COSMO Priority Project

C2I

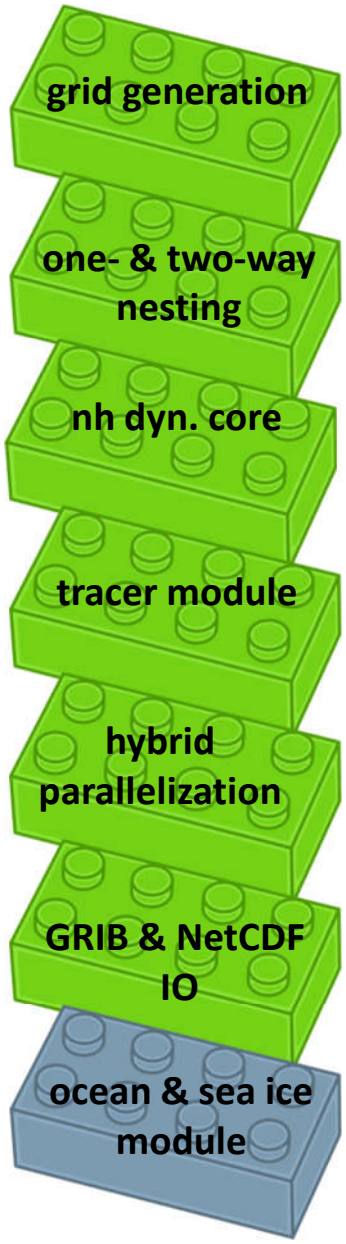
Transition of COSMO to ICON-LAM

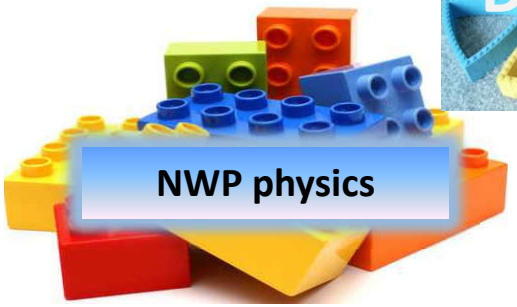
D. Rieger, G. Zängl and D. Majewski

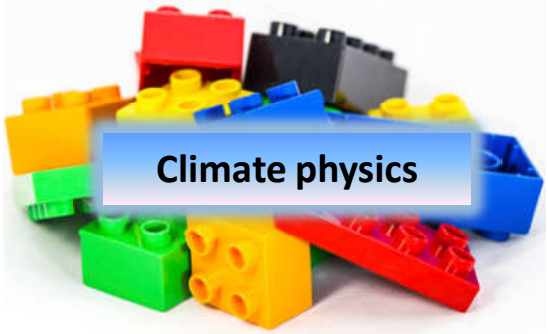
…with contributions from many

COSMO and ICON colleagues

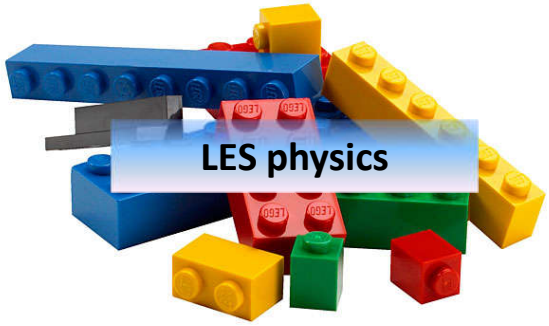
Daniel.Rieger@dwd.de

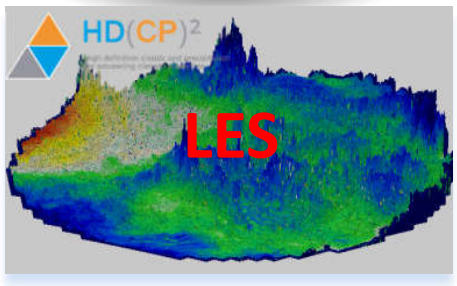






KIT
Karlsruhe Institute of Technology





The ICON Modelling Framework

ICON-LAM – Goals

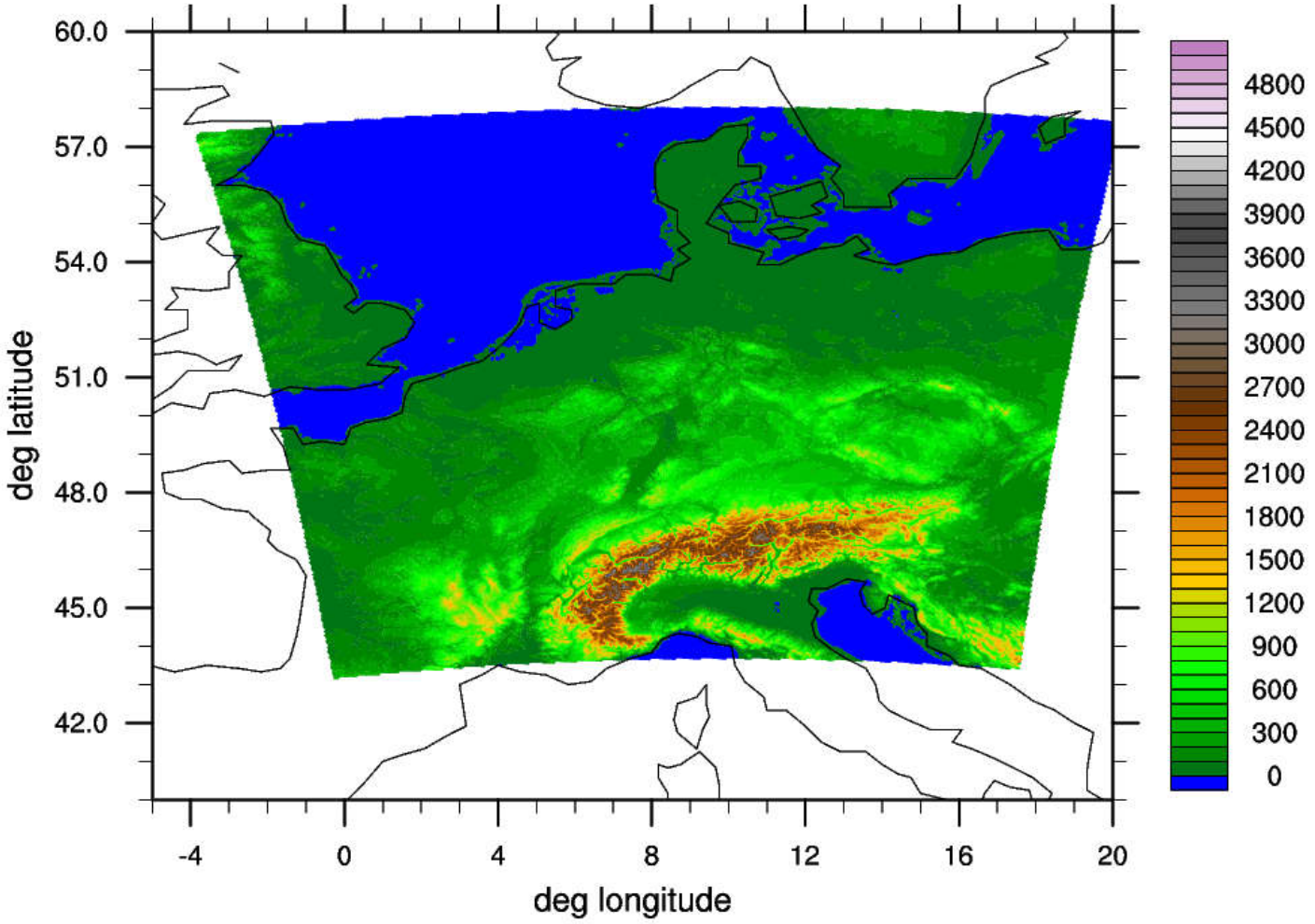
- Unified modelling system for global and regional scale
- Focus of national and international collaborations on this modelling system (e.g., COSMO, CLM, ART, universities)
- Better efficiency in model development (content and software infrastructure)
- Improvements in model physics (e.g., surface tiles)
- Better forecast quality
- Higher efficiency in terms of HPC resources

ICON features important for COSMO

- Mass conservation, mass consistent tracer advection
- Stable dycore for steep terrain
- Up-to-date physics packages, e.g. RRTM, tile approach
- One-way and two nesting options available
- Hybrid MPI / OpenMP parallelization, highly scalable and efficient
- ICON-model is between 30 to 50% faster than COSMO-model
- Consistent initial and lateral boundary data based on global ICON-model
- Further development and support by DWD, MPI-M, KIT and DKRZ

ICON-D2 – Setup

- Grid: R19B7 (2.08 km), 65 layers with model top at 22 km
- Grid covers an area similar to COSMO-D2



ICON-LAM: Time line at DWD

- ➔ Optimization of model configuration and parameterizations (permanent task)
- ➔ Coupling of ICON-LAM with KENDA (Km-scale ENsemble-based Data Assimilation)

Goal: Consolidated version until end of 2018, afterwards further improvements

- ➔ Further extension of the verification system
- ➔ Parallel routine in summer 2019 (det. & ens.)

Operational in the second half of 2020

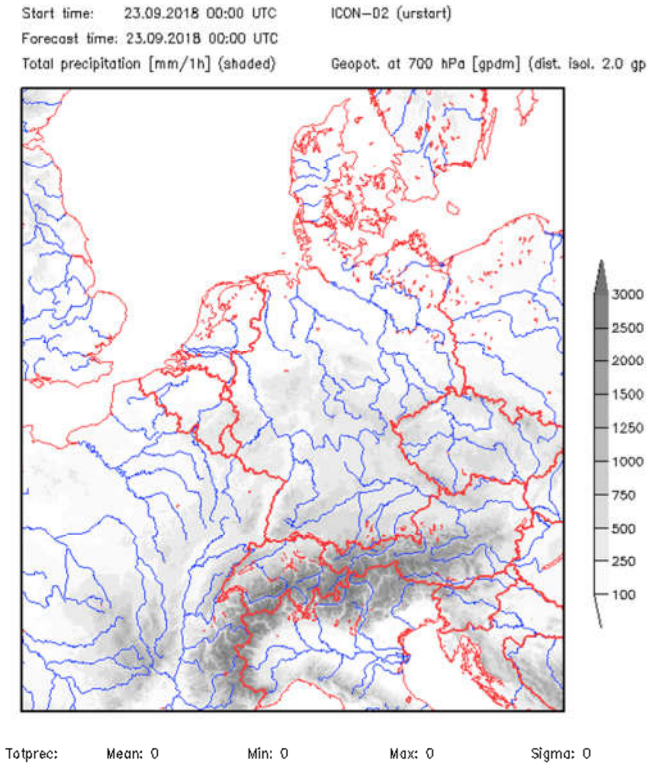
Results for June 2018

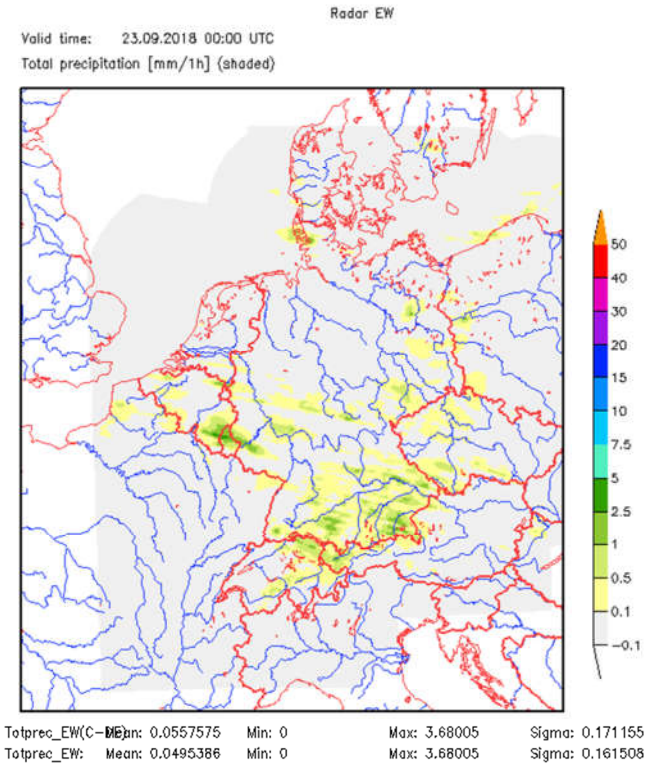
- COSMO-D2 forecasts (routine)

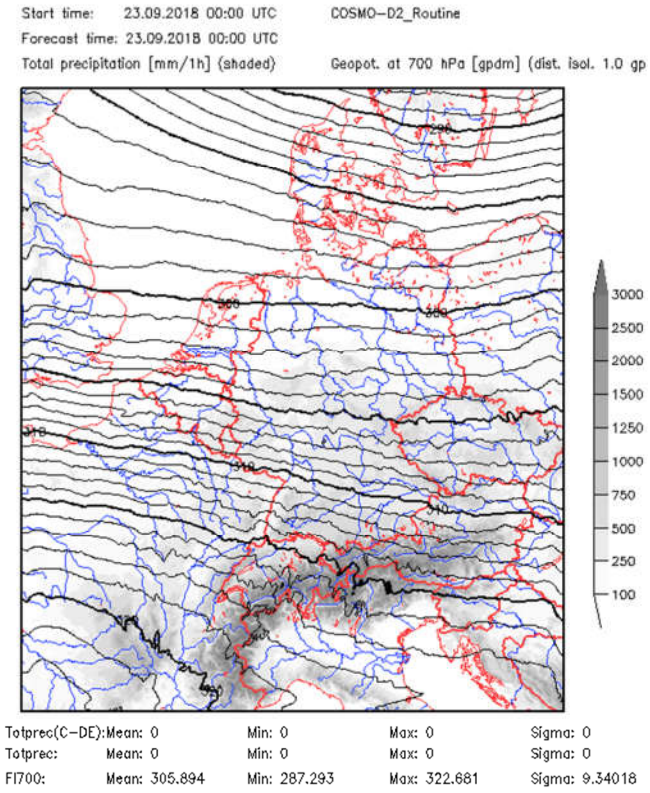
- ICON-D2 started every 12h from interpolated analysis with BC from ICON-EU

ICON-D2 Tests at DWD

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



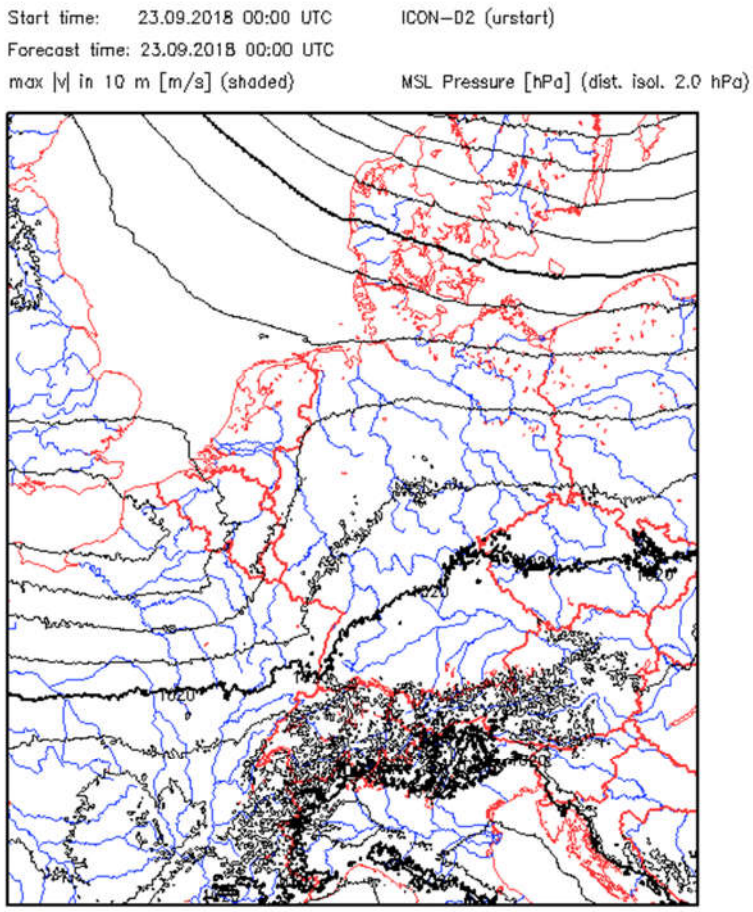




ICON-D2 **OBS** **COSMO-D2**

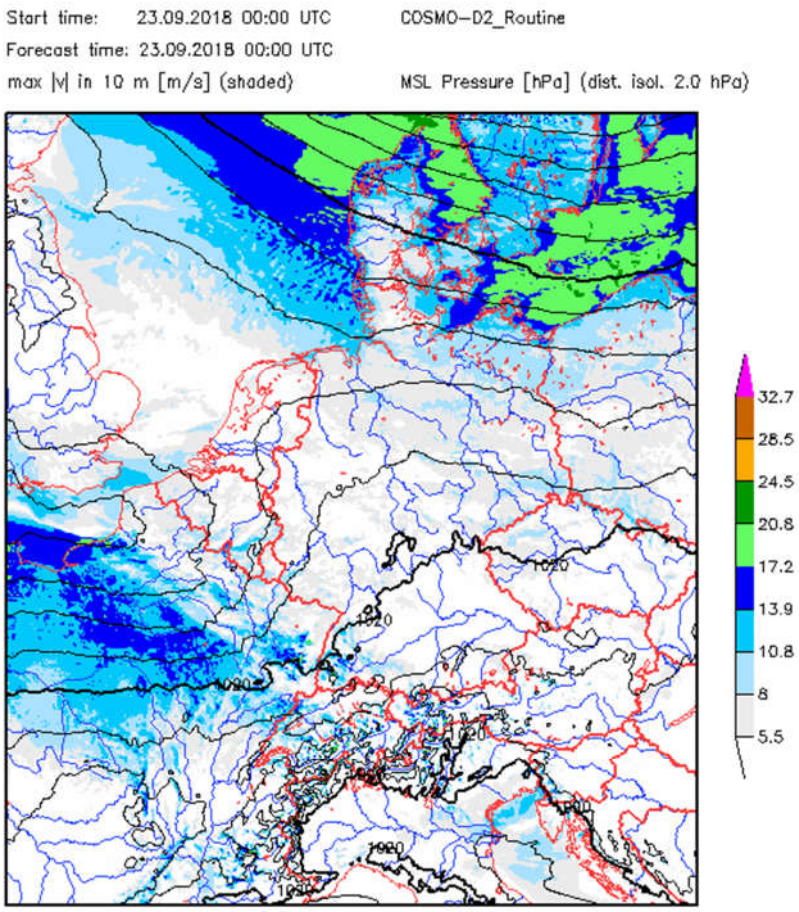
ICON-D2 Tests at DWD

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



vmax_10m: Mean: 0 Min: 0 Max: 0 Sigma: 0
PMSL: Mean: 1016.28 Min: 1000.71 Max: 1028.47 Sigma: 5.14861

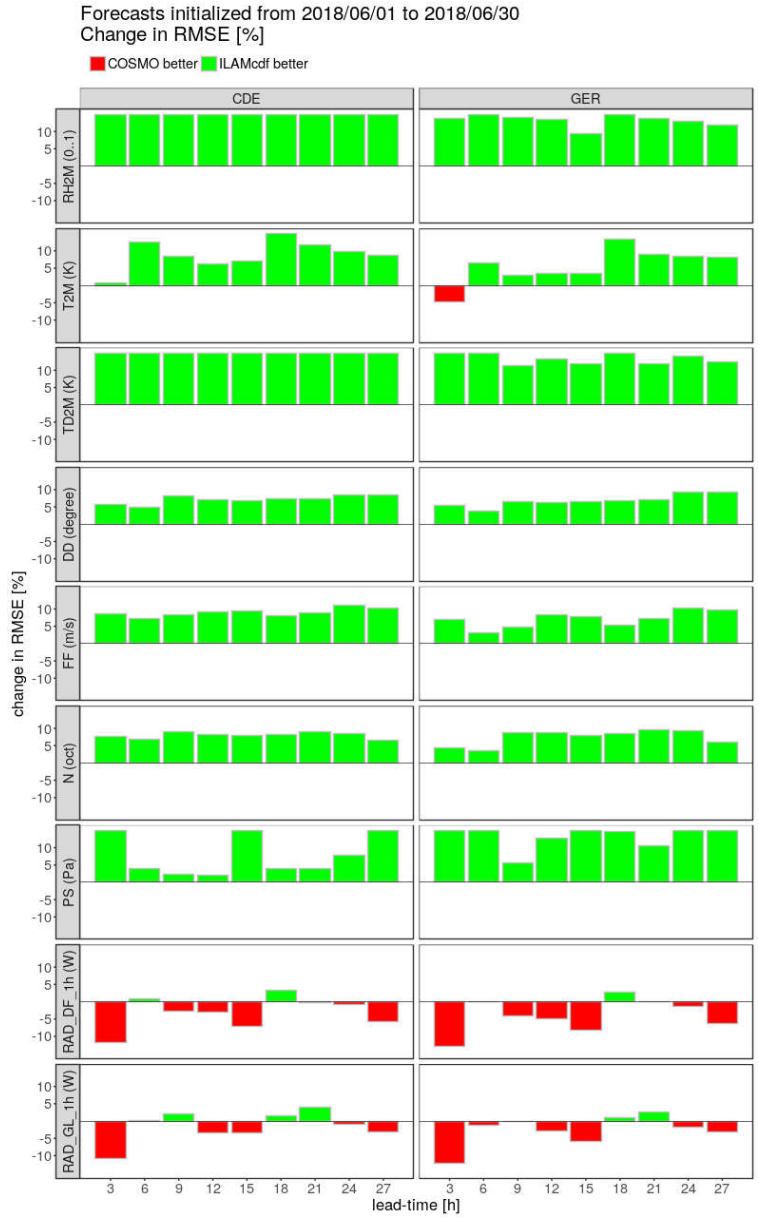
ICON-D2



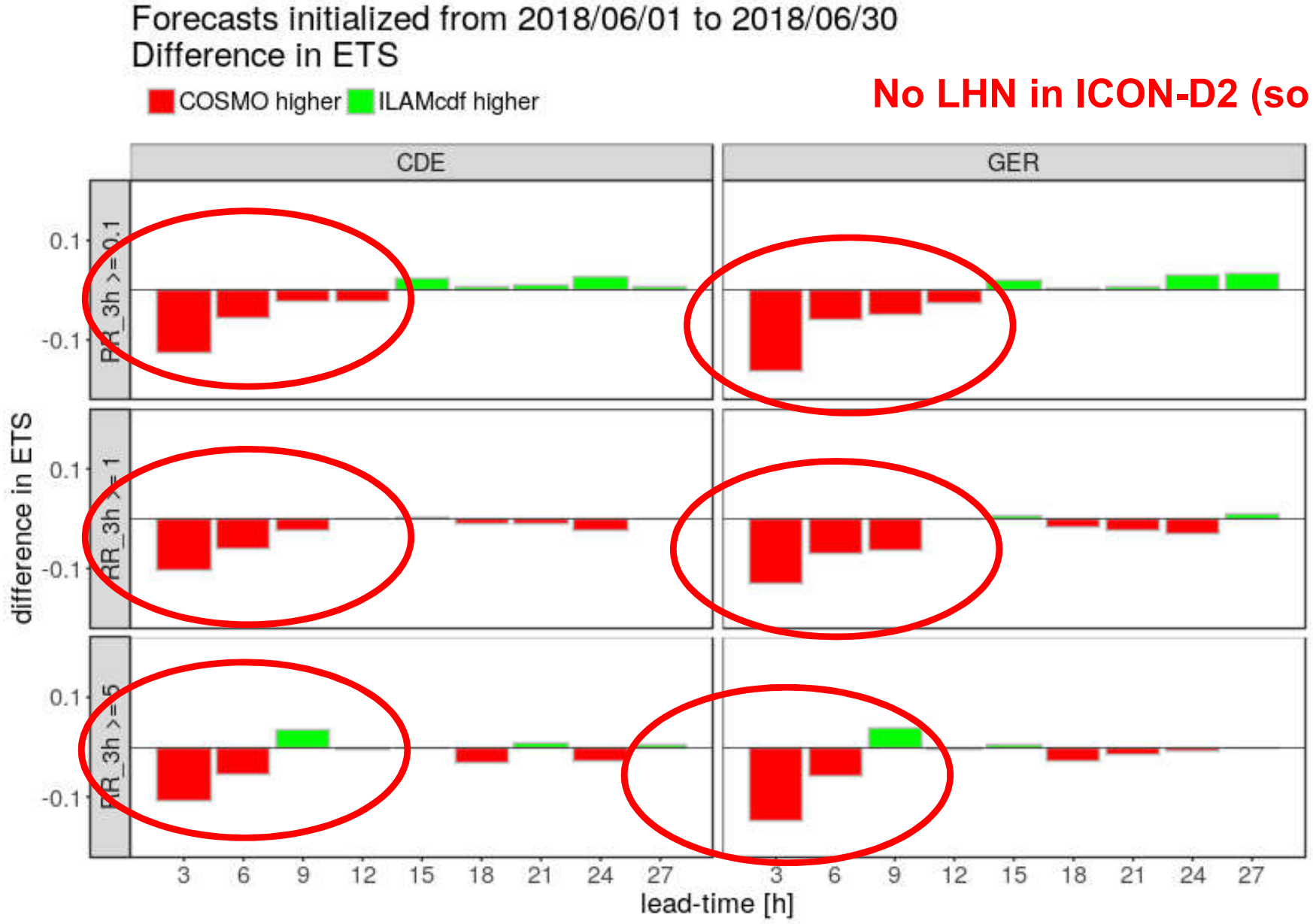
vmax_10m(C-D2): Mean: 7.17556 Min: 0.0116721 Max: 31.2299 Sigma: 4.39442
vmax_10m: Mean: 7.71169 Min: 0.0116721 Max: 31.2299 Sigma: 4.82304
PMSL: Mean: 1016.64 Min: 1000.74 Max: 1030.09 Sigma: 5.18758

COSMO-D2

ICON-D2 Tests at DWD

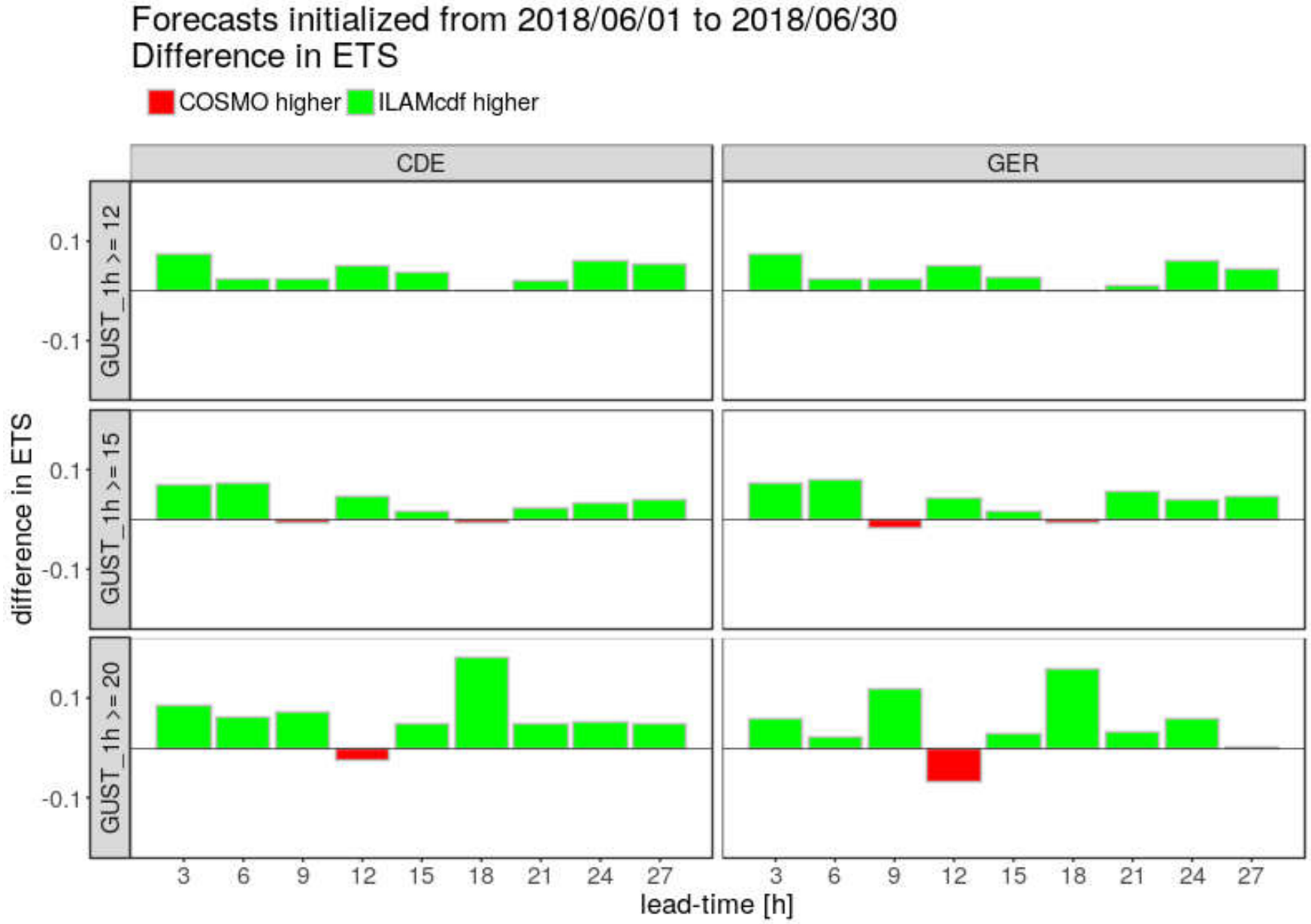


ICON-D2 Tests at DWD



No LHN in ICON-D2 (so far)

ICON-D2 Tests at DWD



Motivation COSMO Priority Project C2I

- COSMO Priority Projects are specific research tasks over a period of 3 to 4 years
- Focus of DWD developments on ICON instead of the COSMO model
- COSMO strategy foresees a transition phase to ICON-LAM
- PP C2I is restricted to deterministic modelling systems. Ensemble applications are covered by COSMO Priority Project APSU

Goal of the COSMO Priority Project C2I is to ensure a smooth transition from the COSMO model to ICON-LAM

Participating institutions

- National meteorological services of the COSMO member states:

  MCH (Switzerland), **COMET** (Italy), **HNMS** (Greece), **IMGW** (Poland), **NMA** (Romania), **RHM** (Russia), **IMS** (Israel)

- Other major COSMO members:

  ARPAE (Italy), **ARPA Piemonte** (Italy), **CIRA** (Italy)

- Academic communities:

  CLM Community, **ART**

- National meteorological services (licensees):

  INMET (Brasil)

PP C2I Timeline

Phase 1

- ICON Training 2018
- Installation
- Setup
- First experiments

Q2 2018 – Q4 2018

Phase 2

- Daily forecasts
- Verification

Q1 2019 – Q2 2020

Phase 3

- Daily forecasts
- Verification
- Data assimilation
- Forecasters' feedback

Q3 2020 – Q4 2021

15-19 October 2018, Langen, Germany

- Financial support from COSMO license money is approved for two participants per institution

Preliminary agenda includes:

- Remapping of initial and boundary data (from global ICON or IFS)
- Conduction of ICON simulations for individually chosen limited-area domains
- Lecture and exercises on Fieldextra
- Visualization of the results
- First, these tasks are performed on DWD's HPC system. The next step is to perform those simulations on the individual participants' HPC system (if remote access is possible)


Thank you for your attention!
Any questions?