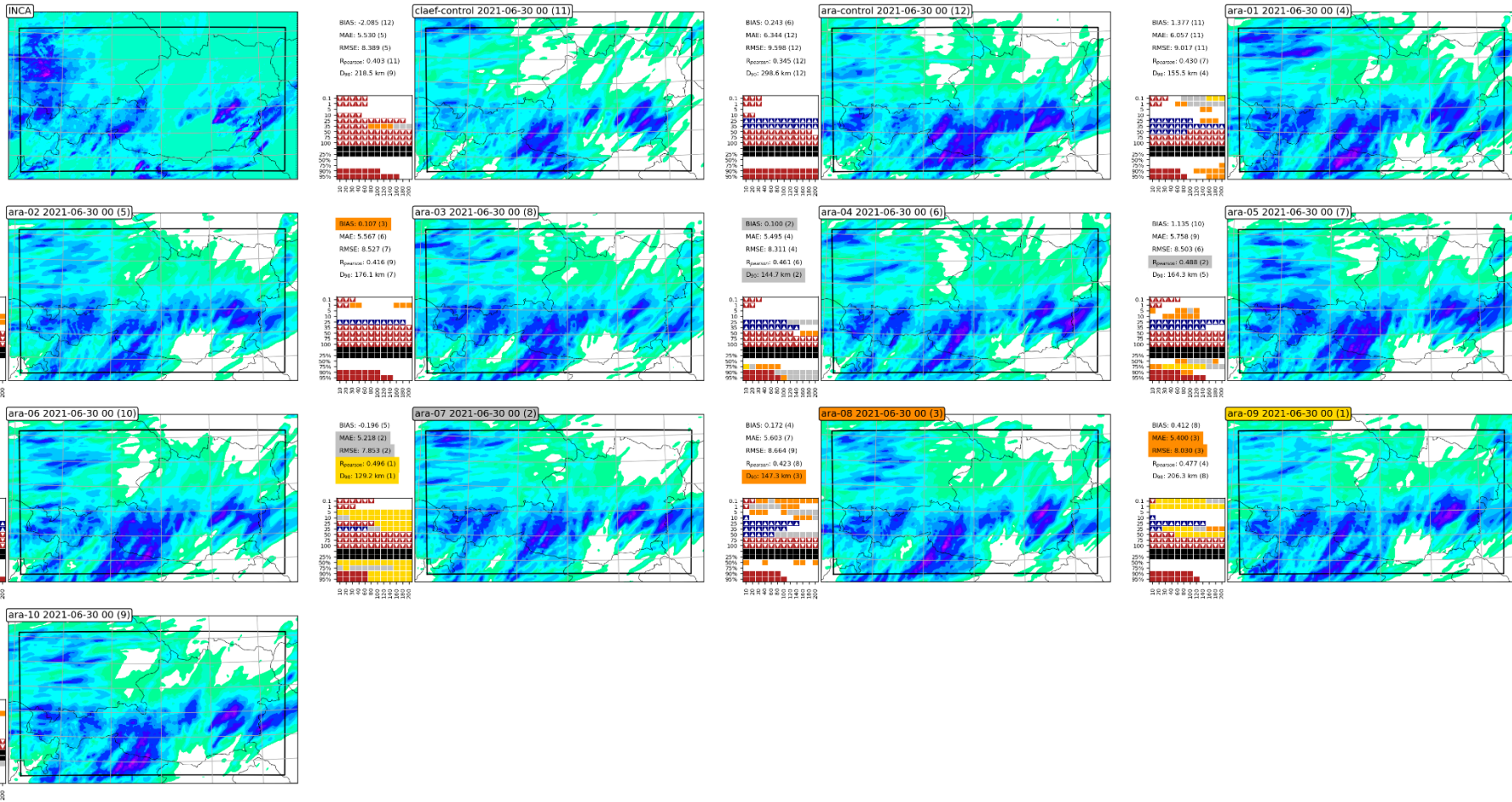


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CASE STUDIES
2021-06-30



Acc. Precip. [mm] from 20210630 00 to 20210701 00 UTC



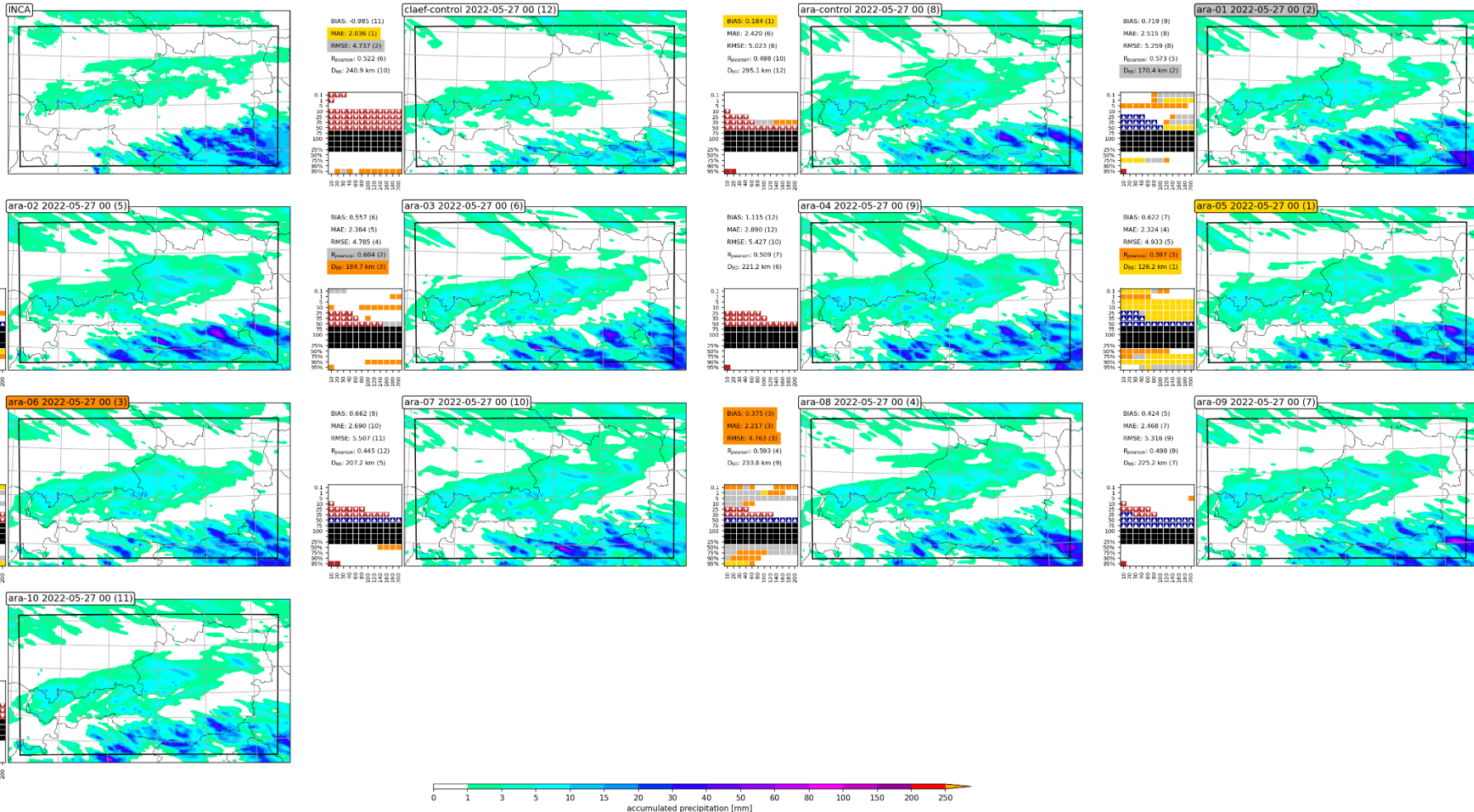
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CASE STUDIES

2022-05-27



Acc. Precip. [mm] from 20220527 00 to 20220528 00 UTC



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CASE STUDIES

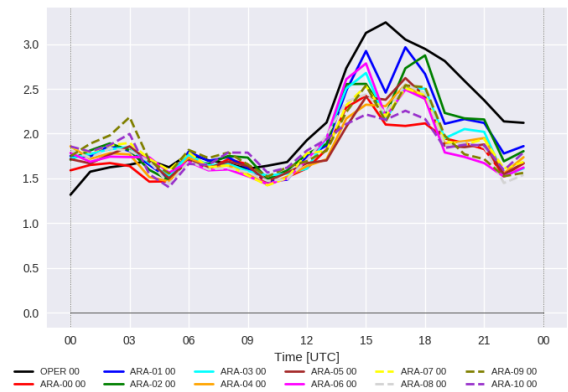
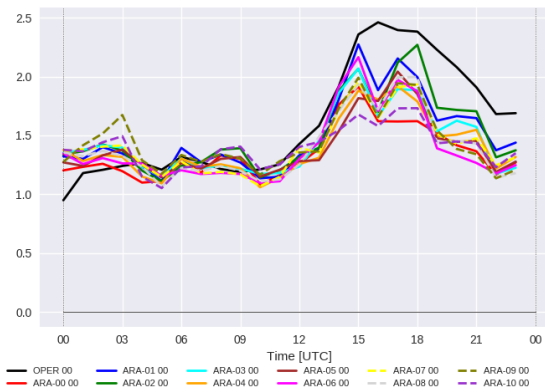
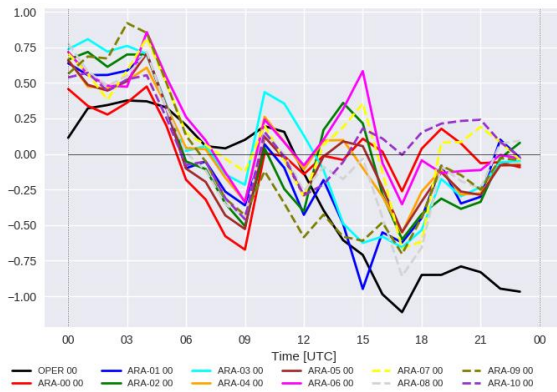
2021-06-24

T2M

Bias

MAE

RMSE

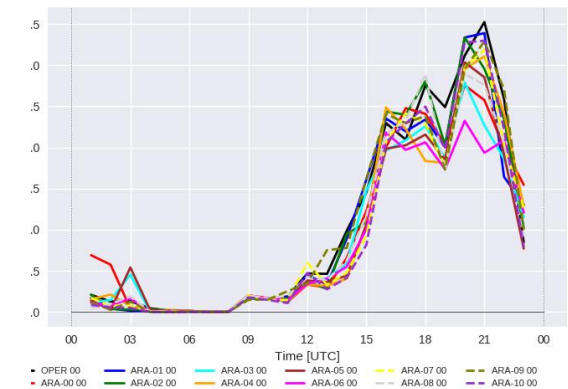
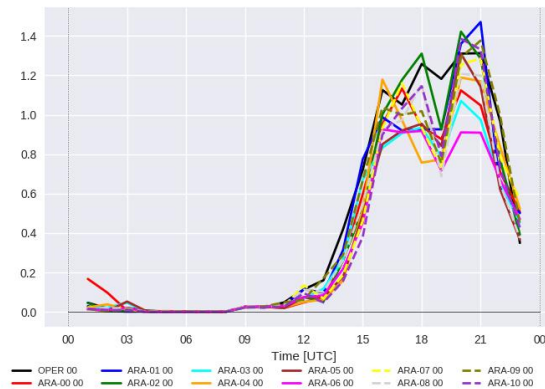
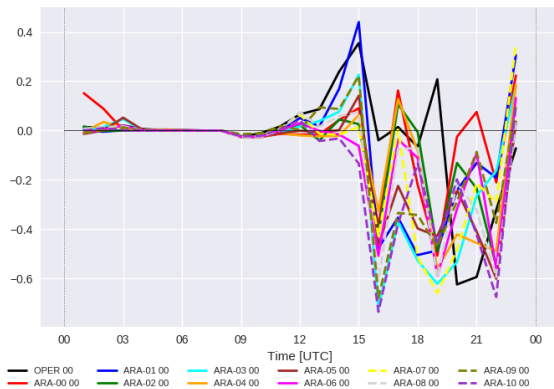


Bias

PREC

MAE

RMSE



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CASE STUDIES

2021-06-30

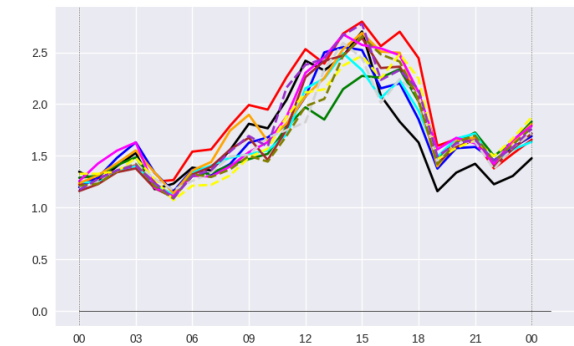
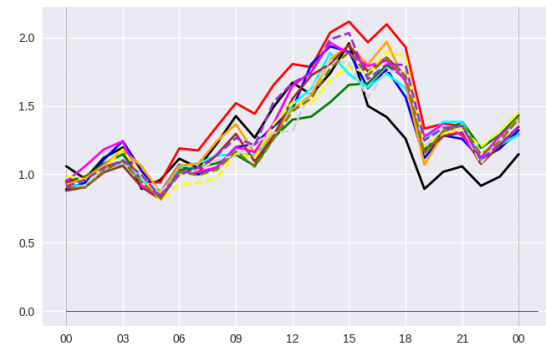
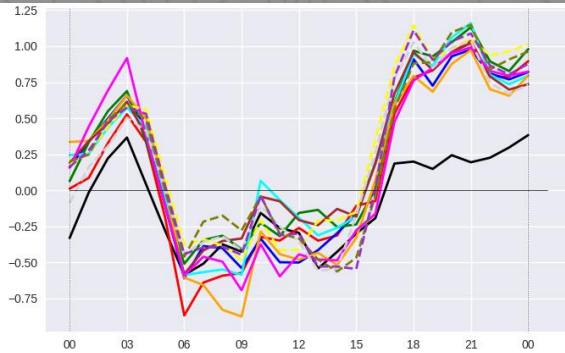


T2M

Bias

MAE

RMSE



— OPER 00 — ARA-01 00 — ARA-03 00 — ARA-05 00 — ARA-07 00 — ARA-09 00
— ARA-00 00 — ARA-02 00 — ARA-04 00 — ARA-06 00 — ARA-08 00 — ARA-10 00

— OPER 00 — ARA-01 00 — ARA-03 00 — ARA-05 00 — ARA-07 00 — ARA-09 00
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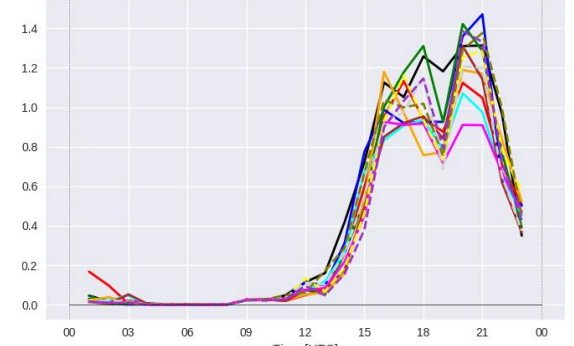
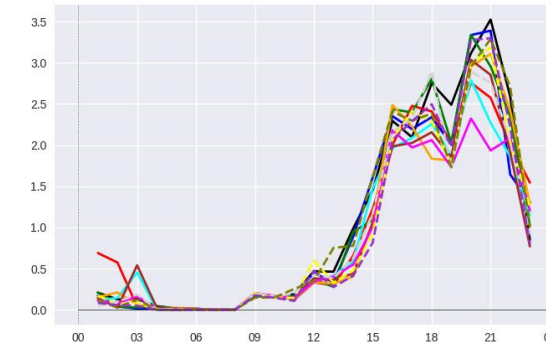
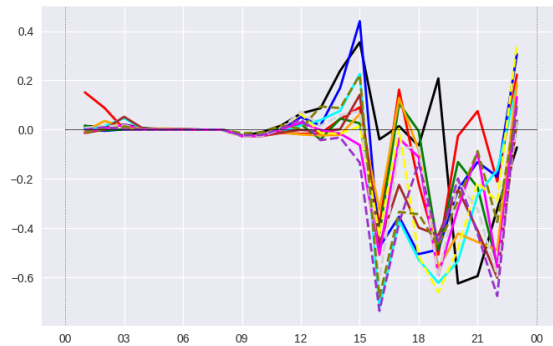
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PREC

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CASE STUDIES

2022-05-27

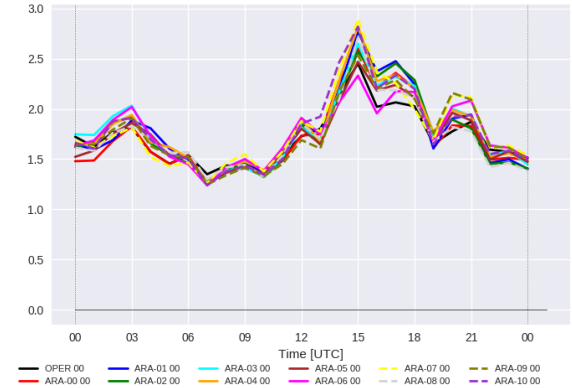
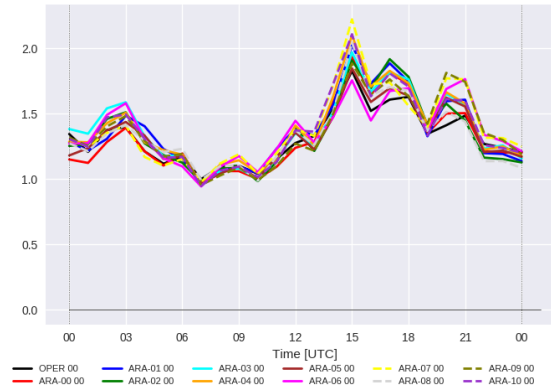
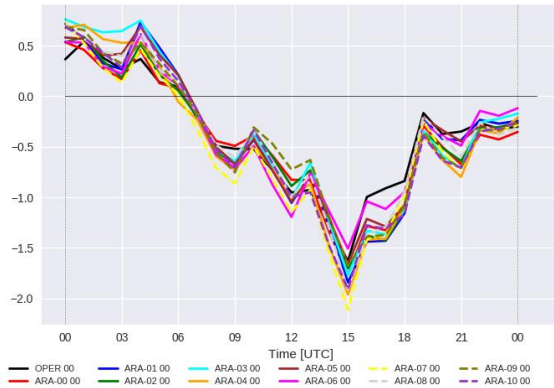


T2M

Bias

MAE

RMSE

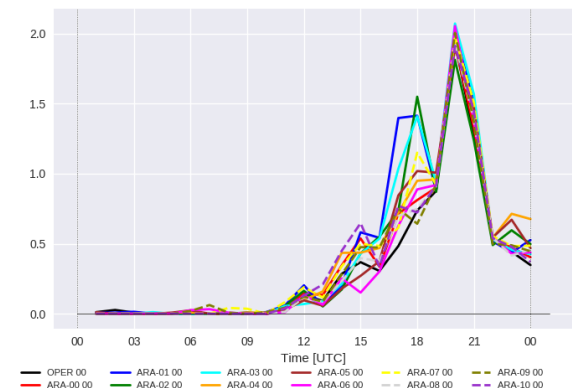
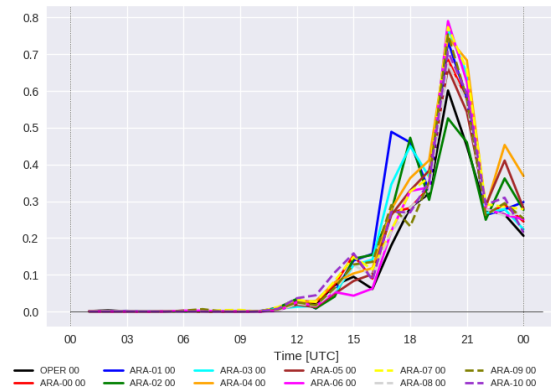
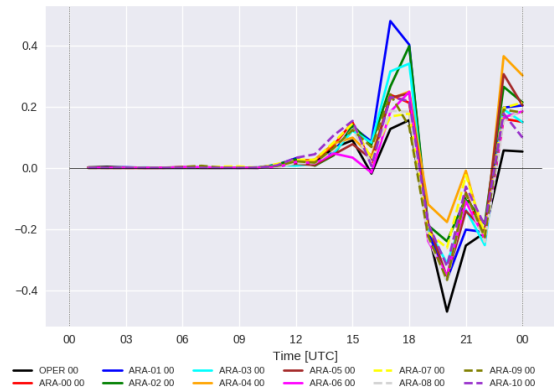


PREC

Bias

MAE

RMSE



Summary & Outlook

- ARA ensemble is performing at par with our operational models.
- The statistical analysis shows that the ARA ensemble has the ability to simulate extreme precipitation events with good accuracy however, spatial and temporal shifts are observed.
- Further evaluation is on-going e.g. 3D evaluation by using a Radar and comparison with novel wegener Net data.
- We intend on using this data to create extreme forecast index (EFI), evaluate NWP models, calibrate and train statistical and AI based algorithms.
- There are several cross cutting ventures in pipeline e.g. use of this dataset for renewable energy generation, in agriculture, aviation, tourism etc.



Thank You!

For your time and attention!