Regional Cooperation for Limited Area Modeling in Central Europe

LACE nwp central europe

ACCORD A Consortium for COnvection-scale modelling Research and Development

Status data assimilation in Austria

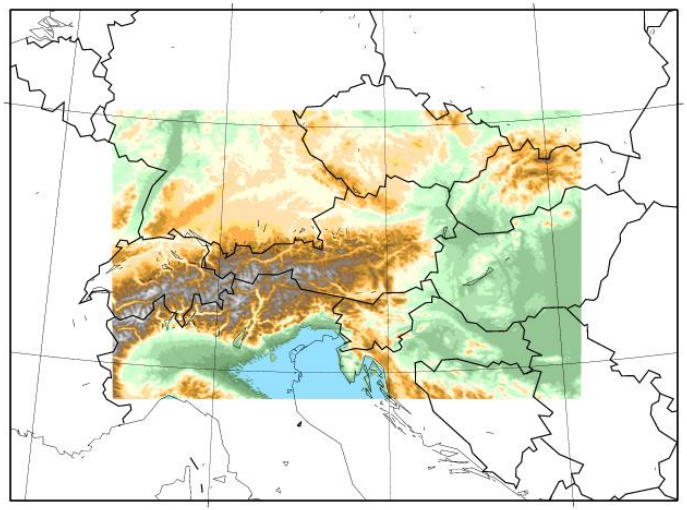
Florian Meier

DHMZ SHMU OMSZ ZAMG ROMANIA ANM

Operational systems (cy40t1)

- 3 AROME configurations cy40t1 Det (AROME-Aut)+EPS (CLAEF)+Nowcasting (AROME-RUC)
- AROME-Aut and CLAEF 600x432 GP 2.5km 90L
- AROME-RUC 900x576 GP 1.2km 90L (5UTC now till +25h)

AROME–RUC Domain & Topography



Initialisation: CANARI-OI-MAIN+3D-Var 6h/3h/1h
CLAEF with EDA and Ens.-Jk
AROME-RUC with IAU, LHN and FDDA-Nudging
Snow exchanged within CANARI with snow model Values
Some lake temperatures exchanged with measurements or averaged T2m values of shore stations

LBCs: IFS/IFS-EPS/AROME-AUT

cy43t2 parallel experiments for all configurations

Observations used in AROME/C-LAEF:

Obstype	Parameter
Synop+Tawes+Ship	U10m,V10m, RH2m,T2m, Z
AMDAR	U, V, T
MODE-S test (KNMI/OPLACE) DK	U, V, T
GEOWIND	AMV (WVCL1/2,WVMW1, IR3,VIS3)
TEMP	U, V, T, Z, Q
PILOT	U,V
MSG-SEVIRI	WV radiances
NOAA18/19/MetOp-A,-B	AMSU-A, AMSU-B, MHS, HIRS
MetOp-A	IASI
MetOp-A	U10m, V10m ASCAT ocean winds 25km

CANARI settings: REF_A=190km, LVARSIGO=F, LMESCAN=T, LCORRF=T
REF_S_T2=5.0,REF_S_H2=0.3,RCLIMCA=0.045,RCT2SY=3.9, RCH2SY=2.5
OROLIM=3800.,ORODIF=1650. REDNMC=1.2->0.5 in cy43t2

T_LAKE from Lake Constance from measurement interpolated inside OIMAIN

Observations used in AROME/C-LAEF:

Obstype	Parameter
Synop+Tawes+Ship	U10m,V10m, RH2m,T2m, Z
AMDAR	U, V, T
MODE-S test (KNMI/OPLACE) DK	U, V, T
GEOWIND	AMV (WV… …MW1, IR3,VIS3)
TEMP	… Q
PILOT	U,V
MSG-SEVIRI	WV radiances
NOAA18/19/MetOp-A,-B	AMSU-A, AMSU-B, MHS, HIRS
MetOp-A	IASI
MetOp-A	U10m, V10m ASCAT ocean winds 25km

No Change since last year!

CANARI settings: REF_A=190km, LVARSIGO=F, LMESCAN=T, LCORRF=T
REF_S_T2=5.0,REF_S_H2=0.3,RCLIMCA=0.045,RCT2SY=3.9, RCH2SY=2.5
OROLIM=3800.,ORODIF=1650. REDNMC=1.2->0.5 in cy43t2

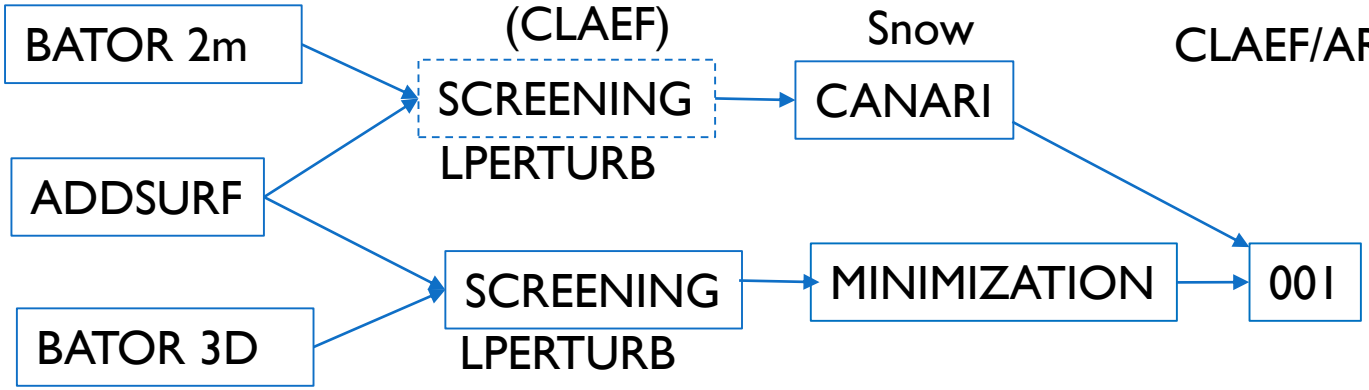
T_LAKE from Lake Constance from measurement interpolated inside OIMAIN

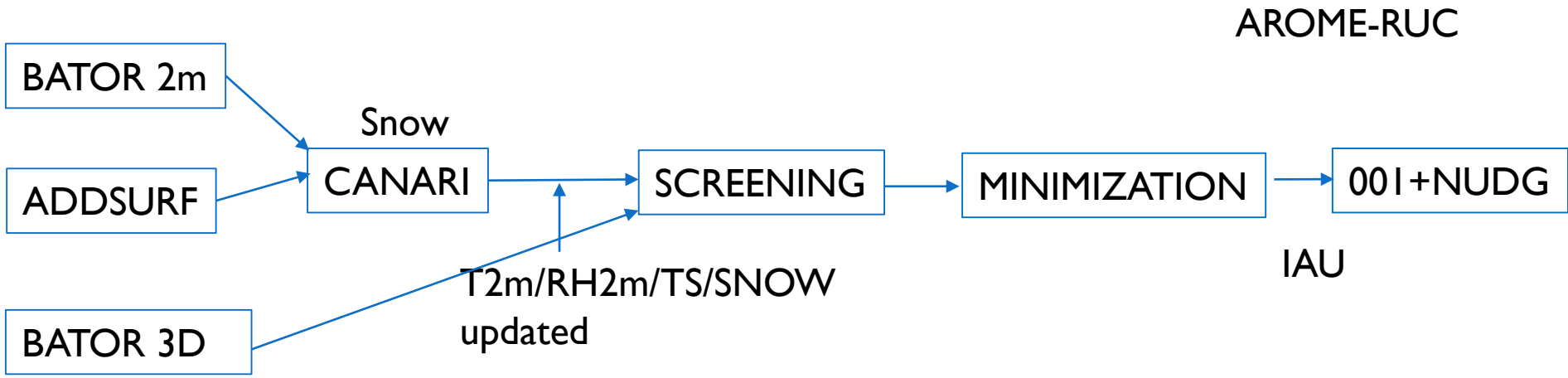
Additional observations in AROME-RUC:

Obstype	Parameter
SYNOP national (AT+ OPLACE without SK)	U10m,V10m, RH2m,T2m, Z
MODE-S ARSO/CHMI (MRAR) KNMI/AT/DK	U, V, T +AMDAR-Q
RADAR	DOW+REF +saturation of profiles
GNSS (AT national) VARBC	ZTD
GNSS-RO ROMSAF	bending angle
Windprofiler + SODAR	U,V
MetOp-C all radiances active	AMSUA, MHS, IASI
ATMS SUOMI+NOAA20	Radiances ch1-3,5-14,16-22
INCA	RR5min via LHN
TAWES+10/20/30min	T2m/RH2m/U10m/V10m via FDDA Nudging
T-Lake (Fertoe/Balaton) pseudo obs	TS_WATER

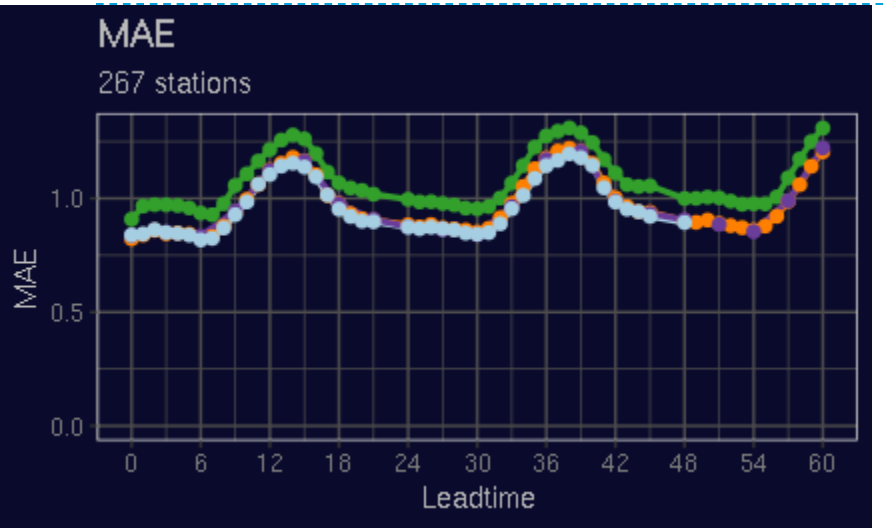
CANARI settings: REF_A=100km, LVARSIGO=F, LMESCAN=T, LCORRF=T
REF_S_T2=3.12,REF_S_H2=0.28, RCLIMCA=0.045, RCT2SY=3.9,
RCH2SY=2.5 OROLIM=3800.,ORODIF=1650. REDNMC=1.5

Order of assimilation

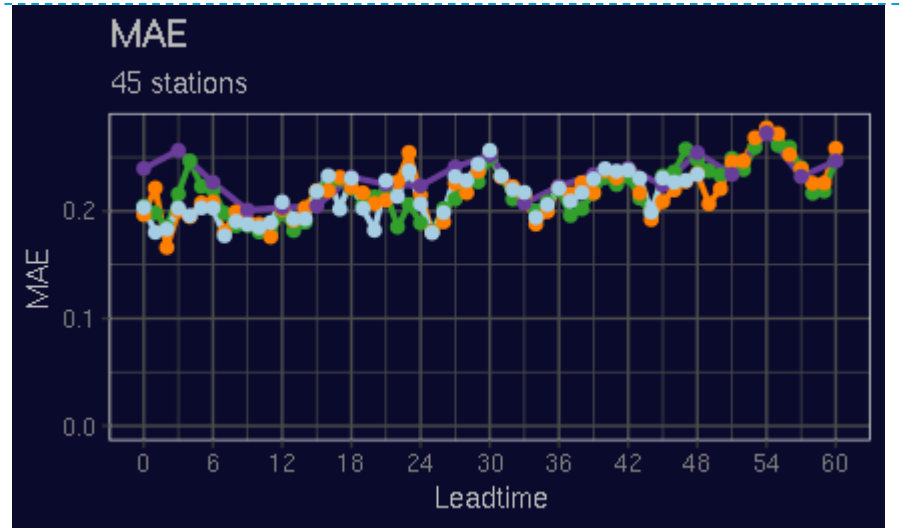




Cy43t2 vs cy40t1 AROME-AUT/CLAEF

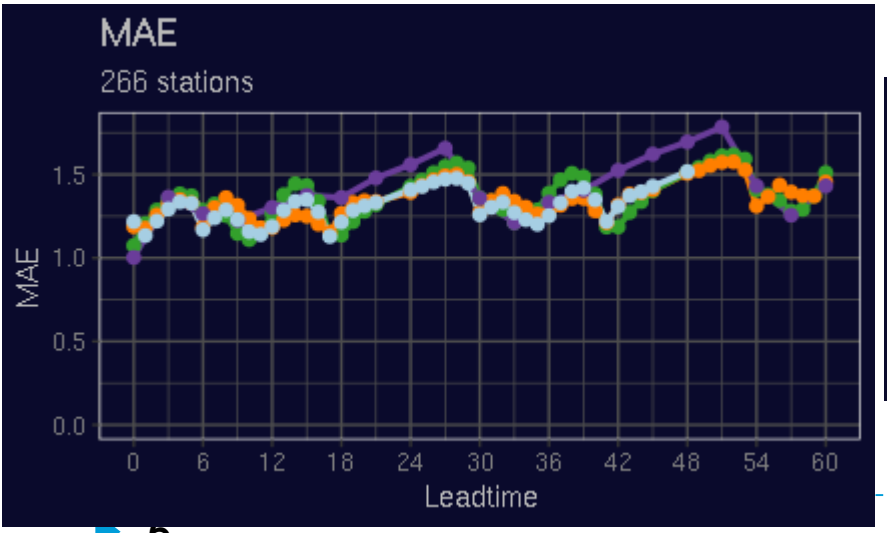


10m wind

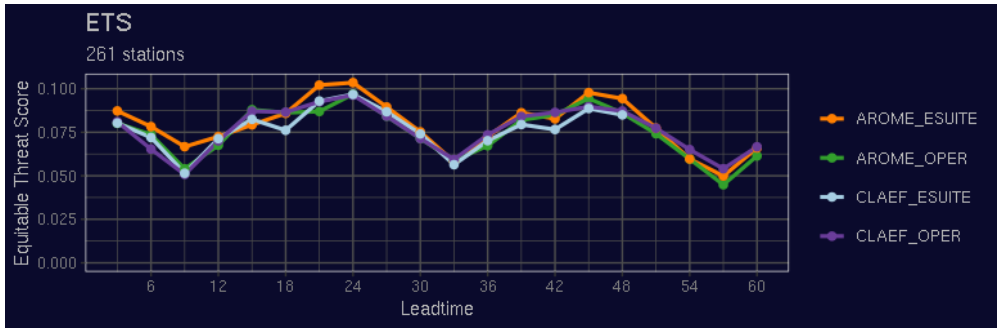


TCC

17th August – 16th September 2021

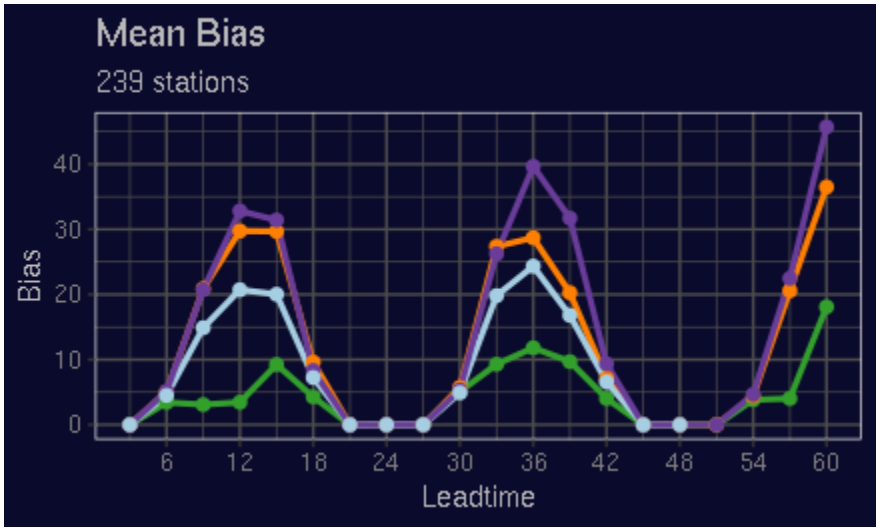


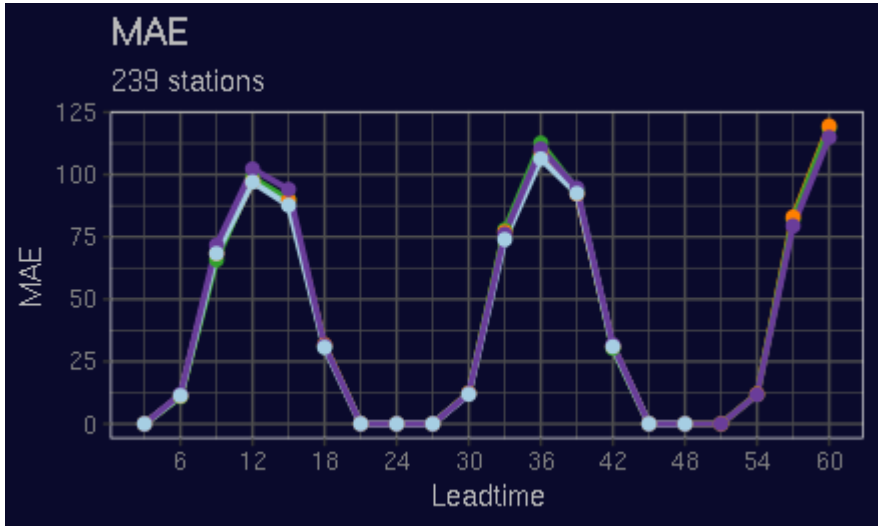
T2m



3h precipitation

Cy43t2 vs cy40t1 AROME-AUT/CLAEF





global radiation

17th August – 16th September 2021

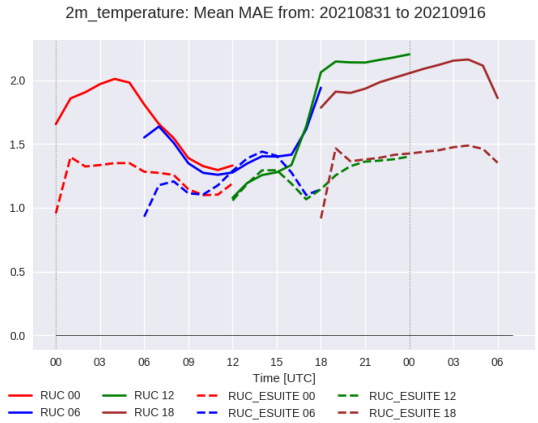
Except bias of global radiation cy43t2 performs equal or better than cy40t1
new 2m diagnostics
->REDNMC changed 1.2->0.5;
new B-Matrix – static based on CLAEF EDA instead downscaled ALADIN-LAEF;
orography GMTED instead of GTOPO 30
and sand/clay FAO->HSWD

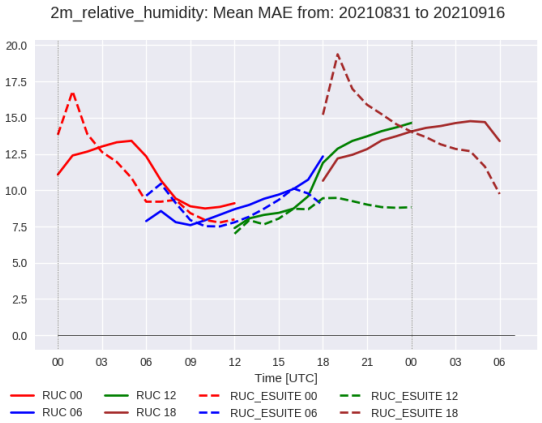
AROME-Aut cy40t1; AROME-Aut cy43t2; CLAEF cy40t1; CLAEF cy43t2

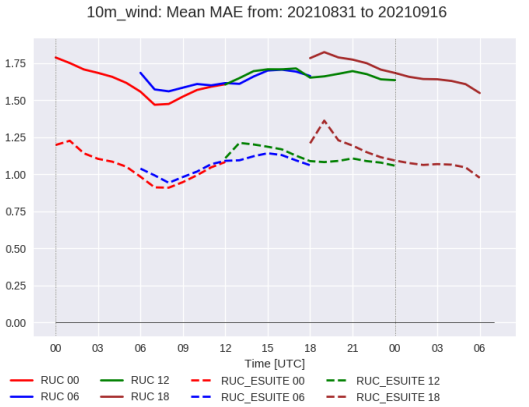
T2m

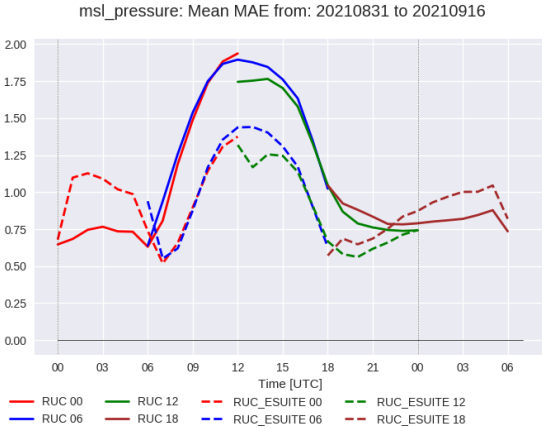
RUC parallel cy43t2 vs RUC cy40t1

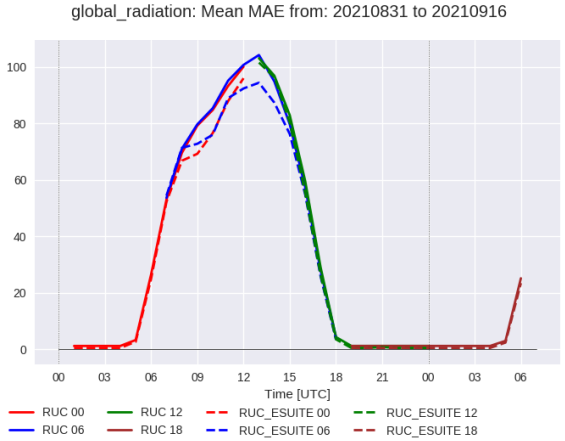
New 2m diagnoistics, bufr-temp; additional opera radars (Hu)
new version of wind farm parametrisation (Volker et al. 2015) physics/dynamics as MF

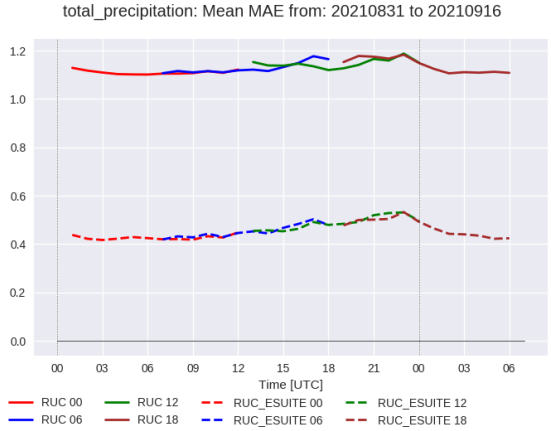






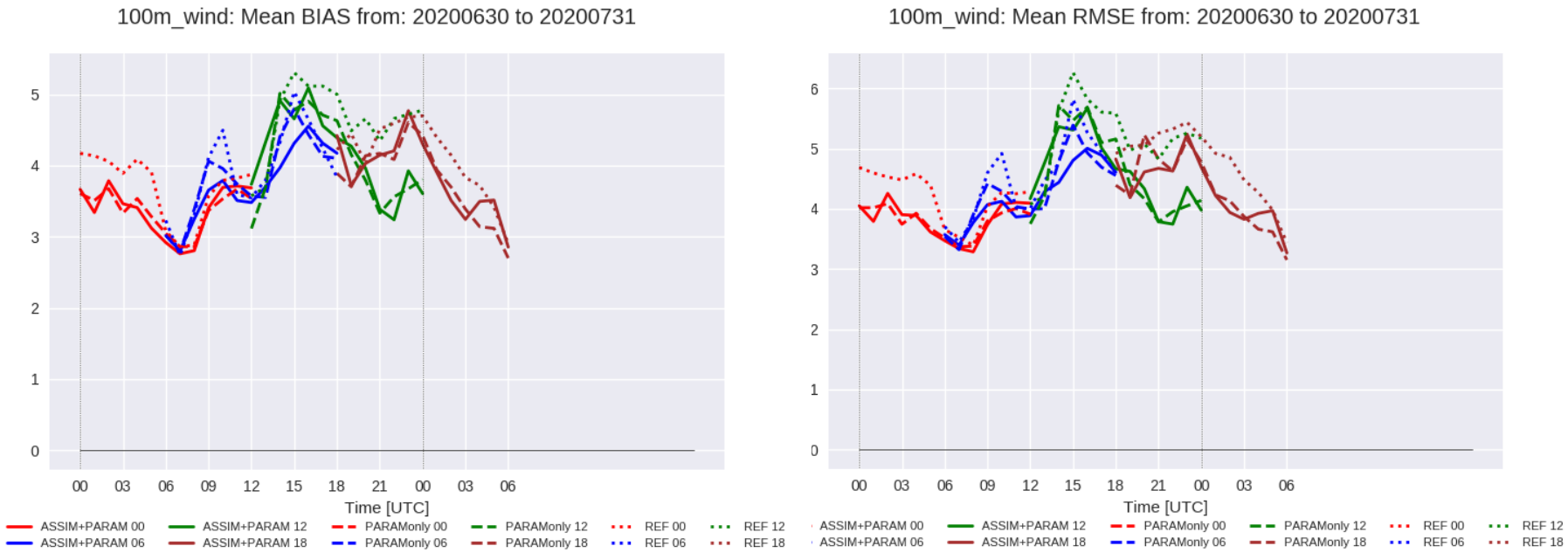






Assimilation of wind farms: July 2020

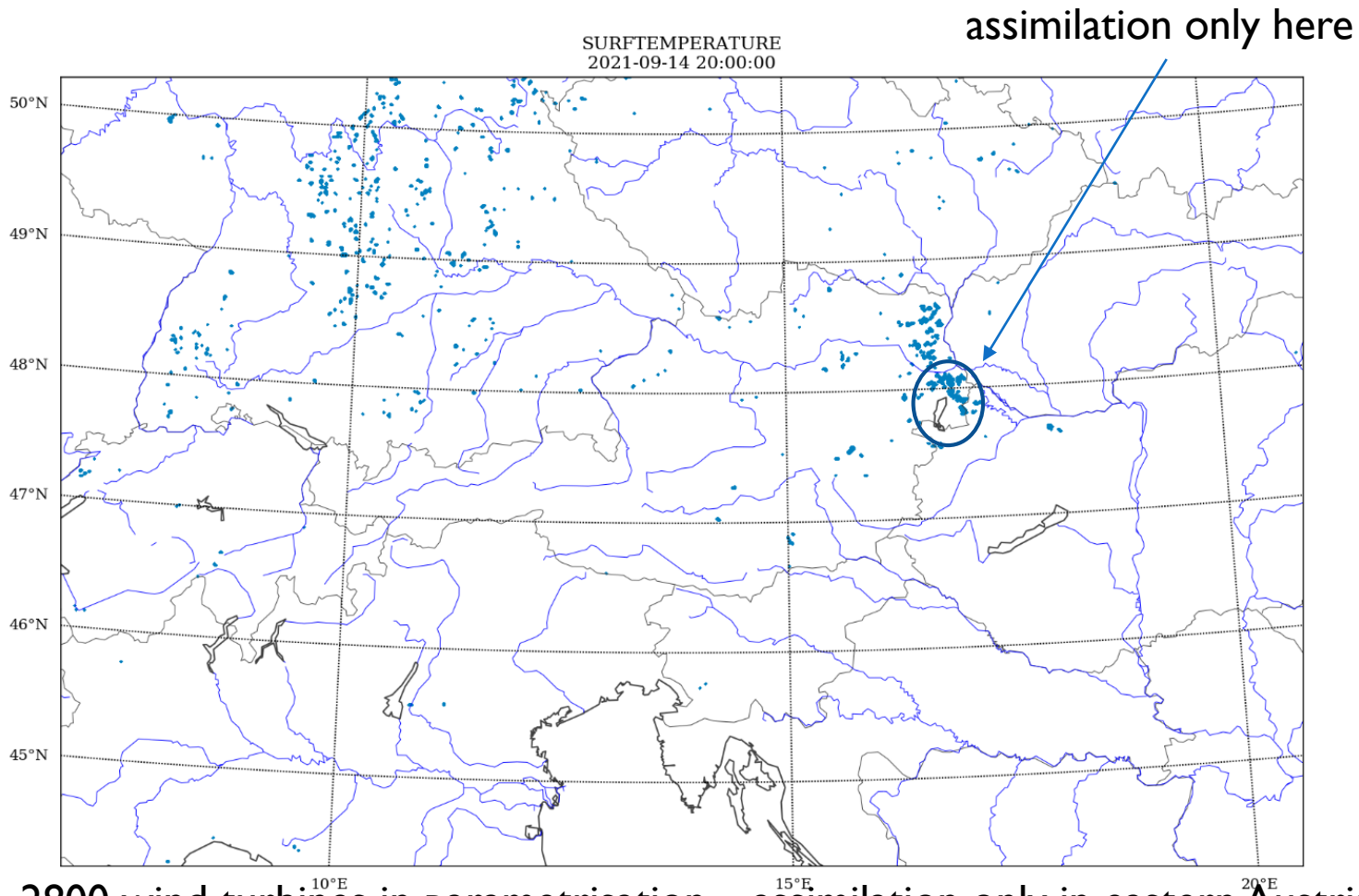
ASSIM+PARAM: Assimilation of SCADA (U,V,T) and parametrisation (Fitch et al. 2012)
PARAMonly: only parametrisation
REF: reference neither parametrisation nor assimilation



BIAS 100m wind RMSE

small improvement also for 10m wind; other parameter neutral

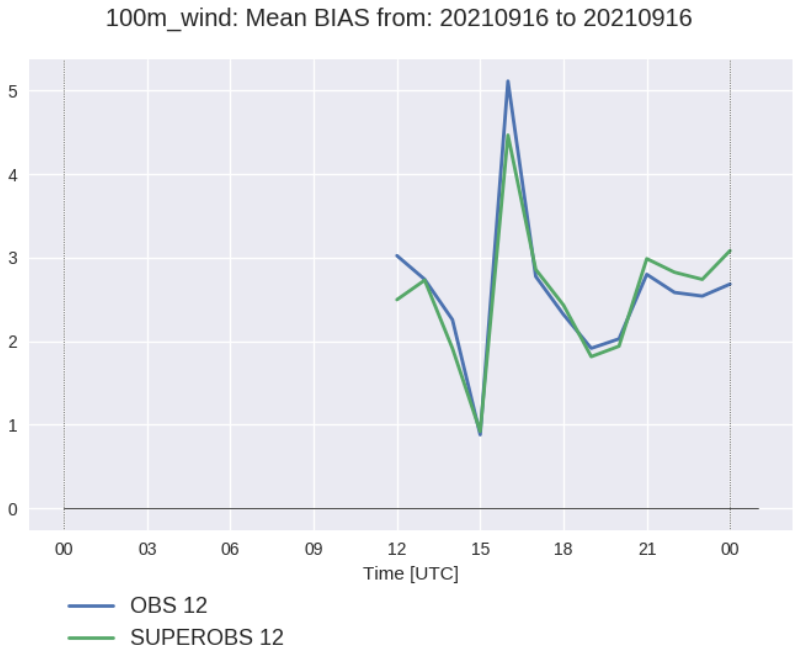
Assimilation and parametrisation of wind farms

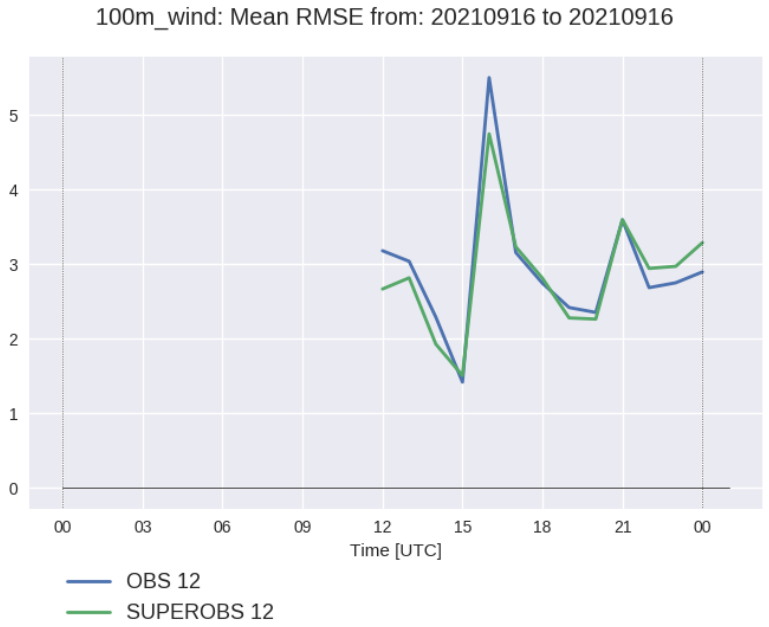


~2800 wind turbines in parametrisation – assimilation only in eastern Austria ~165

Superobbing of windfarm data

- SCADA observations averaged per wind farm
- 15 obs instead of 165 single turbines -> very little to none improvement on 100m wind



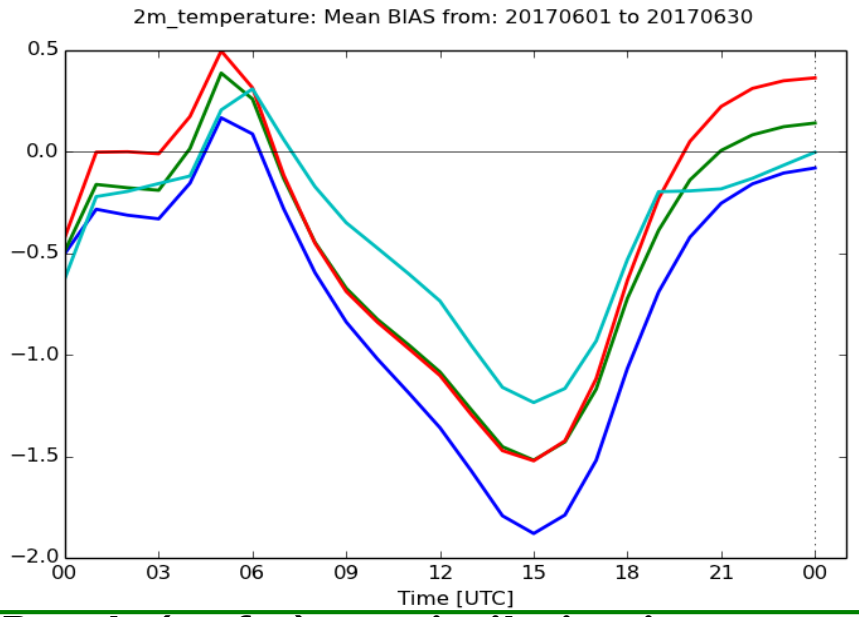


LAI assimilation @ ZAMG

Goal
improve screen level parameter forecasts by a better representation of vegetation

Measurements
LAI, based on Sentinel 2, processes by BOKU*), resolution down to 10m

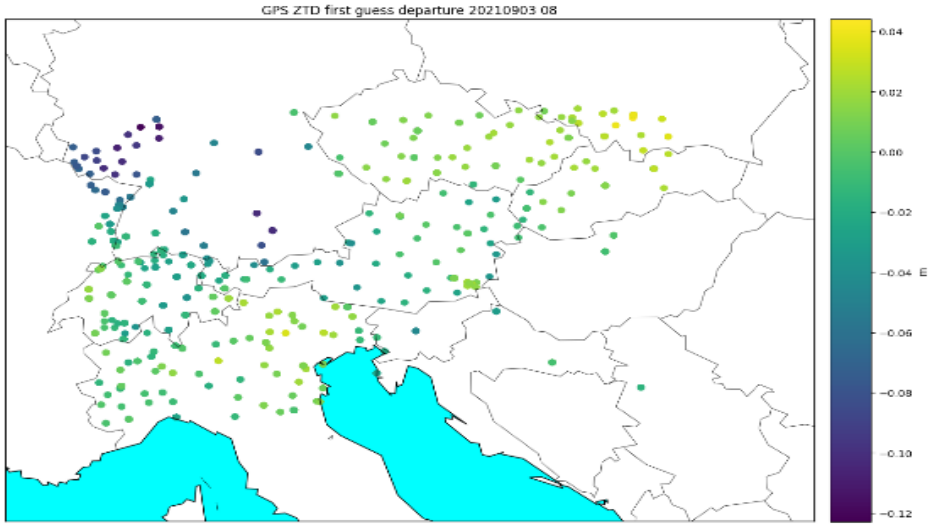
Assimilation method
Simplified Extended Kalman Filter in SURFEX 8.1, 14 layer diffusion soil scheme, 12 patches, prognostic LAI (CPHOTO=NIT), atmospheric forcing from AROME CY43, no atmospheric data assimilation

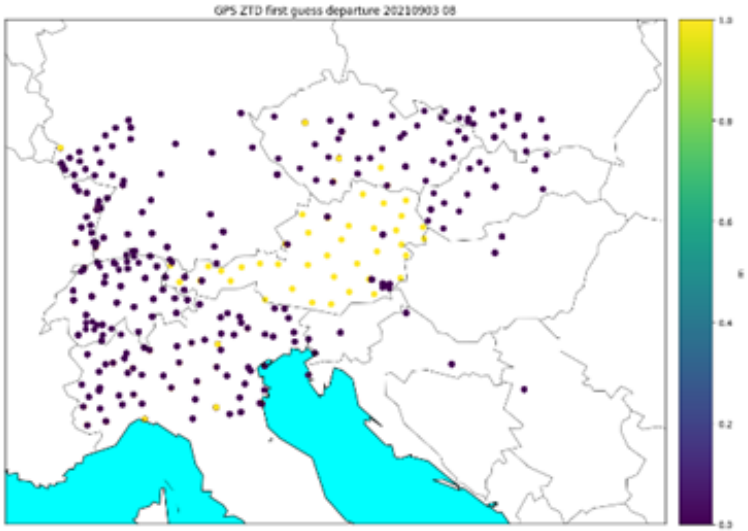


Result (so far) – assimilation is beneficial
Reference run (no data assimilation at all), 1 patch, climatological LAI
Run with 12 patches and prognostic LAI
Run with 12 patches, prognostic LAI and high-resolution land cover data (instead of ECOCLIMAP)
Run with LAI assimilation, 12 patches, prognostic LAI

*) University of Natural Resources and Life Sciences, Vienna

ZTD from OPLACE/E-GVAP passive assimilation in RUC parallel





First guess departure

passive

Plans for 2022

- Assimilation of GNSS-ZTD on board of Austrian trains (FlorianW.)
- Assimilation of Sentinel-1 radar delays in AROME/CLAEFWF
- Start with Oops/3D-EnVar
- Exploitation of microwave links from Austrian mobile phone network ->LHN/1D-3D-Lopez-Code (Phillip S.)

- bring CLAEF/AROME-AUT/RUC configurations closer together; test 1km version (effort of whole group)
- Soil assimilation by SURFEX offline+SEKF for operational configurations
- Small modifications on snow implementation

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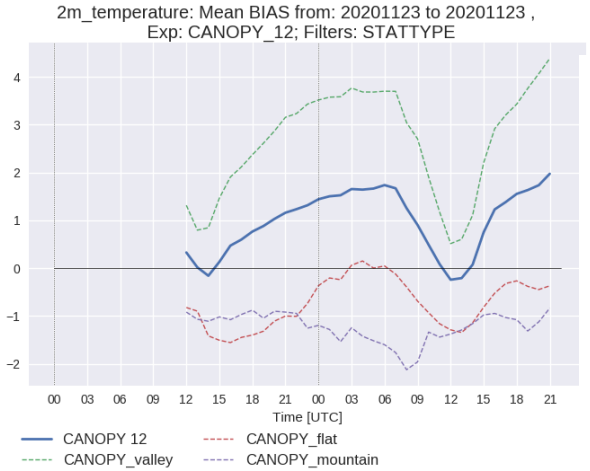
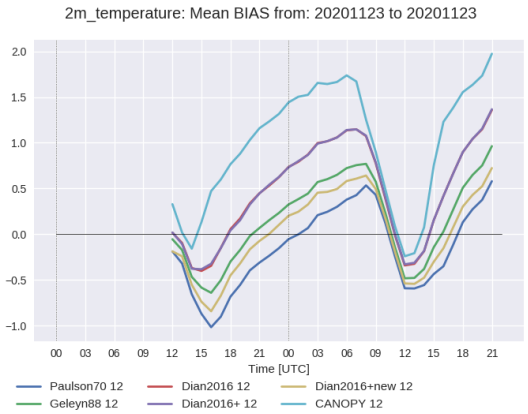
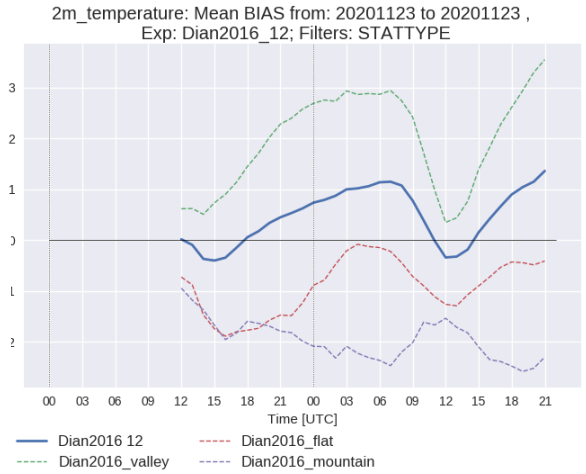
Problem with 2m diagnostics with GMTED/SRTM

T2m Bias
stable conditions
at night

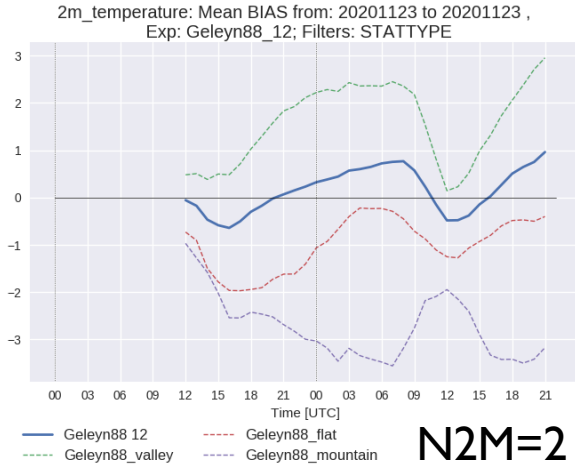


CANOPY

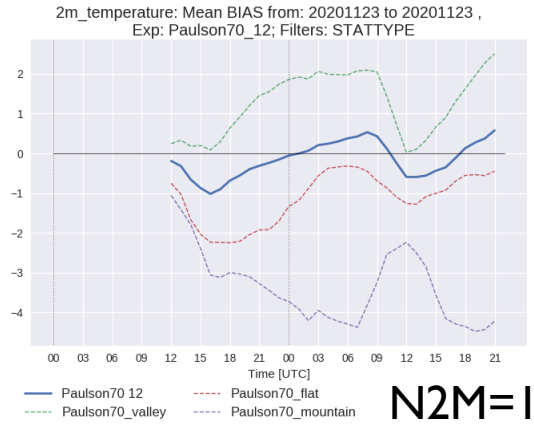




Dian 2016



N2M=2



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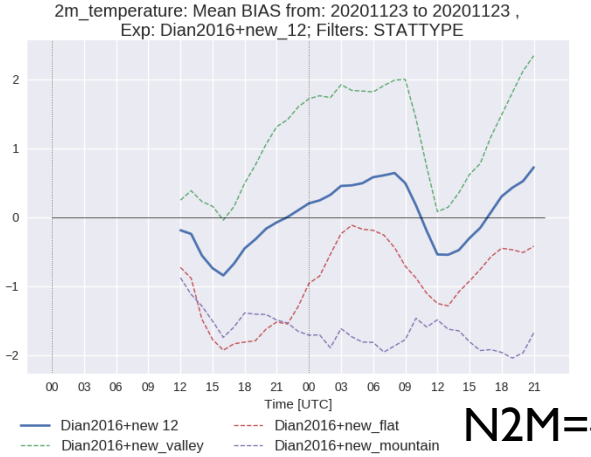
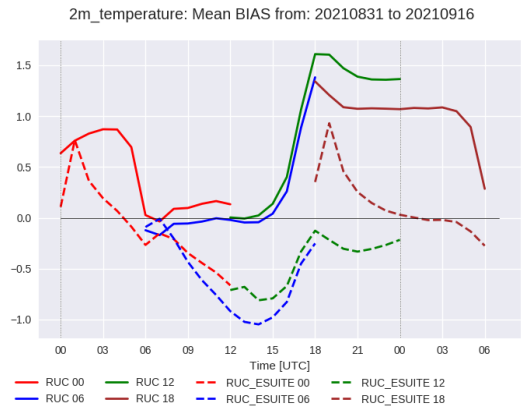
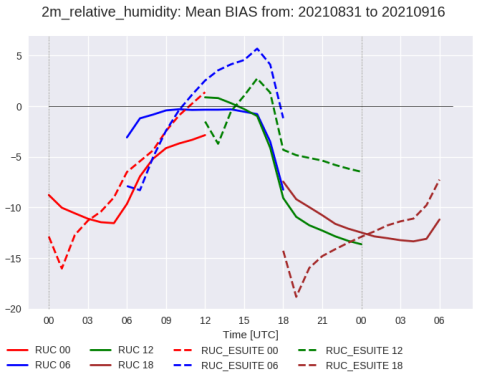


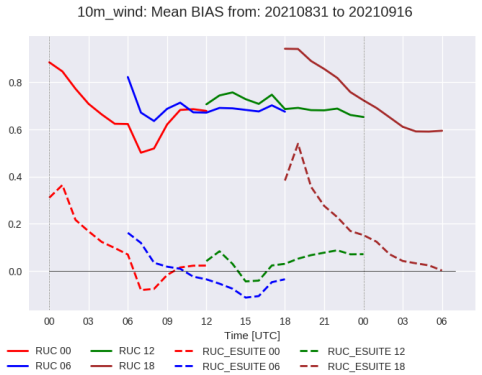
N2M=4

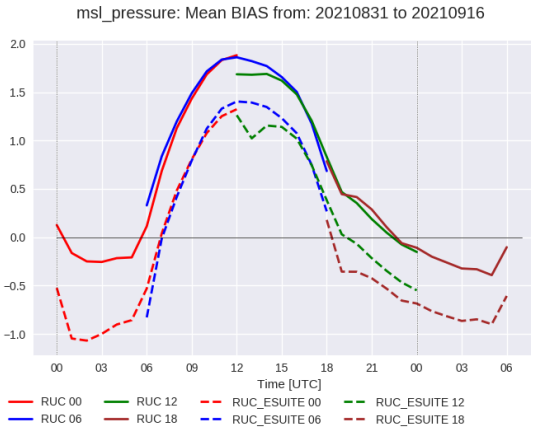
RUC parallel cy43t2 vs RUC cy40t1

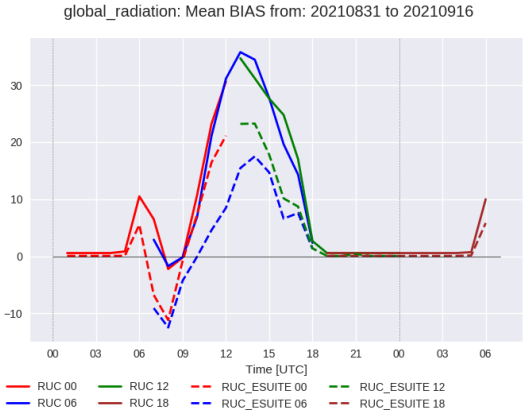
New 2m diagnoistics, bufr-temp; additional opera radars (Hu)
new version of wind farm parametrisation (Volker et al. 2015) physics/dynamics as MF

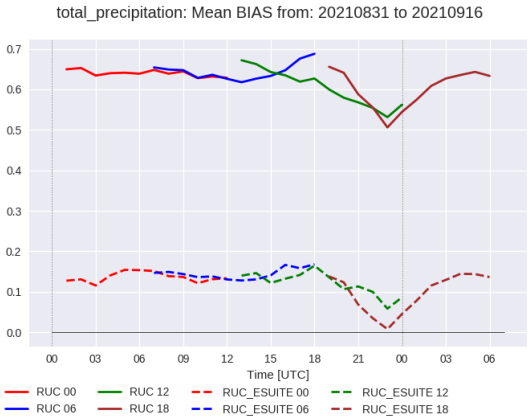


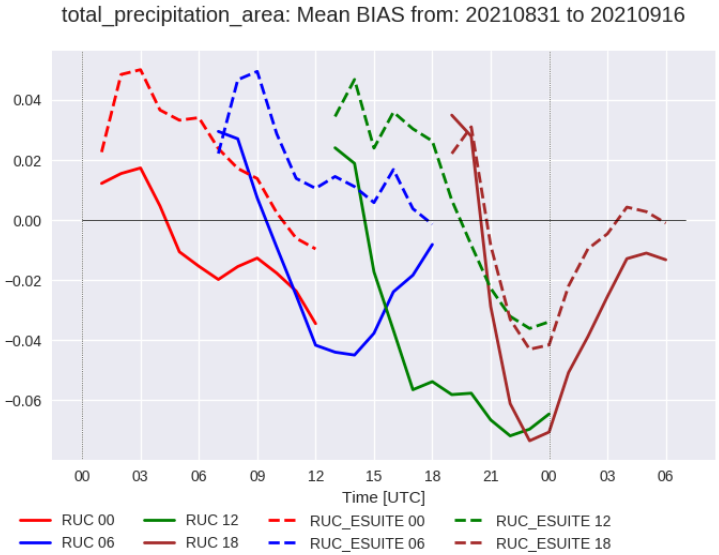








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0.00
−0.02
−0.04
−0.06
00
03
06
09
12
15
18
21
00
03
06
Time [UTC]
RUC 00
RUC 06
RUC 12
RUC 18
RUC_ESUITE 00
RUC_ESUITE 06
RUC_ESUITE 12
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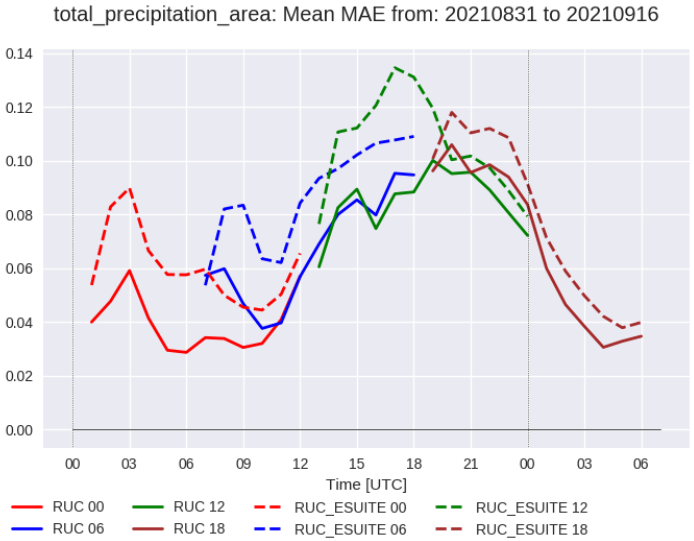
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0.04
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