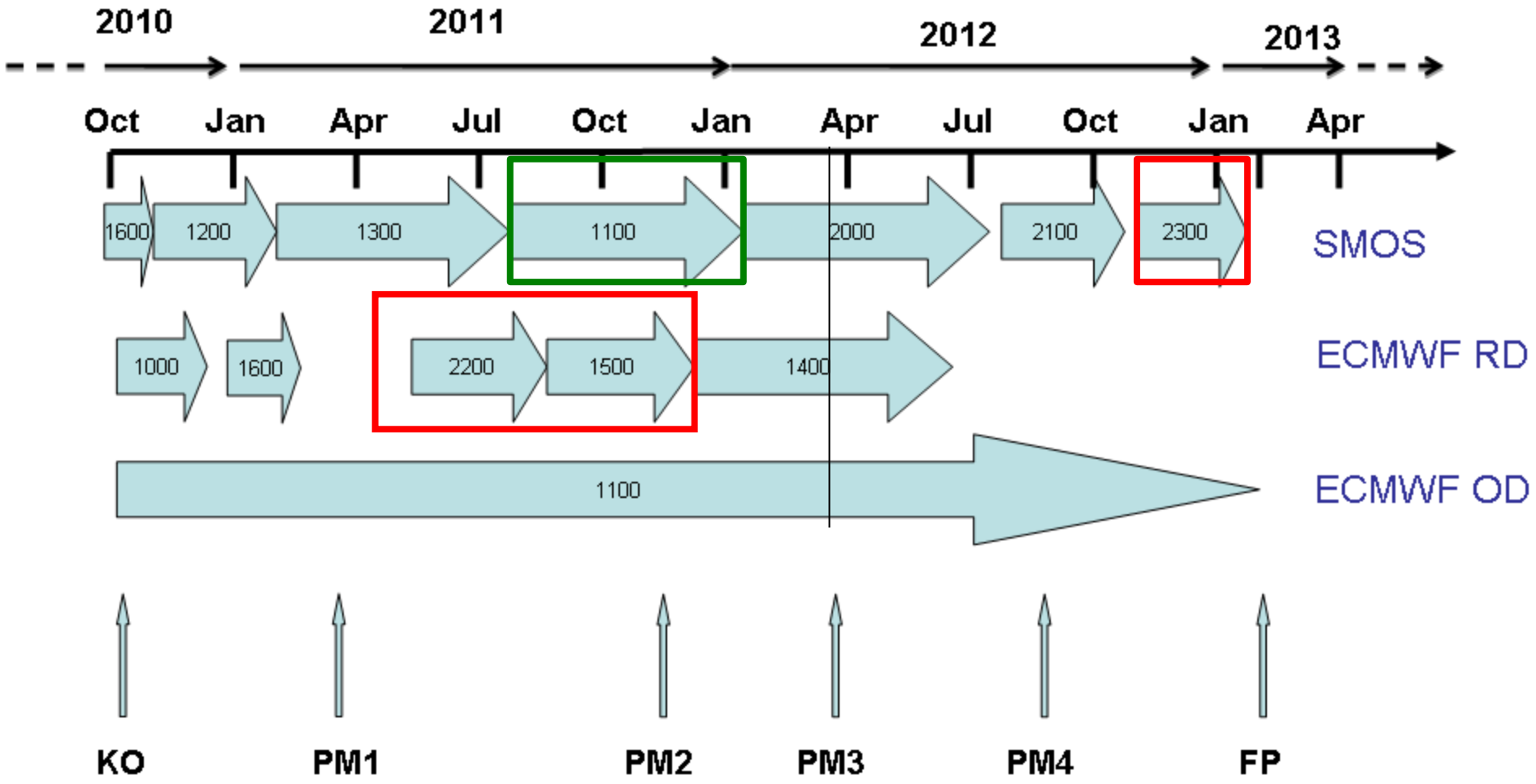
Overview on status of individual tasks (WP)

ESA SMOS Project at ECMWF

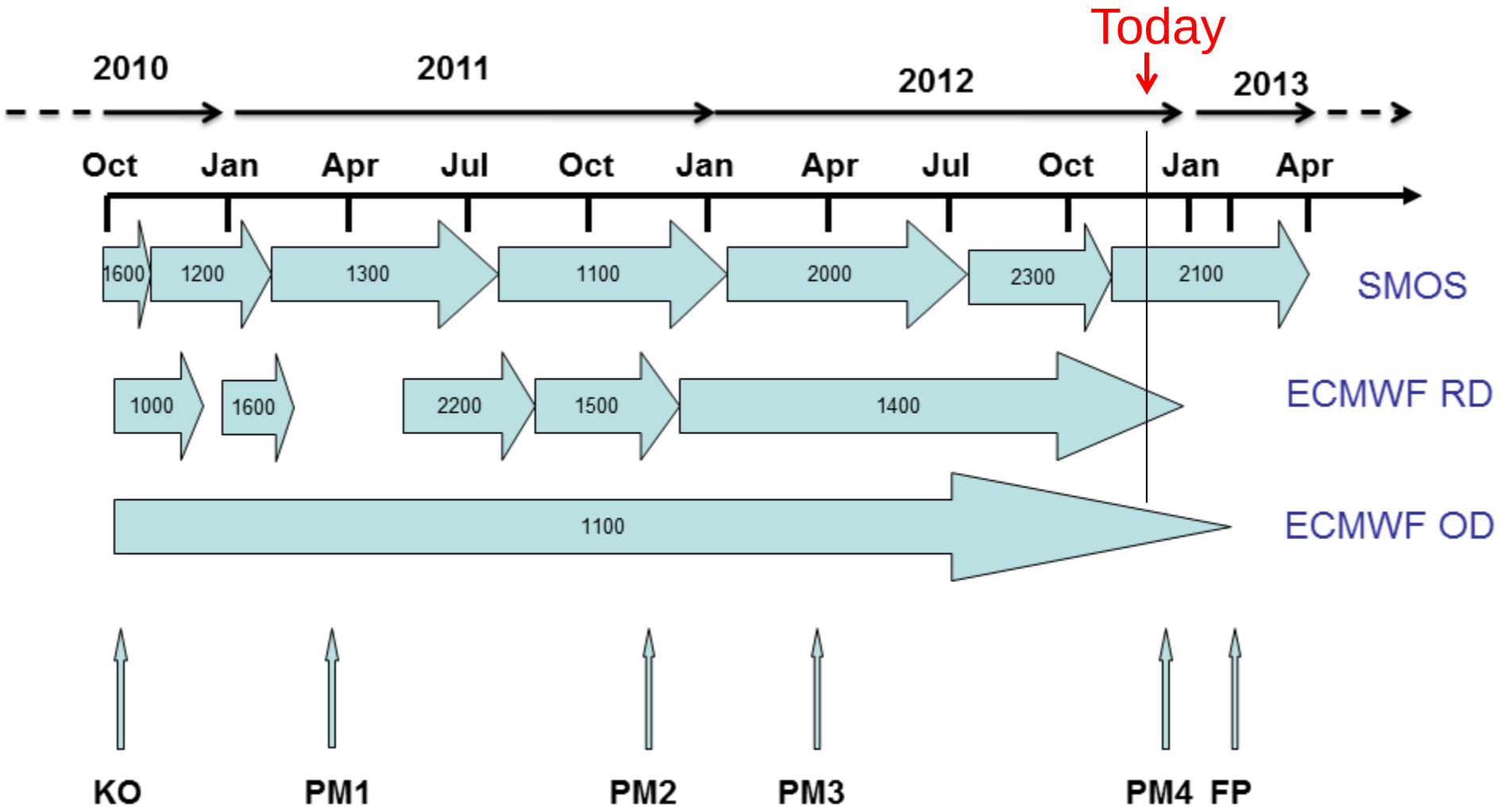
Status in March 2012



Overview on status of individual tasks (WP)

ESA SMOS Project at ECMWF

Status in December 2012



Overview progress since last PM in February

- Monitoring: Up to date with monitoring suite (c2a and new cycles) + preparation for next o-suite,
- Assimilation:
  - Global calibration of CMEM done (several metrics) + on going CDF matching parameters computation (for 40XX, 40YY, 50XX, 50YY),
  - Continuous technical developments/implementations in SEKF (developments, masks, bugs corrections, compatibility, etc.)
  - DA experiments (preliminary impact study):
    - first set of technical experiments over Australia and North America, at T159 → intended to demonstrate the feasibility of the technical approach (many caviats), √
    - second set of experiments over Australia in February 2011 → show an impact on SM, but no validation data (set also scripting work for validation and impact on land surface and atmosphere), √
    - third set of experiments over North and South America in July 2011 → with validation data at SCAN network (still approximate BC) (on-going)
  - Hot spot analysis started,
    - seasonal maps of obs STD with monitoring suite,
    - on-going seasonal offline Jacobians

Status of deliverables

ESA SMOS Project at ECMWF Project Phase-II (28 Months):

- 01 October 2010 - 31 January 201
- 11 WPs (13PM ECMWF ; 28 PM ES

WP	ECMWF Funding (OD+RD)	ESA Funding (Joaquín)	Task	
WP 1000	1 pm	1 pm	Coordination	✓
WP 1100	2 pm	3 pm	Continuous monitoring	✓
WP 1200		3 pm	Data thinning	✓
WP 1300		6 pm	Noise filtering	✓
WP 1400	6 pm		Bias correction	-
WP 1500		3 pm	CMEM maintenance	✓
WP 1600	1 pm		Web Page	✓
WP 2000		6 pm	Data assimilation	-
WP 2100		3 pm	L3/4 Root zone SM → **Start before Xmas**	
WP 2200		3 pm	Validation data base	✓
WP 2300	3 pm		Hot spot analysis	

Colour code:

- **To do**
- **Ongoing**
- **Done**

Status of deliverables

- On going Final Report of first contract → Hampered by other DA, deliver before end of current contract?
- New Monitoring report → When?
- Bias correction and global calibration report → On going,
- DA Impact report → When?
- L3 root-zone SM report → We can deliver it by the end of current contract,
- Hot spot analysis → Unlikely to have time to do it by end January.
- Final report → need of the previous ones.

Monitoring – Status

SMOS Monitoring Suite:

- NRT monitoring suite currently running in cy37r3 in old c1a,
- NRT suite migrated to new c2a
  - Running and statistics are identical with previous suite,
  - Waiting availability of OD to substitute current suite in c1a,
  - Suite running only in monitoring mode and only with SMOS data → *few computer resources needed, guaranteeing the NRT.*
- Future operational monitoring running in current e-suite (CY38R2). It will run outside the critical path, in a new monitoring family of passive data to avoid strong time constraints in operational suite.
- Operational suite will include:
  - Freezing soil and snow covered areas masks based on forecast fields.
  - Version v4.1 of CMEM in IFS.
- Next implementations:
  - Topography mask (4% maximum slope allowed),
  - RFI flag of standard NRT (currently limited information, only strong sources).

Main technical work and developments since last PM

- Scripting work to make compatible operational monitoring and assimilation experiments in the SEKF,
- Bias correction of SMOS observations through grib files of CDF-matching parameters implemented,
- Compatibility of the Operational DataBase to support in an optimized way several sources of satellite data in the SEKF, and independent handling,
- Snow cover and freezing soils masks added to SMOS screening,
- Bug correction for Jacobians computation (routines and interfaces modified),
- SEKF adjustments to compute Jacobians at the right time and over areas with forecasted SM equal to zero + calibration of Jacobians (experiments equivalent to 36 weeks),
- SEKF developments to include debugging meaningful information of SMOS fields in grib fields, independently for some polarisations and angles,
- Added real estimated observation error as SMOS observation error (R matrix),
- Other bugs associated to compatibility with new observations (ralt, cris) or no satellite observations,
- Bug correction associated to a float number divided by zero with current IFS Fortran compiler. Discovered when using new calibrated configuration of CMEM (for std metric).
- Developments necessary to handle with an unique namelist for observations configuration, both monitoring and assimilation of SMOS data in an unique experiment.

WPs 1500 and 1400 CMEM maintenance, calibration and Bias correction

More work on CMEM:

- May 2012: CMEM v4.1: vertical grid interpolation (multi-layer version)

  Soil moisture and soil temperature profiles 2D REAL and vertical interplation flexible for any LSM and MW discretisation (layers numbers and depths).

- May and August 2012: bug fixes on Wigneron 2007 roughness model and Wang porosity. Small impact, however redo calibration for Wang.

- Support to new users: Thomas Kaminski (FastOpt), Maheshwari Neelam (Texas Univ).

CMEM reprocessed data and Calib/BC:

- Second reprocessed data acquisition is still ongoing (Ioannis does it in parallel to operation task that have priority) - Convertion bufr2grib of 2nd reprocessed data ongoing (2010 40° completed)

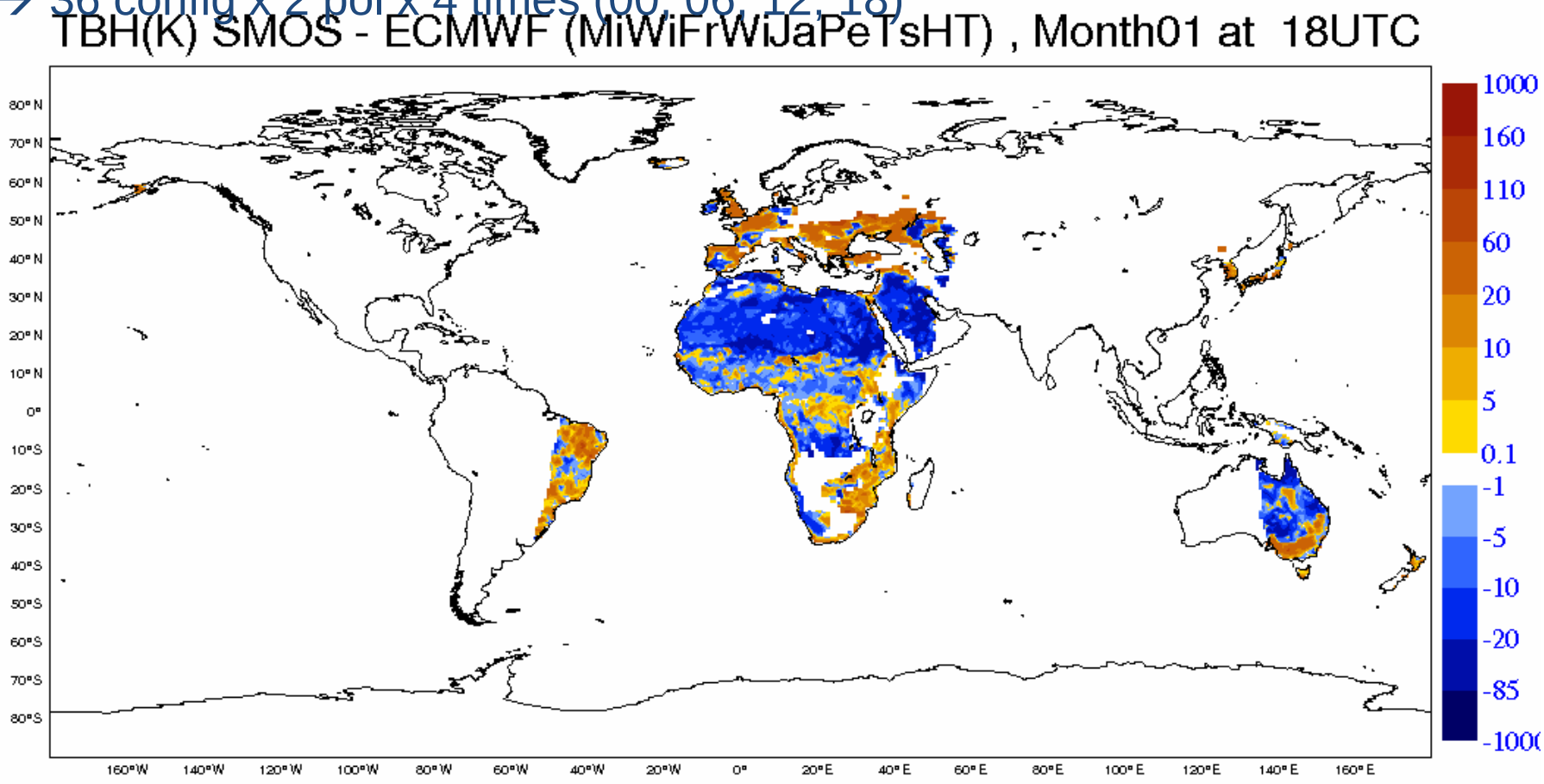
- March: 18 CMEM configurations, 06UTC

- Dec: 36 config (3 diel x 4 roughness x 3 vegetation),00, 06,12,18 UTC

36 CMEM simulations for Calib&BC

- 3 dielectric models: wang, Dobson, Mironov
- 3 vegetation opacity models: Jackson, Wigneron, Kirdyashev
- 4 roughness models Wigneron simple, Choudhury, Wigneron texture, Wigneron 2007

→ 36 config x 2 pol x 4 times (00, 06, 12, 18)



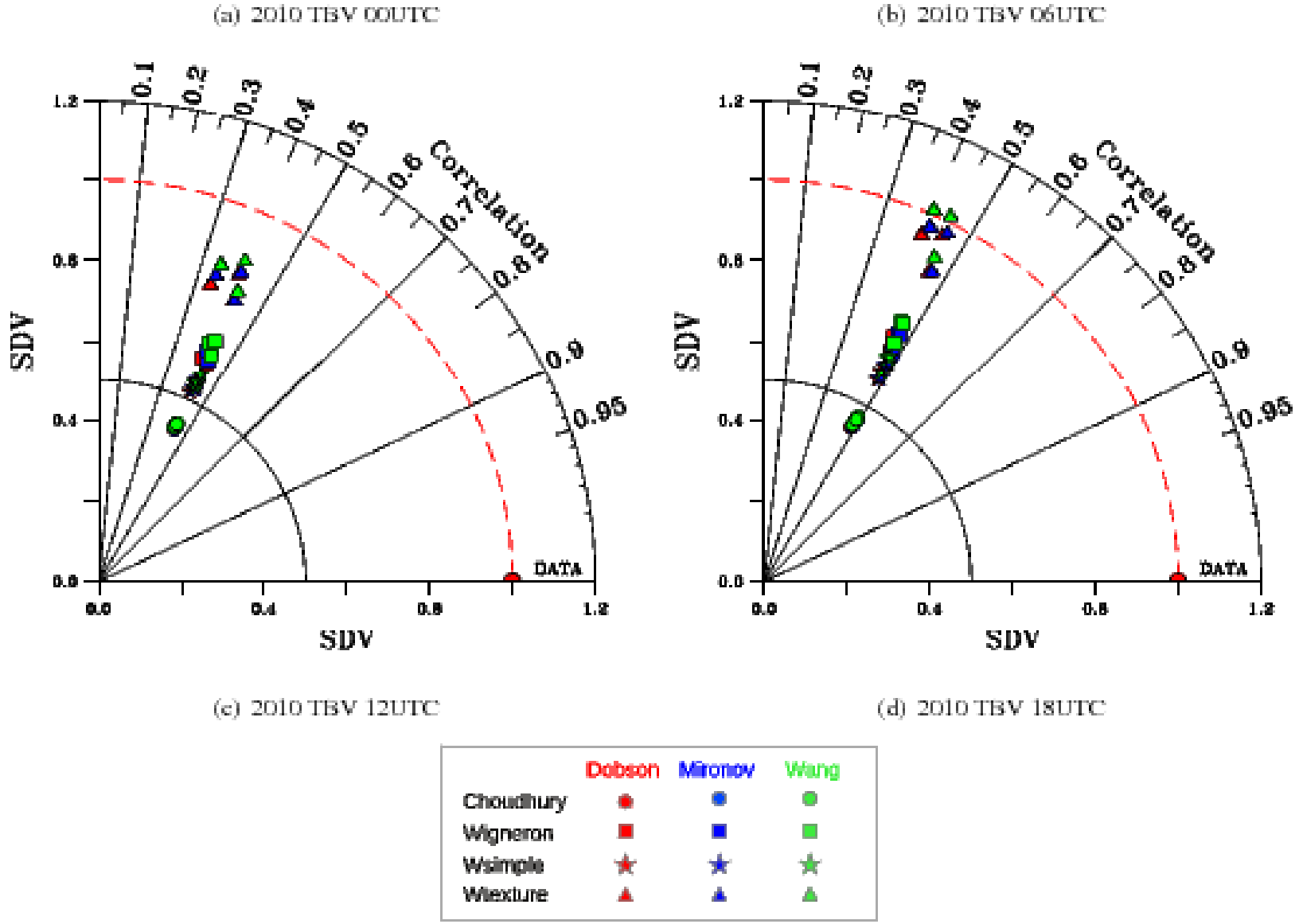
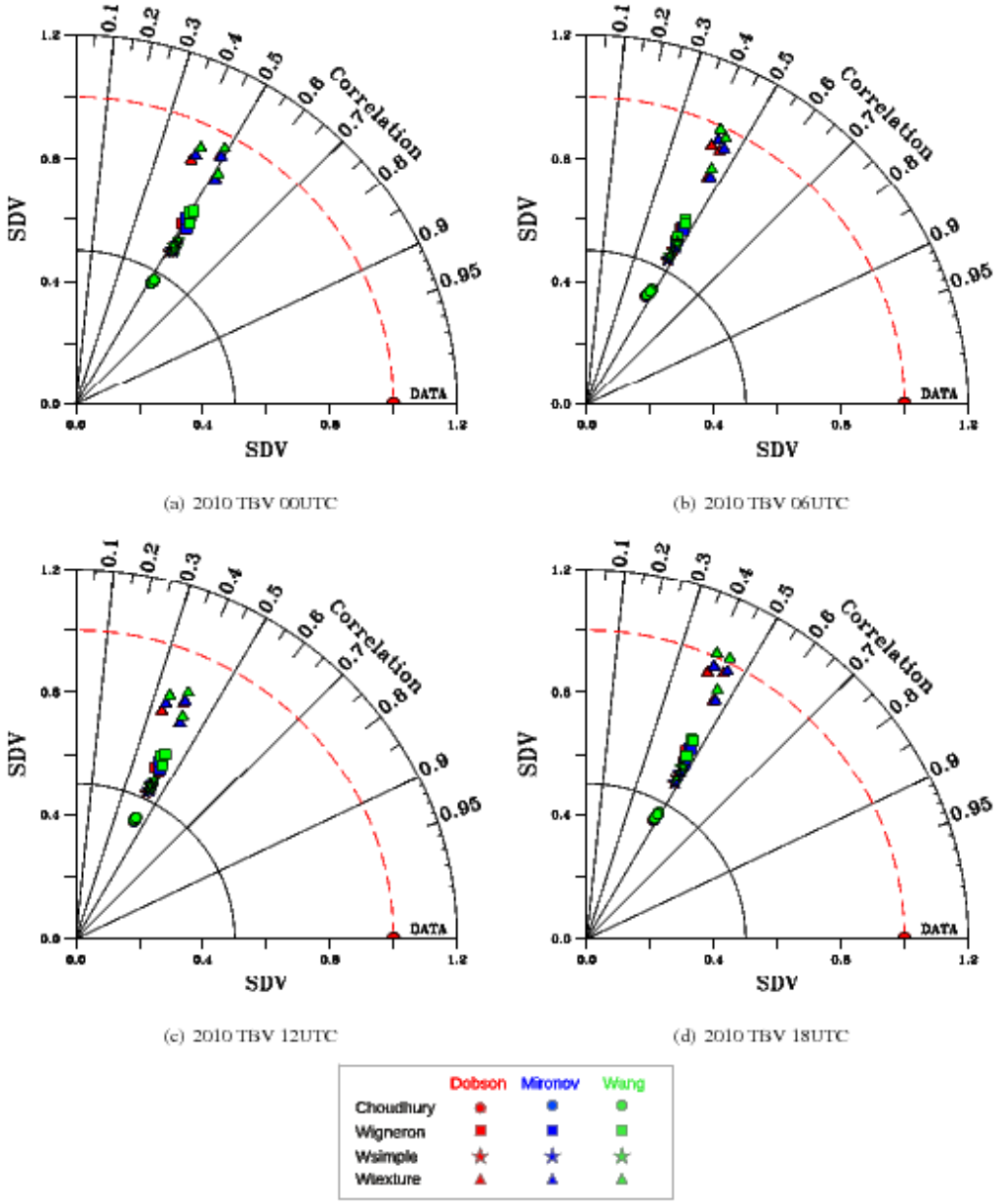


Figure 2: Comparison between ECMWF simulated and SMOS measured TB at L-band (1.4 GHz) at vertical polarisation, at 00UTC (a), 06UTC (b), 12 UTC (c) and 18 UTC (d), for 2010 for 36 CMEM configurations. Symbols color and shapes represent different dielectric and roughness models, respectively.



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Metrics:
Bias,
R,
uRMSD
SDV standardised

→Taylor diagrams
As in ALMIP-MEM
(de Rosnay et al JGR 2009)

Roughness:
Best SDV Wtexture
Best R: Wsimple

Dielectric model:
Best: Mironov & Wang

Consistent
at 00, 06, 12, 18

← Draft report on BC
(de Rosnay et al 2013)

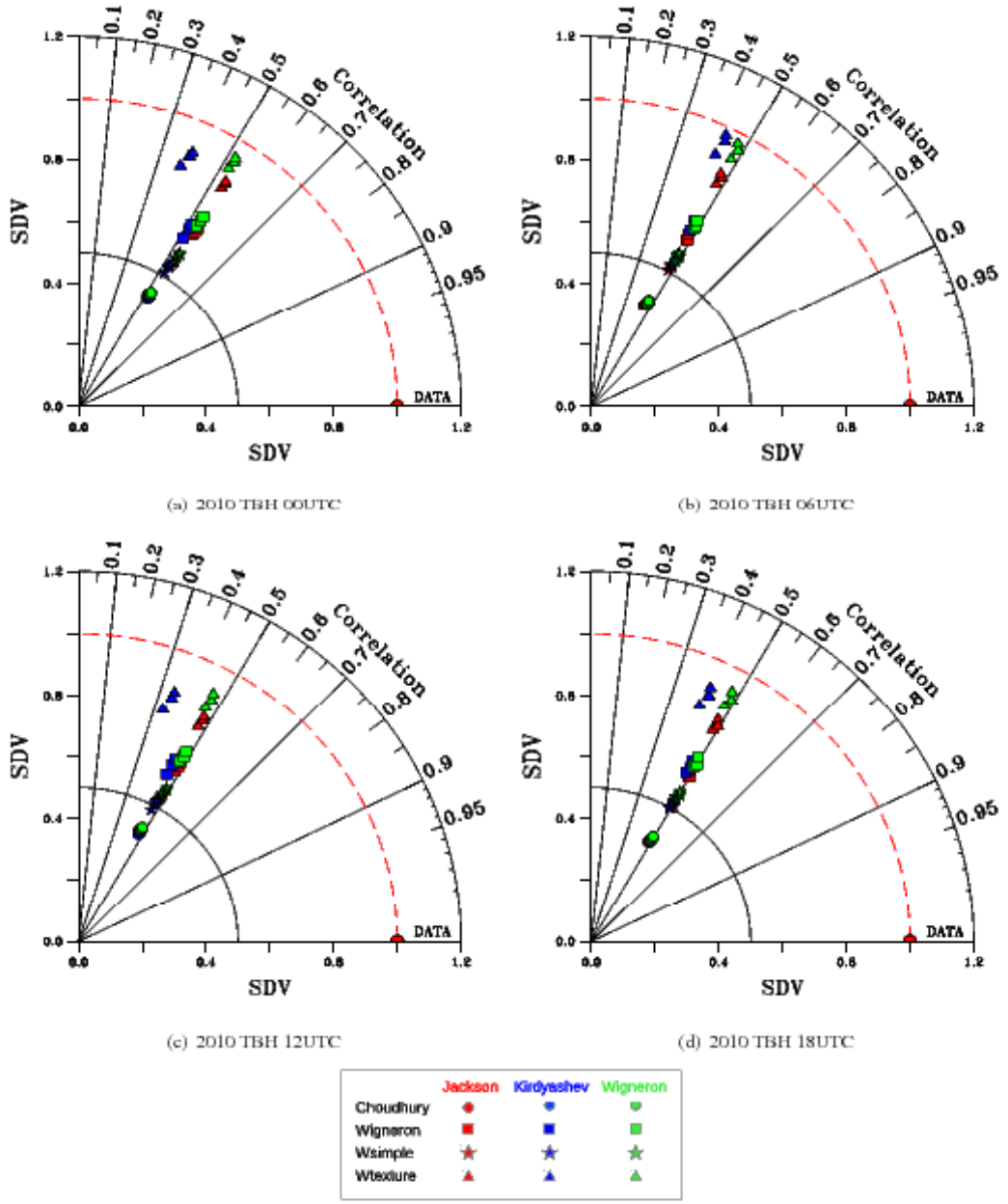


Figure 3: Comparison between ECMWF simulated and SMOS measured TB at L-band (1.4 GHz) at horizontal polarisation, at 00UTC (a), 06UTC (b), 12 UTC (c) and 18 UTC (d), for 2010 for 36 CMEM configurations. Symbols color and shapes represent different vegetation opacity and roughness models, respectively.

Metrics:
Bias,
R,
uRMSD
SDV standardised

→Taylor diagrams
As in ALMIP-MEM
(de Rosnay et al JGR 2009)

Roughness:

Best SDV Wtexture
Best R: Wsimple

Vegetation model:

Best: Jackson (R)
Wigneron (SDV)

Consistent H&V and at 00, 06, 12, 18

Consistent monthly & yearly

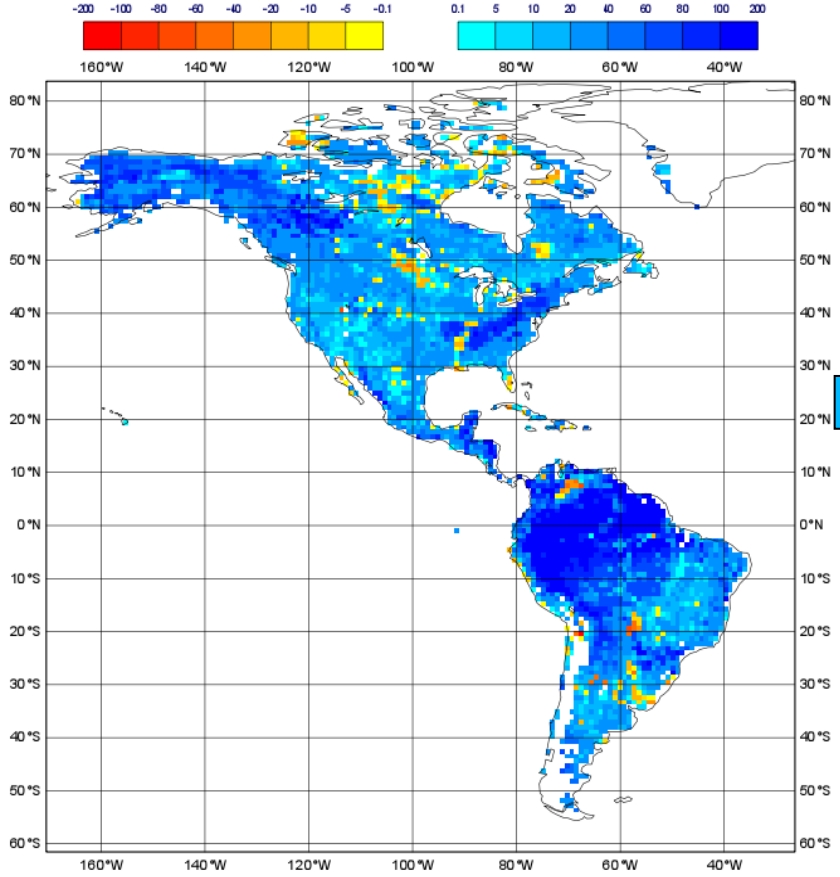
Last DA impact experiments

- Assimilation of SMOS T_B in the antenna reference frame. Experimental setup:
  - Period: **01 July 2011** 00UTC – **31 July 2011** 12UTC analysis
  - Resolution: **T511** (~40 km ~ SMOS resolution)
  - Observations:
    - NRT brightness temperatures (standard product),
    - **expt-fska**: 20, 50 (± 0.5) degrees, XX polarisation → (20XX, 50XX),
  - CMEM configuration calibrated according to SDV metric.
  - **Jacobians calibrated** ($\Delta\theta j=0.01 m^3 m^{-3}$, $/H^-_{max}/ = /H^+_{max}/ = 250$ $K/m^3 m^{-3}$)
  - **STD of observations error** → radiometric accuracy
  - Degraded observational system → expt run faster and shows better the impact of SMOS on the SM fields and fc skill (only conventional data at global scale is used to constrain atmospheric analysis),

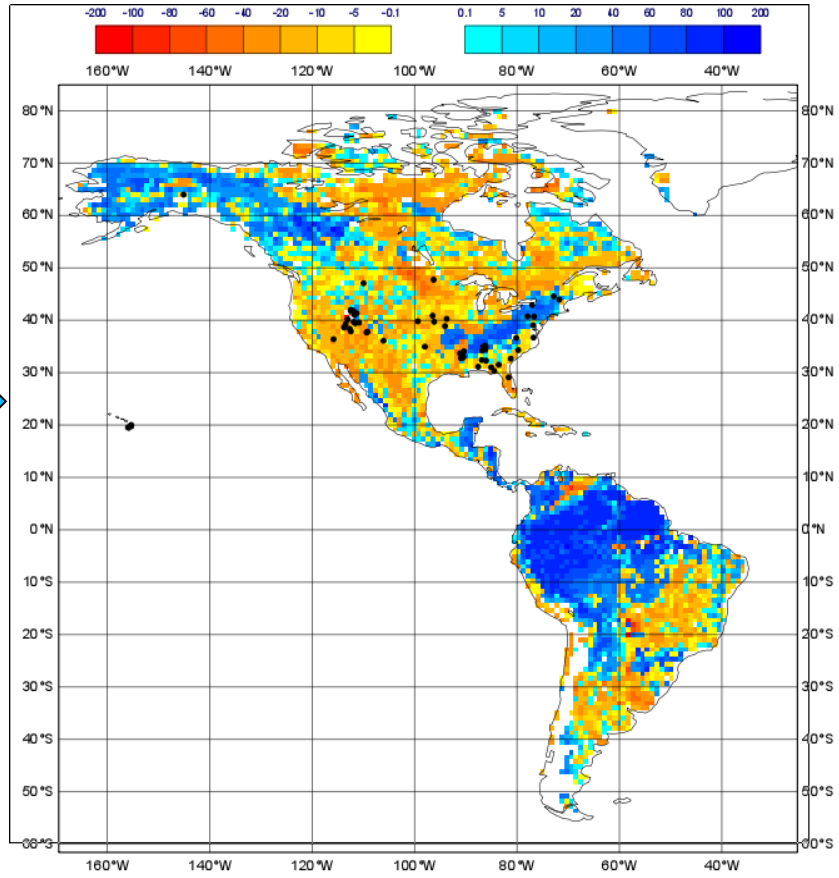
- Assimilation expts: North and South America (few RFI, dry period North America)
- **ctrl-fskc**: assimilation of T^{2m}, RH^{2m} → default configuration (CTRL)
- **expt-fska**: assimilation of T^{2m}, RH^{2m}, SMOS T_B (20XX,50XX)

Last DA impact experiments

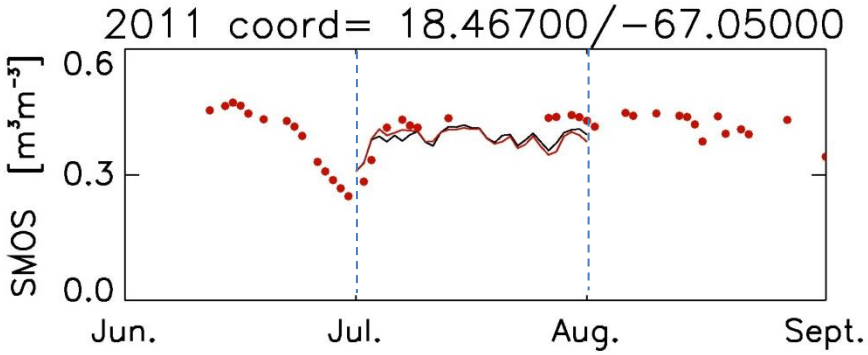
Without bias correction (20XX)

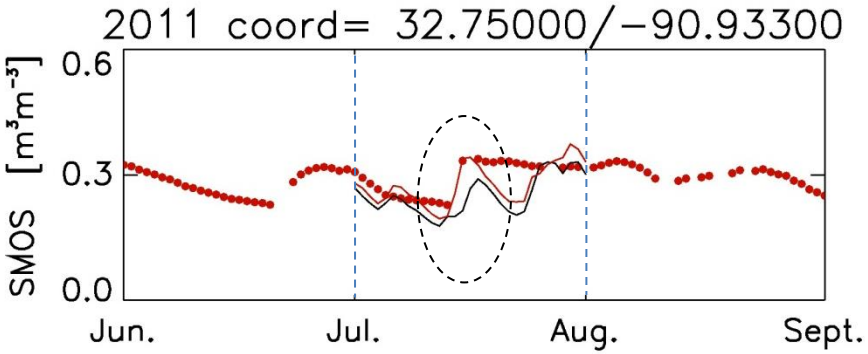


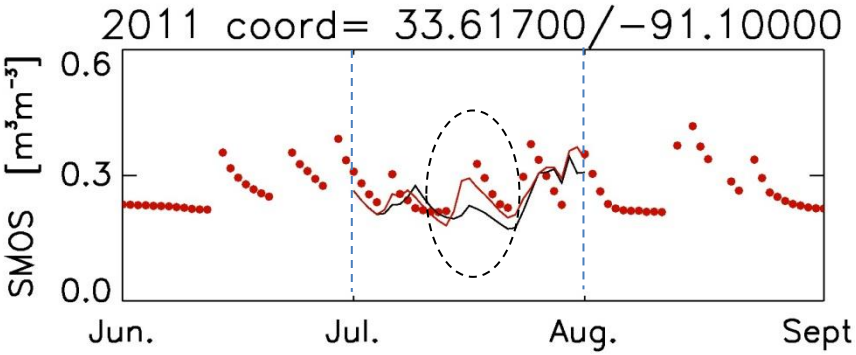
With approximate bias correction

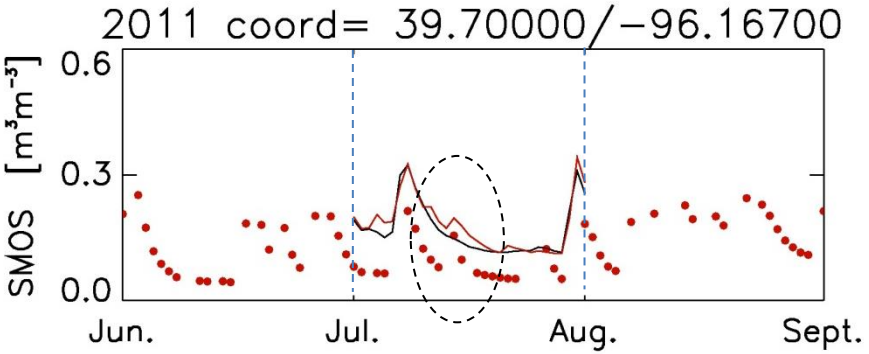


NRCS-SCAN networks 07-2011



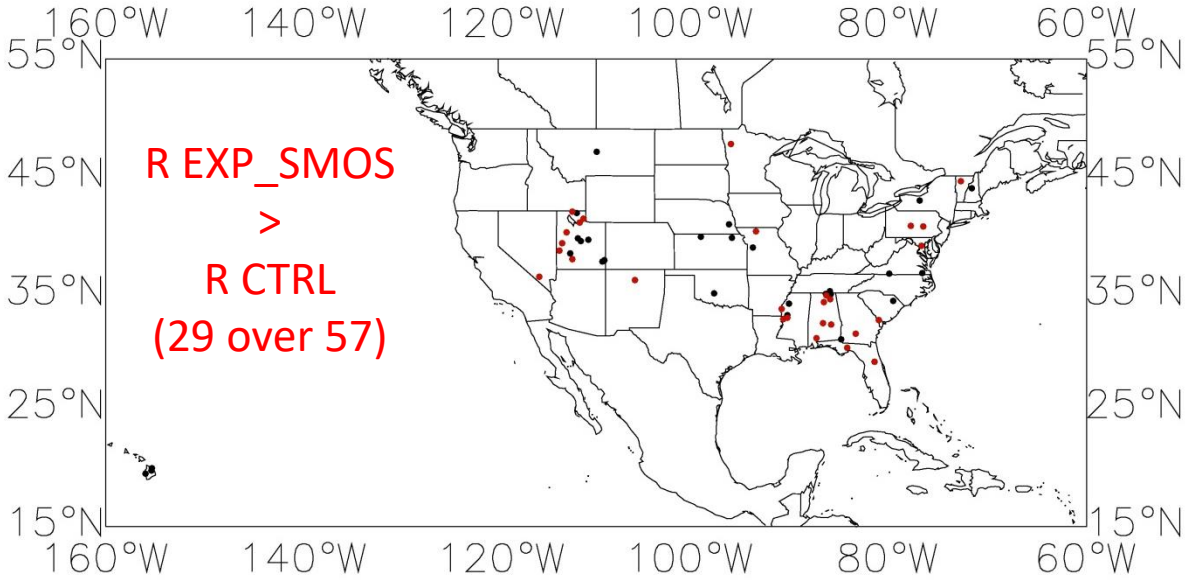


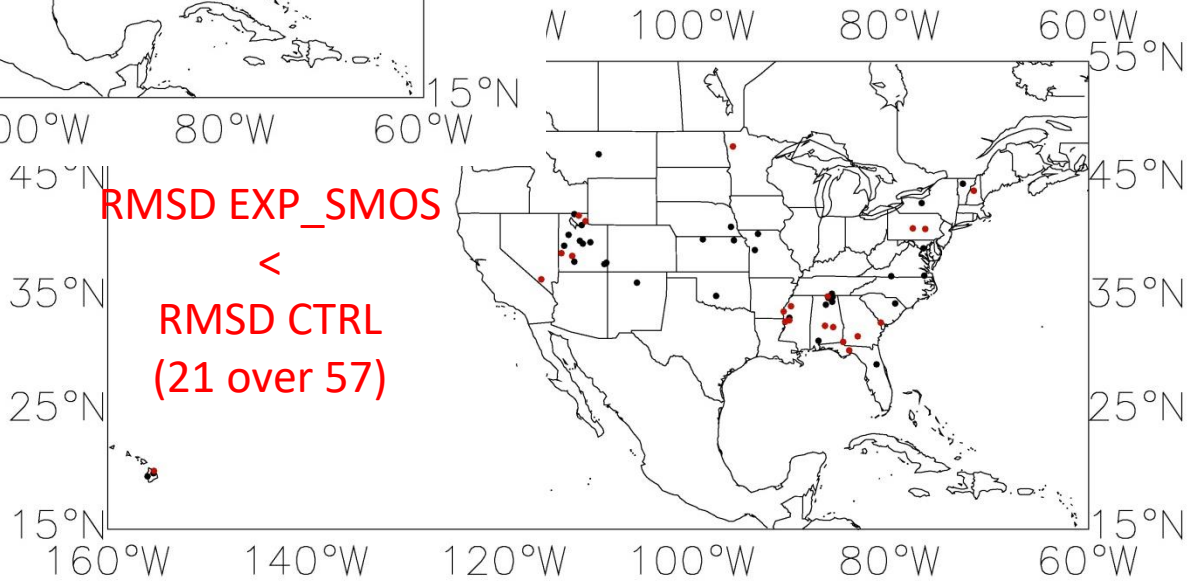




Obs (5cm) CTRL EXP_SMOS

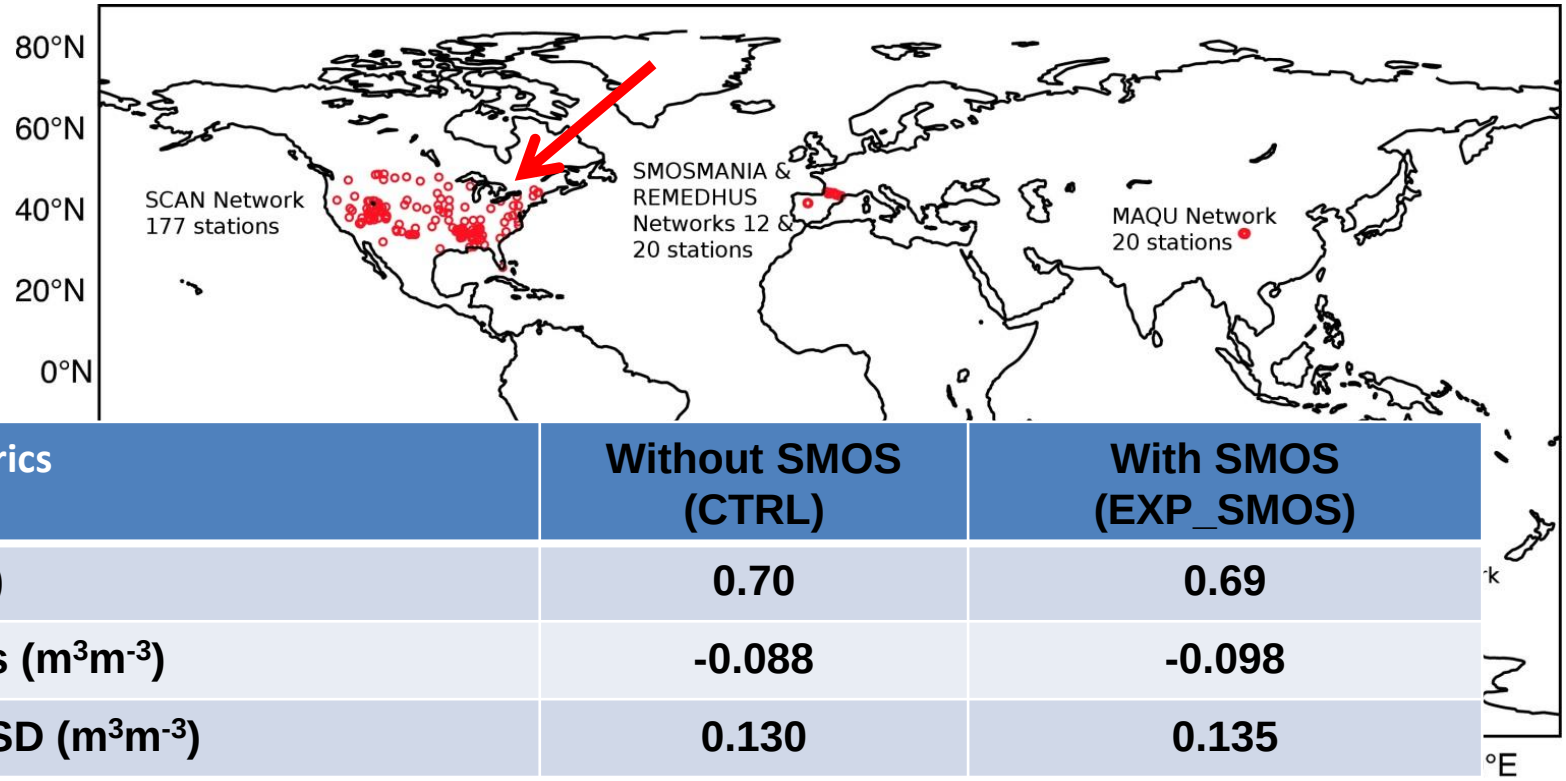
NRCS-SCAN networks 07-2011





NRCS-SCAN networks 07-2011

57 stations with significant R (p-value <0.05) in July

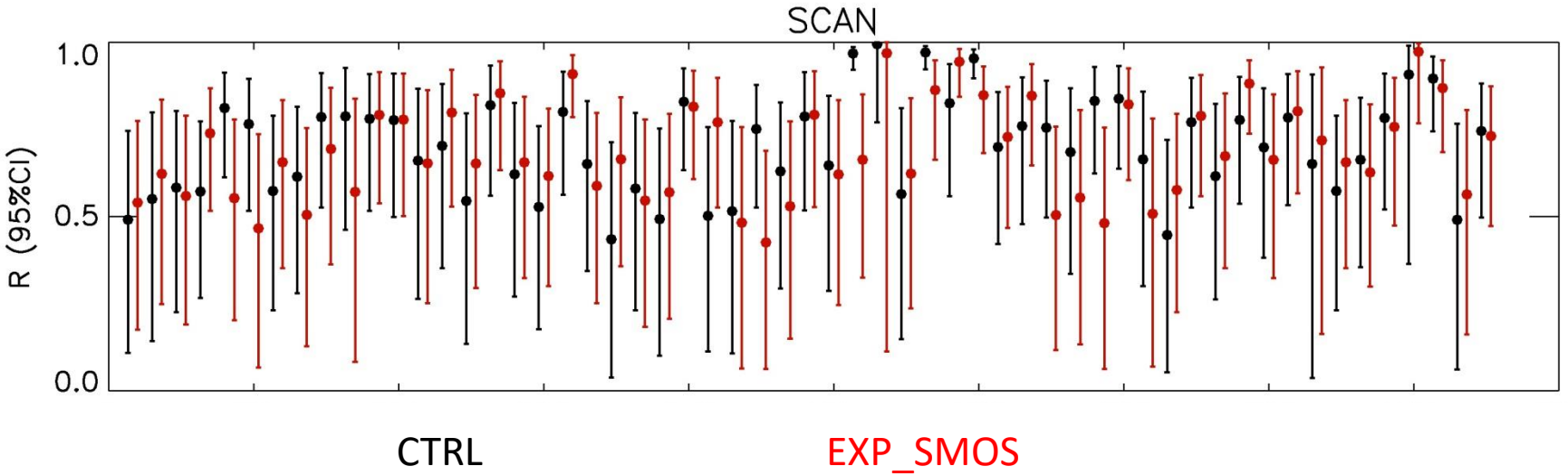


Metrics	Without SMOS (CTRL)	With SMOS (EXP_SMOS)
R (-)	0.70	0.69
Bias (m^3m^{-3})	-0.088	-0.098
RMSD (m^3m^{-3})	0.130	0.135

29 stations over 57 where R (EXP_SMOS) > R (CTRL)

21 stations over 57 where RMSD (EXP_SMOS) < RMSD (CTRL)

NRCS-SCAN networks 07-2011



CTRL EXP_SMOS

For each R estimate a 95% Confidence Interval (CI) was calculated using a Fisher Z transform

Small sample (1 month) ➔ large CI

One experiment is not significantly better than the other

Last DA impact experiments