



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

Swiss Confederation

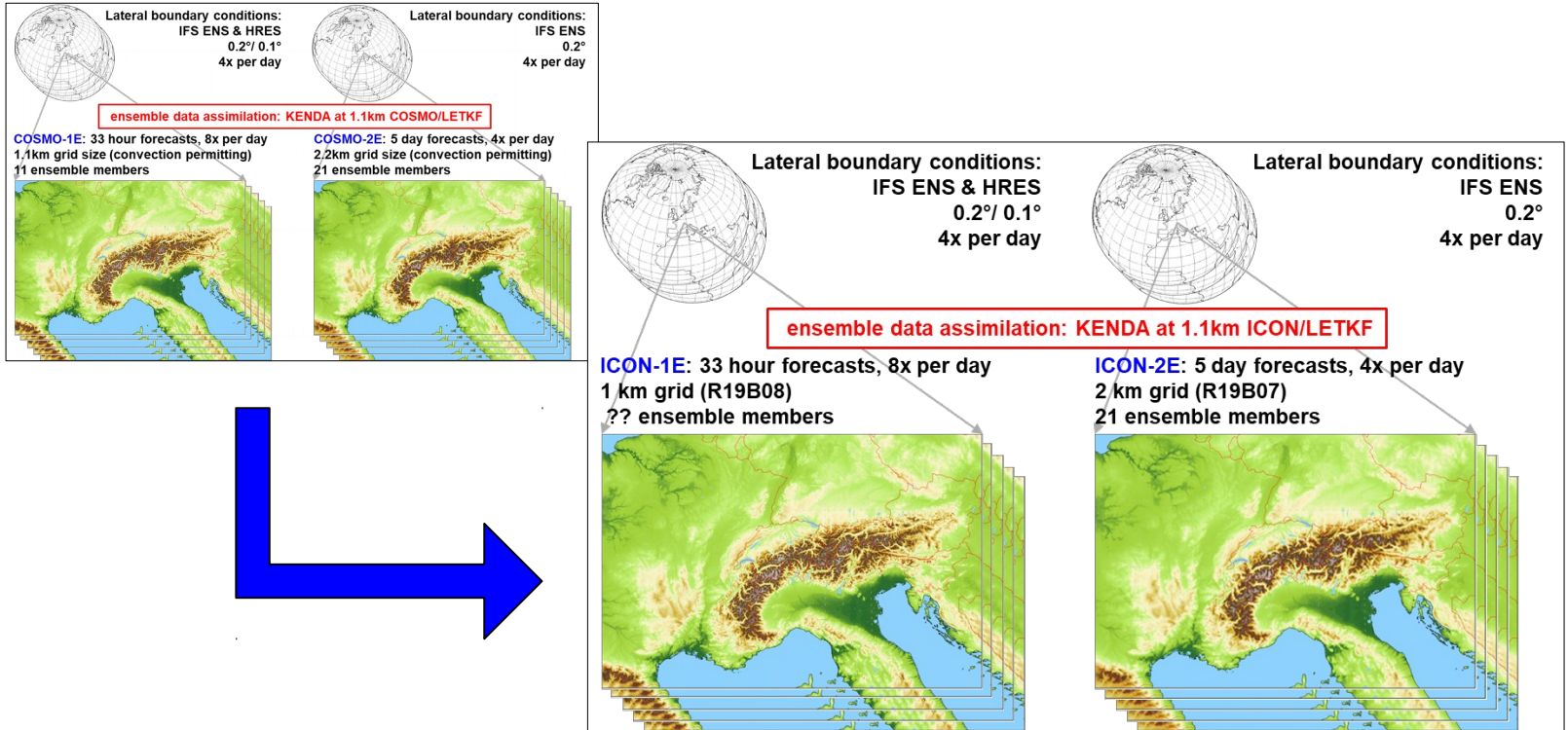
Federal Department of Home Affairs FDHA  
Federal Office of Meteorology and Climatology MeteoSwiss

# C2I Status at MeteoSwiss

André Walser, Sascha Bellaire, Guy de Morsier

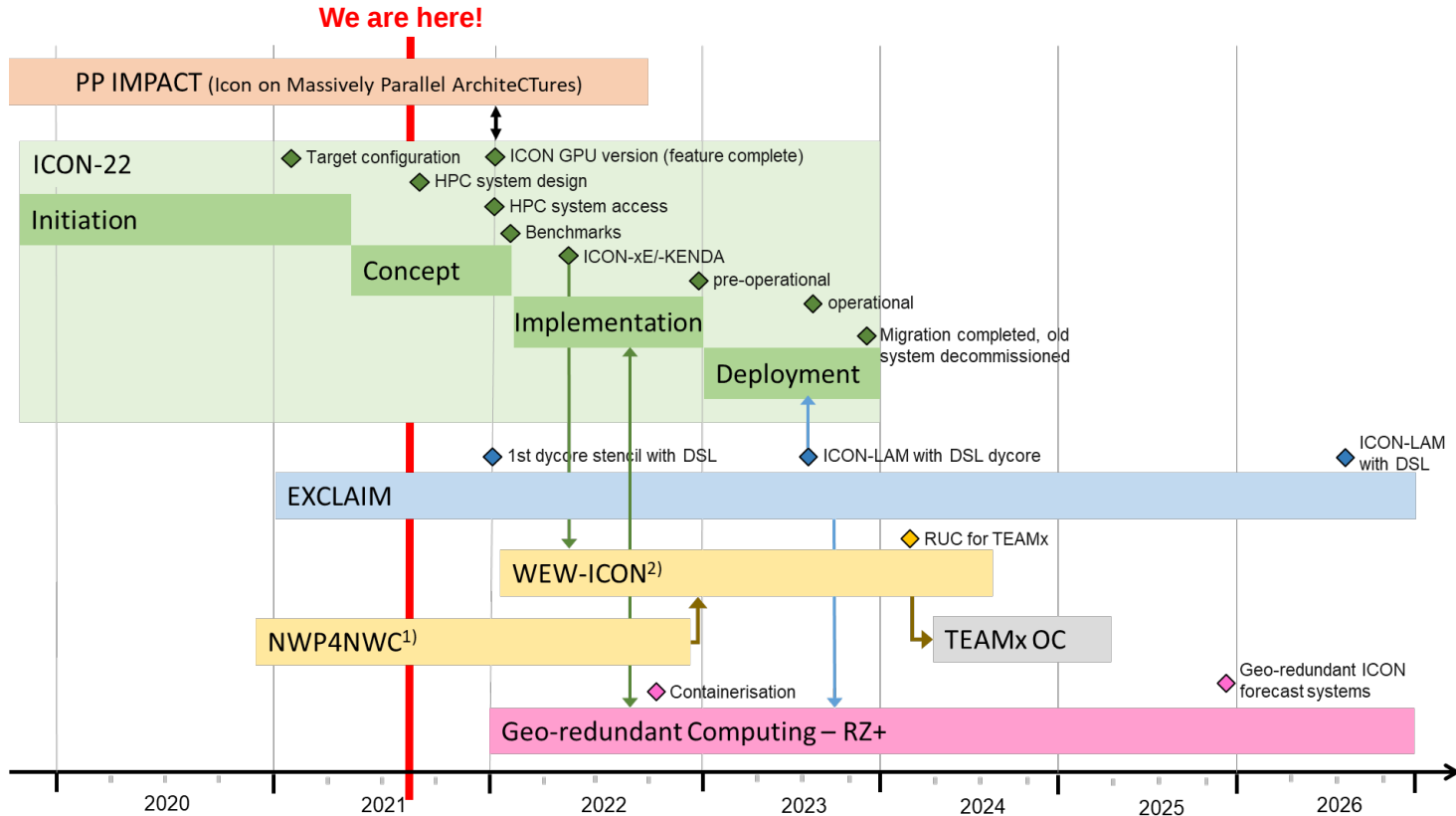


# Project ICON-22: ICON-1E & ICON-2E





# Timeline ICON-22



<sup>1)</sup> Assimilation of Raman lidar, rapid update cycle (RUC) & NowPrecip; innovation project within OWARNA2@MCH

<sup>2)</sup> Assessment of benefit of new NWP configurations (assimilation & forecasts) for Nowcasting (RUC) and TEAMx Observational Campaign

deterministic ICON forecasts  
@ ECMWF:  
ICON-1 & ICON-2



# Summary of progress since ICCARUS

- upgrade of namelists to be closer to ICON-D2 (cp/cv bugfix)
- use R19B08 grid for ICON-1 (before: R5B10) and use HWSD (1km resolution) soil textures instead of FAO-DSMW (10km resolution)
- tried to alleviate pressure bias with a larger nudging lateral zone width (20 grid points as in COSMO) and upper boundary nudging: without success
- ICON tests on ECMWF's new TEMS/ATOS machine in collaboration with Daniel Rieger, Alon Shtivelman and Paul Dando (ECMWF support):
  - build with gcc and intel compiler possible
  - significantly slower compared to current system CCA/CCB
  - bottleneck memory bandwidth/OpenMP parallelization
- work on a 'single precision ICON' suspended (due to priorities)



# ICON-2 model setup



- daily 00 and 12 UTC forecasts up to +72h
- domain: Alpine region
- IC: opr KENDA-1 / LBCs: HRES
- grid: R19B07 / ~2.1 km, dtime=20s
- DWD setup (but lgrayzone\_deepconv=.false.)
- 80 levels, only shallow convection, ECrad every 10'
- external parameters with HWSD (as for COSMO suites)
- ICON 2.6.2-nwp2 (since April 14, 2021)
- computed on CCA at ECMWF (CPU) twice a day



# ICON-1 model setup



- daily 00 and 12 UTC forecasts up to +33h
- domain: Alpine region
- IC: opr KENDA-1 / LBCs: HRES
- grid: R19B08 / ~1 km, dtime=10s
- DWD setup (but lgrayzone\_deepconv=.false.)
- 80 levels, only shallow convection, ECrad every 10'
- external parameters with HWSD (as for COSMO suites)
- ICON 2.6.2-nwp2 (since April 14, 2021)
- computed on CCA at ECMWF (CPU) twice a day

# Verification results





# Verification

- 00 and 12 UTC deterministic forecasts until +24h
- domain: Switzerland (SwissMetNet stations)
- **ICON-1** vs. **ICON-2** vs. **ICON-D2** vs. **COSMO-1E control**
- scores: mainly mean error (bias) and standard deviation

*many thanks to Christoph Gebhardt for providing the ICON-D2 data!*



# ICON-1 vs. C-1E Ctrl: spring 2021 (+13 to +24h)

Parameter	ME	STDE
PMSL	Red	Red
T_2M	Green	Green
TD_2M	Green	Green
RELHUM_2M	Green	Green
GLOB	Light Blue	Light Blue
CLCT	Green	Light Blue
FF_10M	Red	Light Blue
DD_10M	Red	Green
VMAX_10M1h	Light Blue	Green
TOT_PREC1h	Green	Light Blue

ICON clearly better

ICON slightly better

ICON neutral

ICON slightly worse

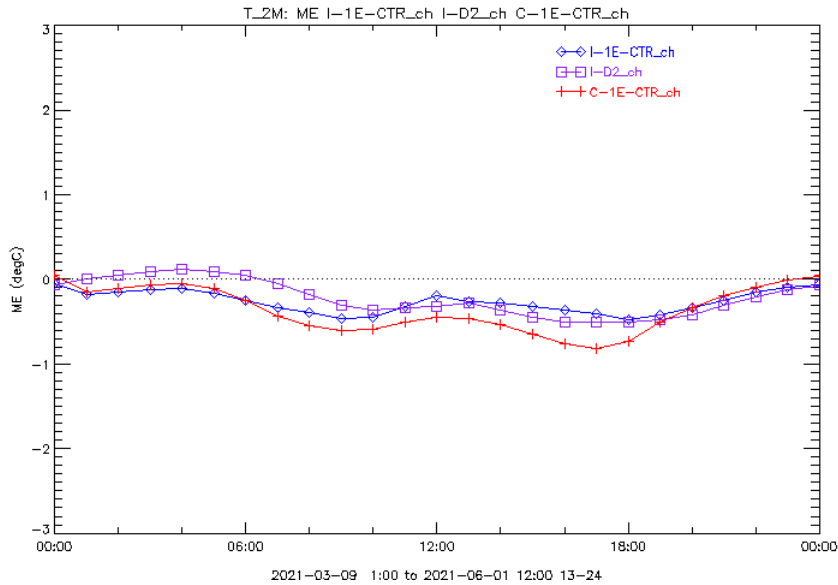
ICON clearly worse



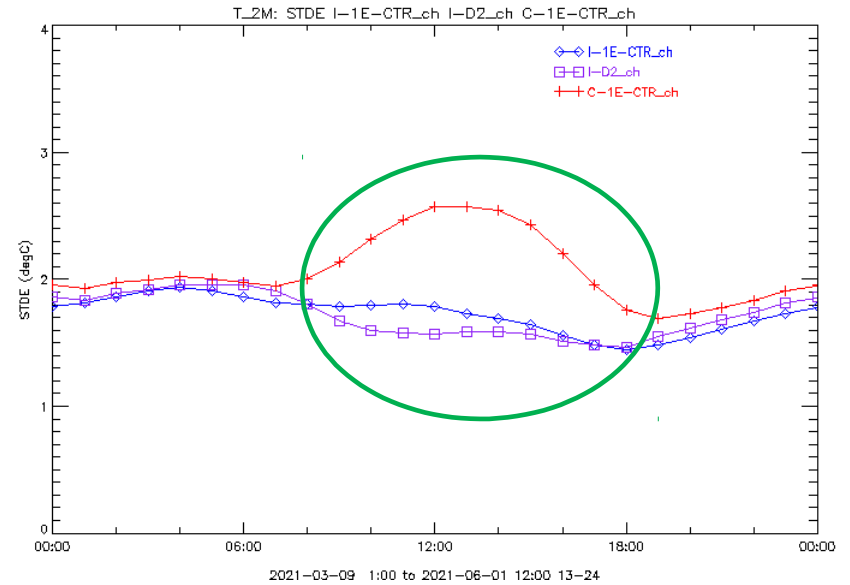
# Highlight: 2m temperature (+13 to +24h)

ICON-1 vs COSMO-1E Ctrl vs ICON-D2 (DWD)

Mean Error (bias)



Standard Deviation



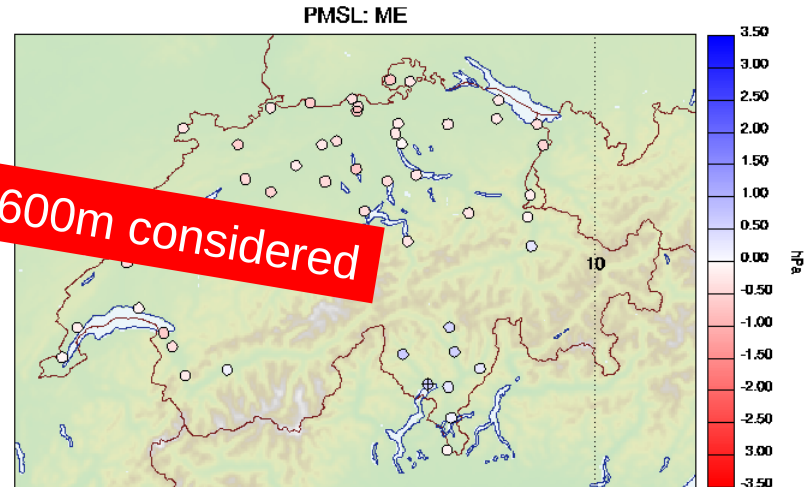
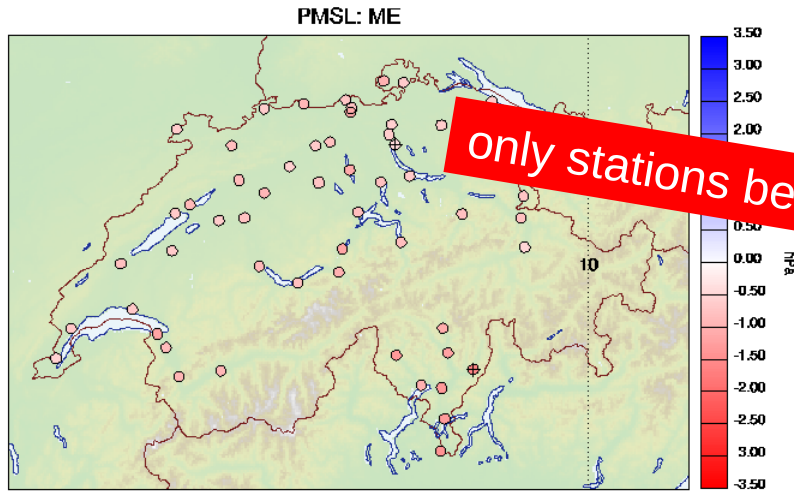


# Surface pressure reduced to msl (+13 to +24h)

Mean Error (bias) +13 to +24h

ICON-1E Ctrl

COSMO-1E Ctrl



I-1E-CTR\_ch 2021-03-09 1:00 to 2021-06-01 12:00 13-24  
+Min: -1.575 hPa at station GRO +Max: -0.4570 hPa at station SMA

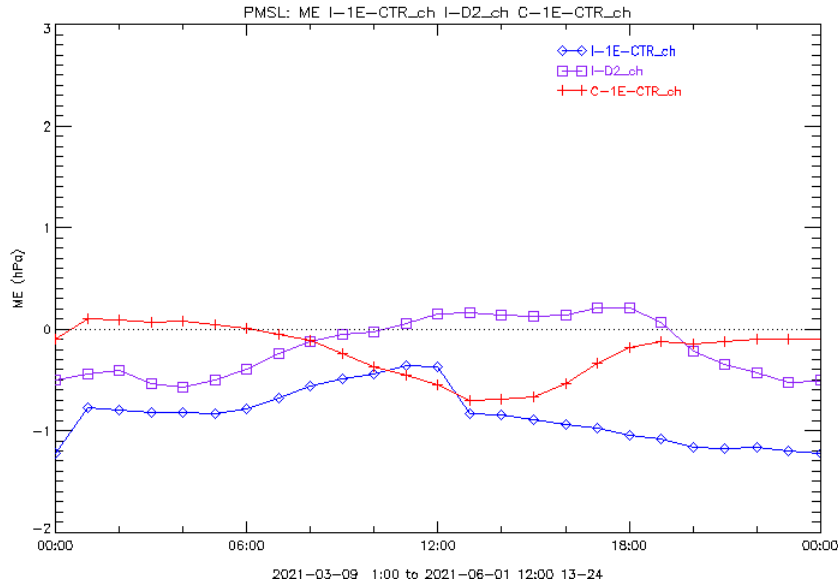
C-1E-CTR\_ch 2021-03-09 1:00 to 2021-06-01 12:00 13-24  
+Min: -0.7766 hPa at station GIH +Max: 0.6679 hPa at station OTL



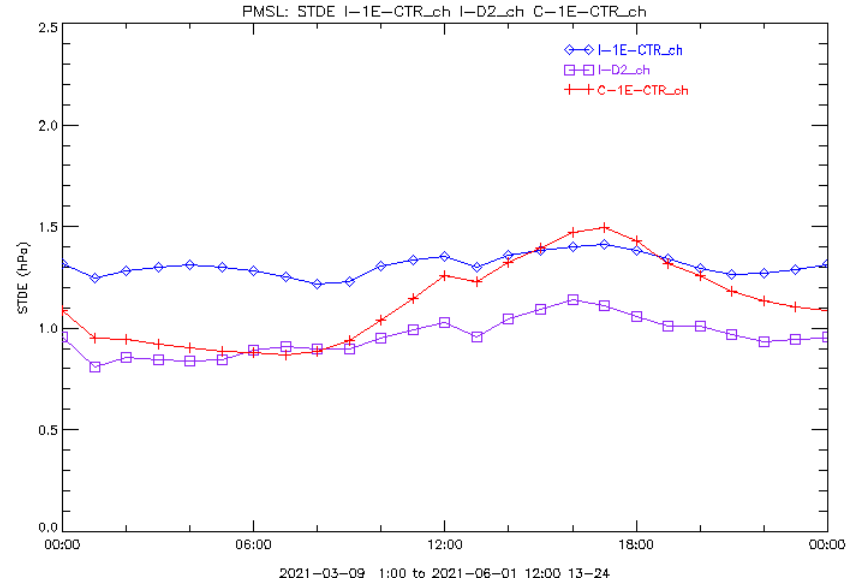
# Surface pressure reduced to msl (+13 to +24h)

ICON-1 vs COSMO-1E Ctrl vs ICON-D2 (DWD)

Mean Error (bias)



Standard Deviation

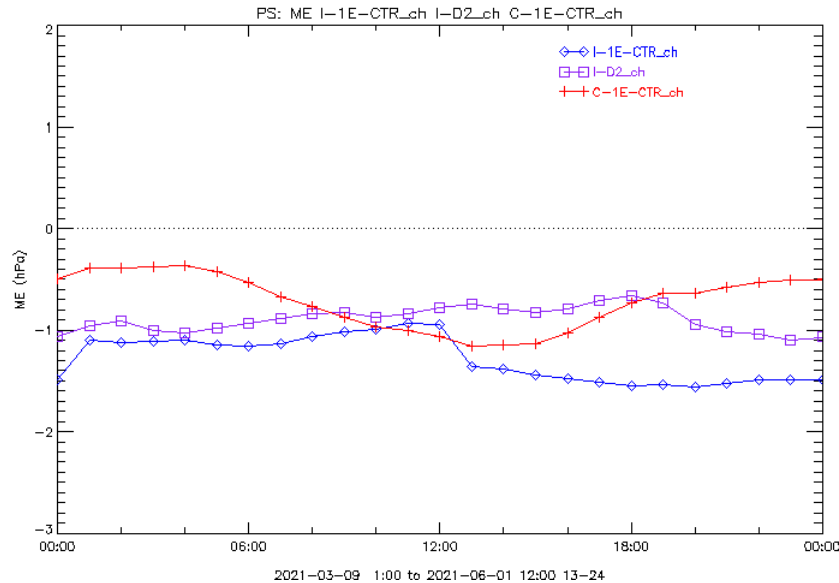




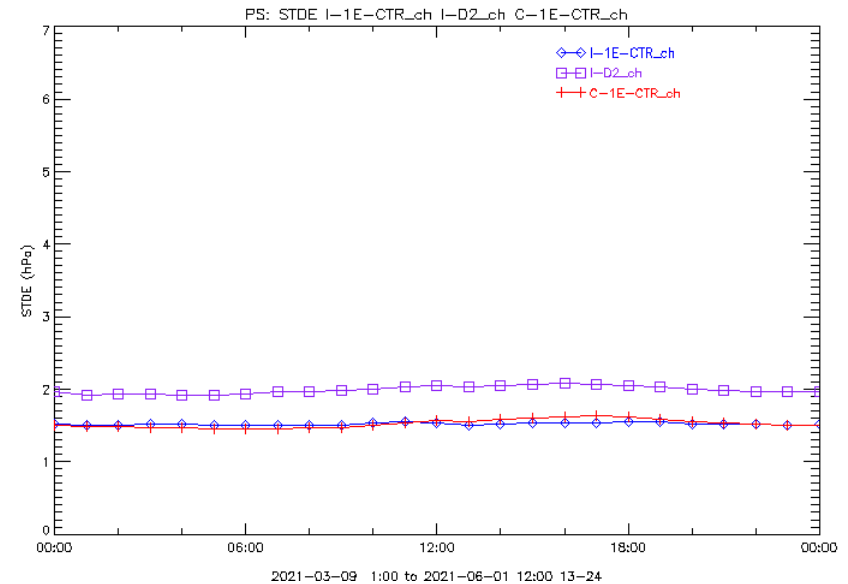
# Surface pressure (+13 to +24h)

ICON-1 vs COSMO-1E Ctrl vs ICON-D2 (DWD)

Mean Error (bias)



Standard Deviation





# ICON-1 vs. C-1E Ctrl: summer 2021<sub>(+13 to +24h)</sub>

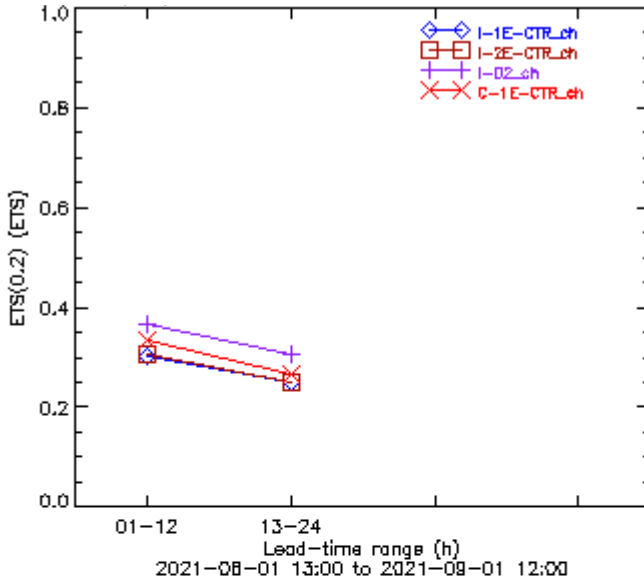
Parameter	ME	STDE
PMSL	Red	Red
PS	Light Blue	Light Green
T_2M	Light Blue	Green
TD_2M	Green	Green
RELHUM_2M	Green	Green
GLOB	Light Blue	Light Blue
CLCT	Light Blue	Light Blue
FF_10M	Red	Light Green
DD_10M	Red	Light Green
VMAX_10M1h	Light Blue	Green
TOT_PREC1h	Light Blue	Red

ICON clearly better  
ICON slightly better  
ICON neutral  
ICON slightly worse  
ICON clearly worse

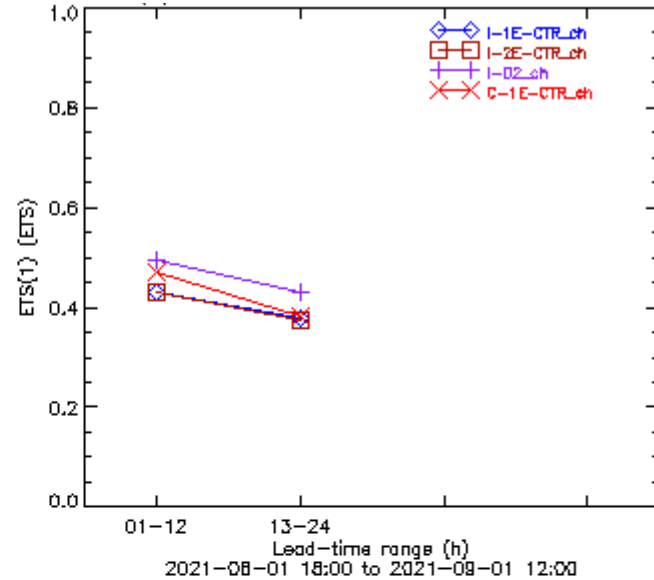


# Precipitation: Equitable Threat Score

TOT\_PREC 1h (0.2mm)



TOT\_PREC 6h (1mm)

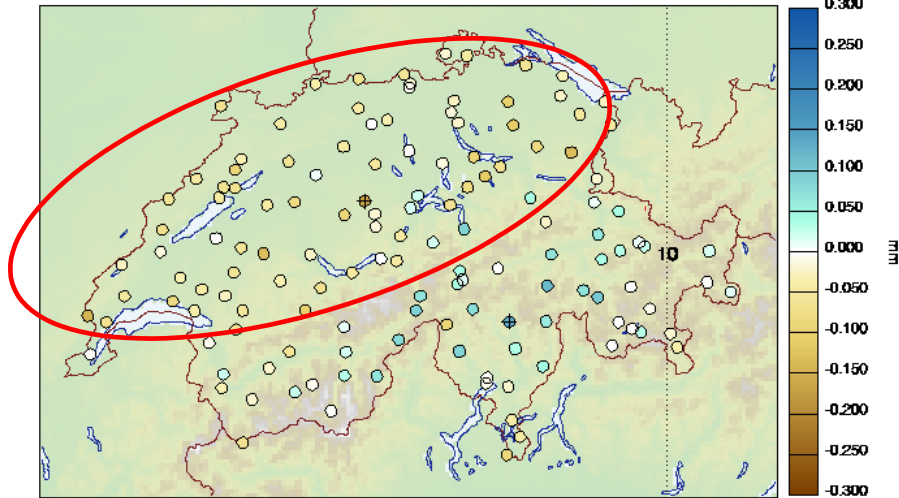






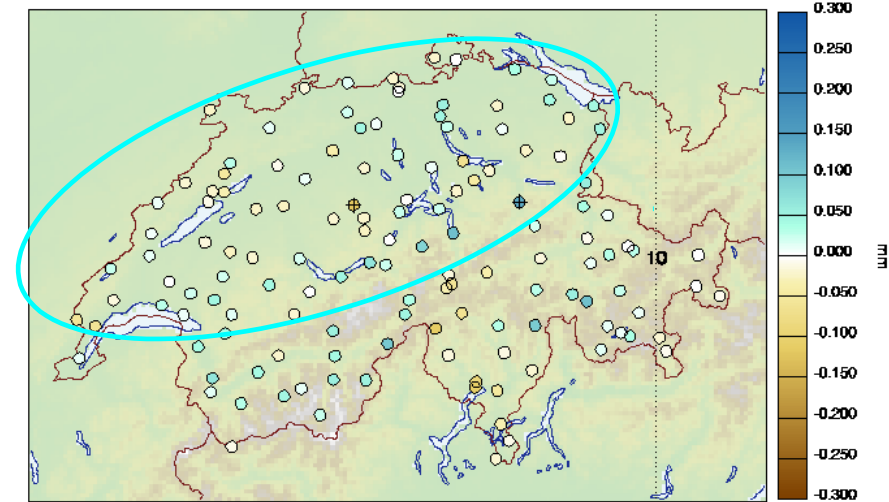
# 1h precipitation bias: ICON-2 vs ICON-D2

ICON-2



I-2E-CTR\_ch 2021-06-01 13:00 to 2021-09-01 12:00 13-24  
+Min: -0.1709 mm at station NAP +Max: 0.1323 mm at station COM

ICON-D2



I-D2\_ch 2021-06-01 13:00 to 2021-09-01 12:00 13-24  
+Min: -0.1205 mm at station NAP +Max: 0.1346 mm at station GLA

- all models except ICON-D2 show a dry bias over the Swiss Plateau
- impact of lgrayzone\_deepconv switch ?



# Outlook

soon:

- `islope_rad = 2` for radiation with horizon (cf. `lrادتopo` in COSMO)
- upper-air verification with `Rfdbk`

later:

- SSO tuning (to mitigate bias in mean wind for Switzerland)
- impact of `lgrayzone` switch on convection in the Alps
- SPPT
- start with ICON ensemble forecasts