SMOS Data Assimilation Study:

Progress Meeting 1

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Agenda

9:15-10:15	**Introduction / Status of the Project / Hand over (M. Drusch)**
10:15-10:30	**Coffee**
10:30-11:15	**CMEM technical overview (WP 1300, P. de Rosnay)**
11:15-12:00	**CMEM sensitivity study on the local and regional scales (WP 1300, P. de Rosnay)**
12:00-12:45	**Global scale study (WP 1300, M. Drusch)**
12:45-14:00	**Lunch**
14:00-14:30	**Discussion on CMEM, RTTOV (WP 1300, 1400, 1500, M. Drusch)**
14:30-15:00	**Sea Surface Salinity and Temperature (WP 1200, M. Drusch)**
15:00-15:30	**Synergy Active-Passive Microwave (K. Scipal)**
15:30-15:45	**Coffee**
15:45-16:15	**Wrap up**

Introduction PM1: Work package overview

Part I: Monitoring

WP 1100: Sensitivity study on auxiliary data sets

WP 1200: Ocean Salinity in the Integrated Forecast System

WP 1300: Global Surface Emission Model

WP 1400: IFS Interface

WP 1500: RTTOVS Update

WP 1610: Collocation Software Development

WP 1620: Operational Pre-processing Chain

WP 1630: Offline Monitoring Suite

WP 1700: Continuous monitoring

WP 1800: Hot Spot Analysis

Introduction PM1: Work package overview

Part II: Data Assimilation Study

WP 2110: EKF Modifications

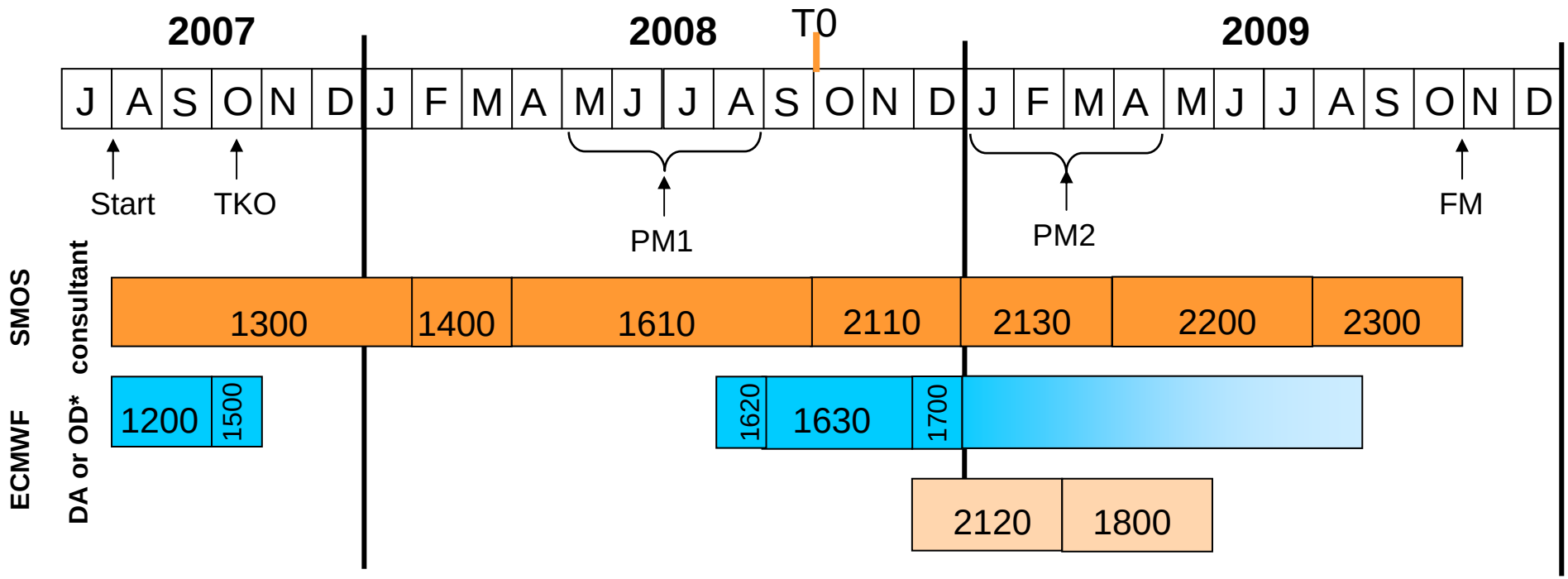
WP 2120: Surface Data Assimilation System Adjustment

WP 2130: Bias Correction

WP 2200: Data Assimilation Experiments

WP 2300: Soil Moisture Monitoring

Introduction PM1: Schedule Phase I



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Introduction PM1

Project status of:

WP 1100: Sensitivity study on auxiliary data sets

WP 1200: Ocean Salinity in the Integrated Forecast System

WP 1300: Global Surface Emission Model

WP 1400: IFS Interface

WP 1500: RTTOVS Update

Project Status: The Observation Operator

WP 1100: Sensitivity study on auxiliary data sets

Deliverable: ECMWF Tech Note at t_0 launch

- Holmes, T., M. Drusch, J.-P. Wigneron, and R. DeJeu (2008): A global simulation of microwave emission: Error structures based on output from ECMWF's Operational Integrated Forecast System, IEEE Trans. Geosc. Rem. Sens., 46, 846-856

- Drusch, M., T. Holmes, P. De Rosnay, and G. Balsamo (2008): Comparing ERA-40 based L-band brightness temperatures with Skylab observations: A calibration / validation study using the Community Microwave Emission Model, *submitted to J. Hydrometeorology*

- De Rosnay, P., M. Drusch, A. Boone, G. Balsamo, T. Pellarin, J.P. Wigneron (2008): Microwave Land Surface modelling evaluation against AMSR-E data over West Africa. The AMMA Land Surface Model Intercomparison Experiment coupled to the Community Microwave Emission Model (ALMIP-MEM)', in preparation

Project Status: The Observation Operator

WP 1200: Ocean Salinity in the Integrated Forecast System

Deliverable: none, needed at t_0

- WP content has been modified to include high resolution GHRSST

- aggregation procedure from regular grid (lat-lon / staggered) to regular grid (reduced Gaussian) introduced in the IFS (RD CY32R3).

- pre-processing chain for GHRSST introduced

- RD experiments started

- NCEP / GHRSST comparison started

- *work on SSS delayed*

Project Status: The Observation Operator

WP 1300: Global Surface Emission Model

Deliverable: Milestone Report at t_0

- CMEM completed
  land : completed
  ocean: Fresnel reflectivity, *SMOS emission model (ATBD) missing*
  atmosphere: Liebe (1989) water vapor absorption or first order approximation

- documentation prepared

- publications accepted / submitted

- www site established

- code available for download

Project Status: The Observation Operator

WP 1400: IFS Interface

Deliverable: Milestone Report at t_0

- science completed (publications)
- NWP – CMEM grib interface available through CMEM www
- ascii / netCDF interfaces for any data – CMEM available
- remaining technical work is part of WP 1610

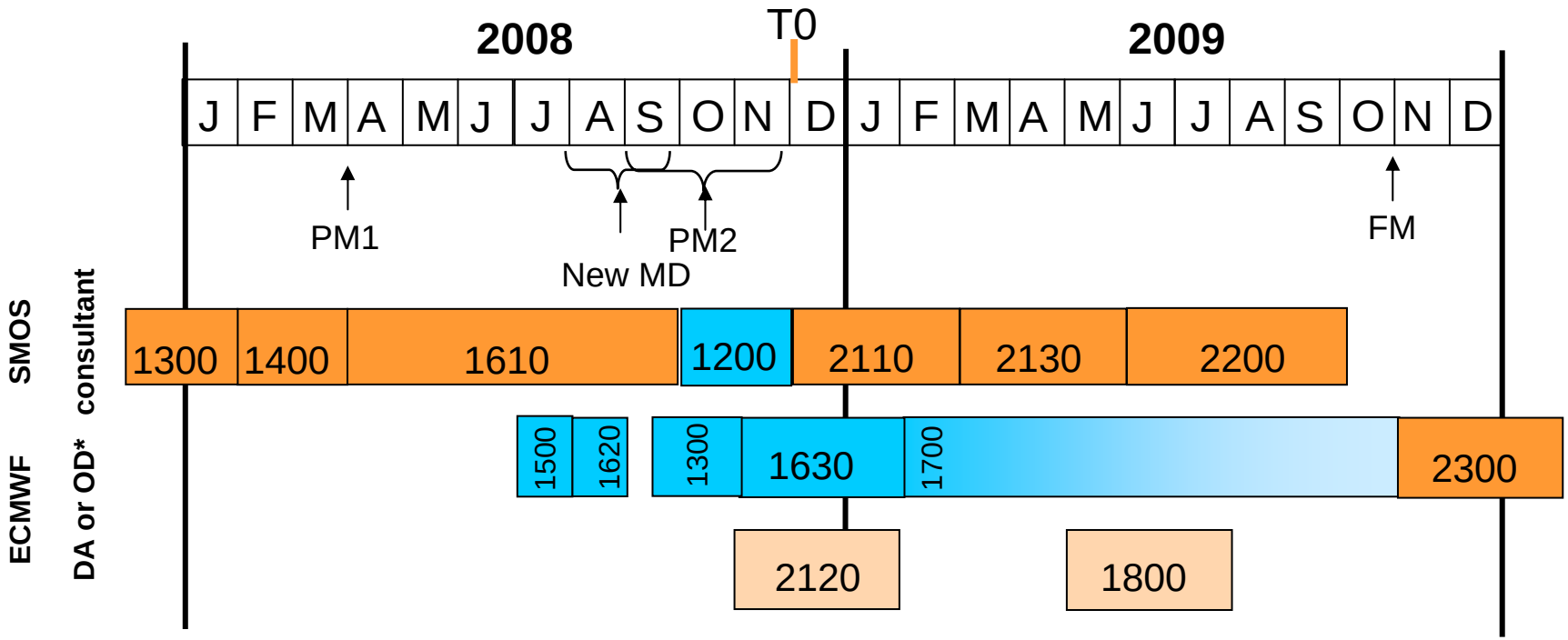
Project Status: The Observation Operator

WP 1500: RTTOVS Update

Deliverable: none

- Meeting with the RTTOV group in November.
- Introducing SMOS as a new sensor can be done quickly at any time.
- *RTTOV – CMEM coupling is still under discussion*.

Hand Over: Schedule Phase (launch in 12 / 2008)



Constraints:

WP 1610, WP 1500, WP 1620 should be ready at t_0

WP 1200, WP 1630, WP 2120 should be ready at t_{0+2}

WP 1700 needs ‘consistent’ data

WP 2130, WP 2200 need ~ 3 months of ‘consistent’ data

Potential risk:

WP 1630 and WP 2120

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Hand Over: WP 1630 and WP 2120

WP 1630 and WP 2120 require an experienced scientist with solid knowledge of the IFS.

Minimizing risks:

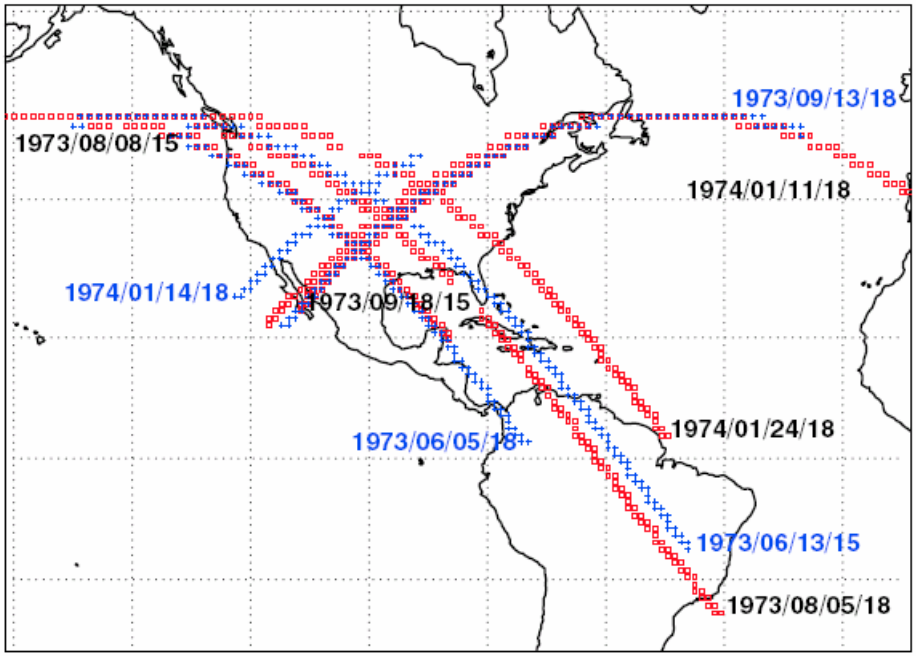
• Data monitoring should be introduced in the atmospheric 4D-Var and the surface analysis (as it is done for the ASCAT soil moisture monitoring).

• WP 2110 could be addressed before WP 1630 to enable RD experiments using the EKF.

- The offline suite to re-process data may not be available at t_{0+2}.

+ WP 2130 (bias correction) and WP 2200 (NWP impact experiments) are independent from the operational surface analysis.

WP 1100 / 1300: Global study - Skylab revisited



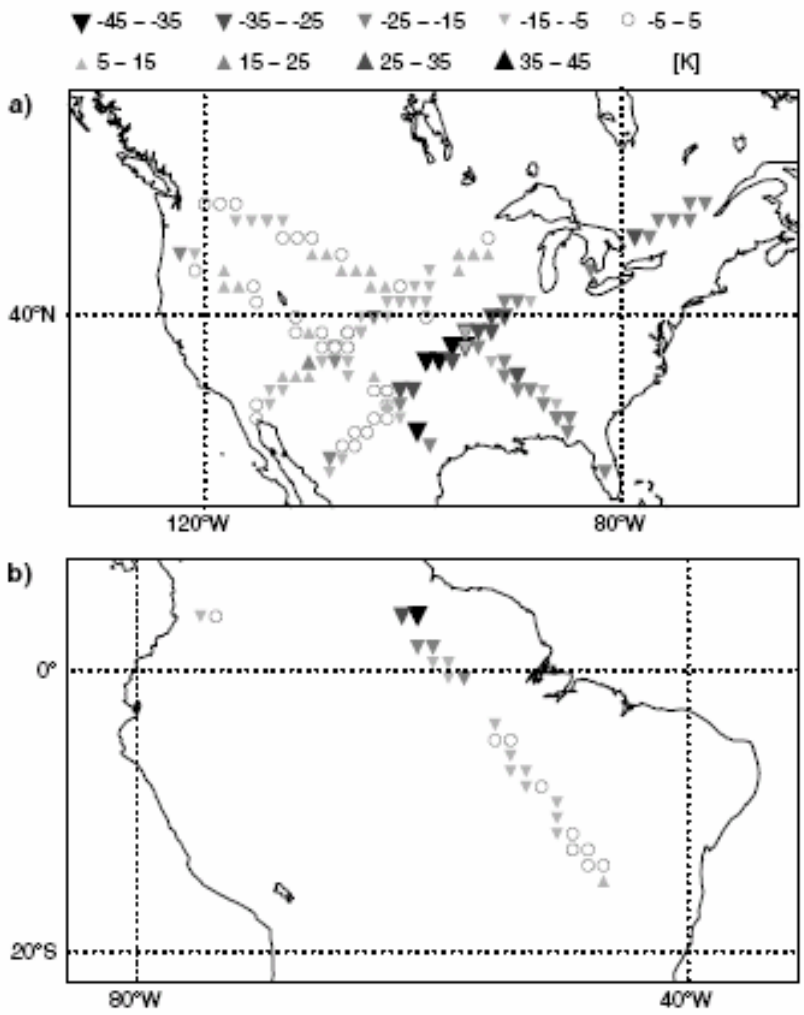
SKYLAB facts:

- launch 14 May 1973
- nominal altitude 435 km
- back on earth 11 July 1977
- data collection required astronaut

S-194 facts:

- L-band radiometer
- nadir looking
- 110 km resolution
- 2.5 km sampling
- most measurements were lost, 9 overpasses could be recovered from print-outs …

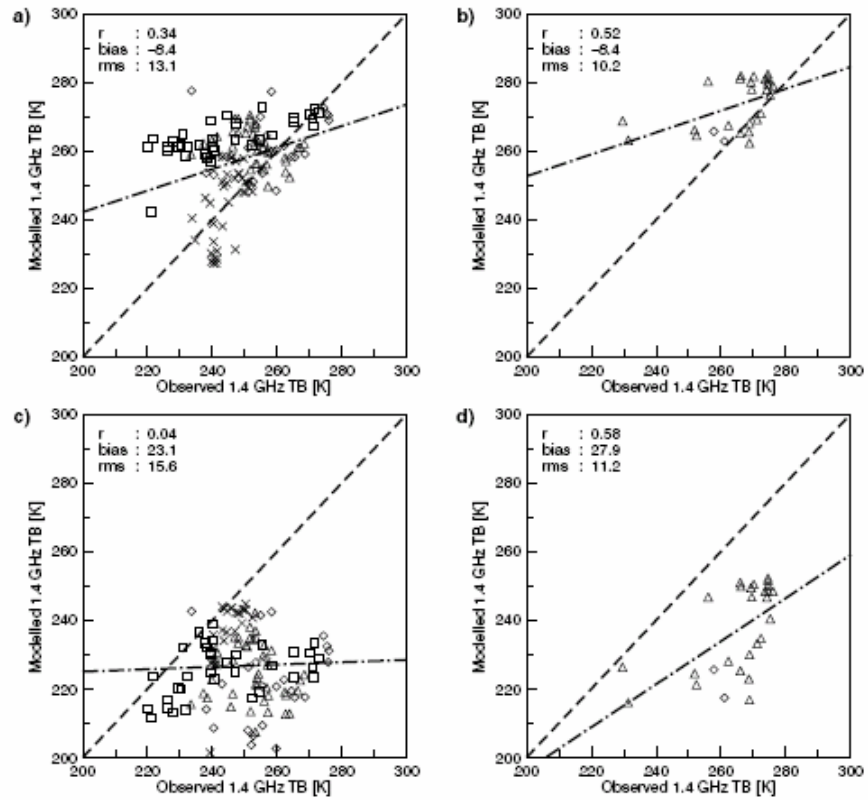
Skylab vs ERA: Calibration configurations



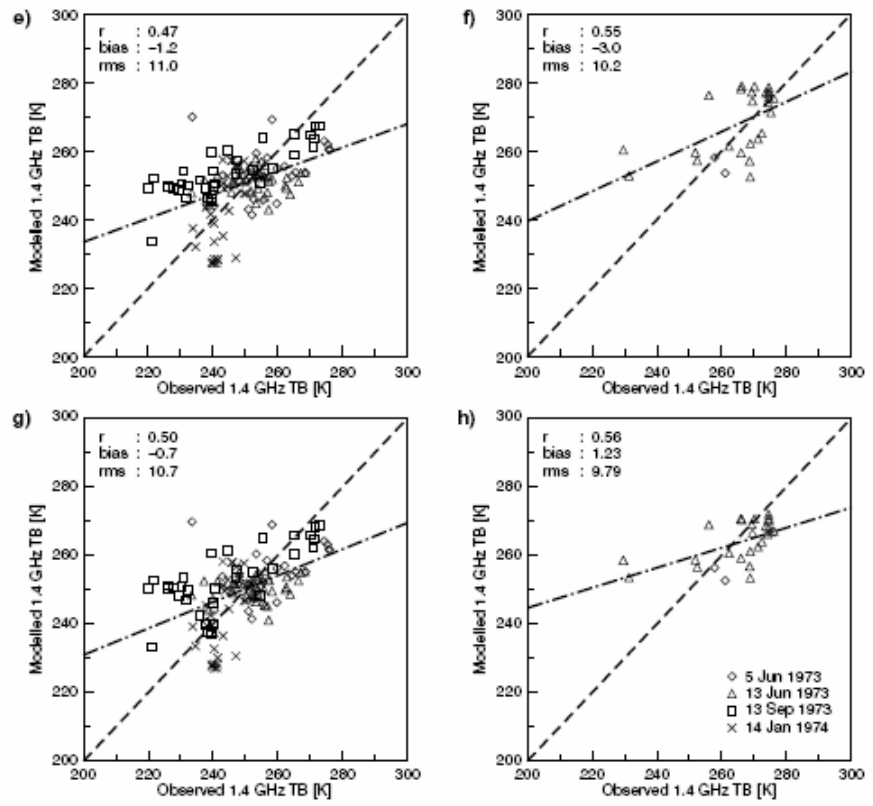
	Roughness			Vegetation		
Setup	Reference	Parameter	Value	Reference	Parameter	Value
A	Wigneron et al. (2001)	h	0.77	Jackson and Schmugge (1991)	$b_{forests}$	0.33
					$b_{C3/C4grass}$	0.20
					$b_{C3/C4crops}$	0.15
B	Wigneron et al. (2007)	$h_{baresoil}$	0.1	Wigneron et al. (2007)	$b'_{C3/C4grass}$	0.0375
		$h_{decid.forest}$	1.0		$b'_{C3/C4crops}$	0.05
		$h_{conif.forest}$	1.6		$b''_{C3/C4grass}$	0.05
		$h_{rain.forest}$	1.3		$b''_{C3/C4crops}$	0.0
		$h_{C3/C4grass}$	$f(\theta)$		b'''	0.7
		$h_{C3/crops}$	0.1			
		$h_{C4/crops}$	0.6			
C	Wigneron et al. (2001)	h	0.73	Kirdyashev et al. (1979)	$a_{geo}(high, low)$	0.33 / 0.66
D	Wigneron et al. (2001)	h	0.77	Kirdyashev et al. (1979)	$a_{geo}(high, low)$	0.33 / 0.33

Skylab vs ERA: Calibration Results

Wigneron et al. 2001 / Jackson and Schmugge 1991



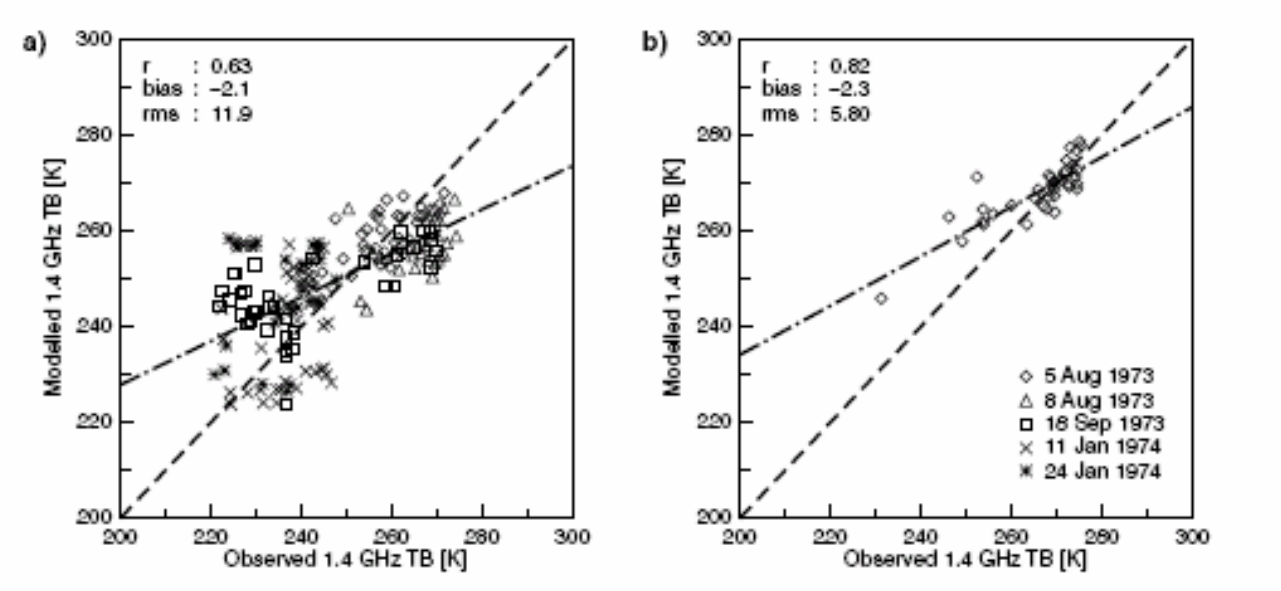
Wigneron et al. 2001 / Kirdyashev et al. 1979



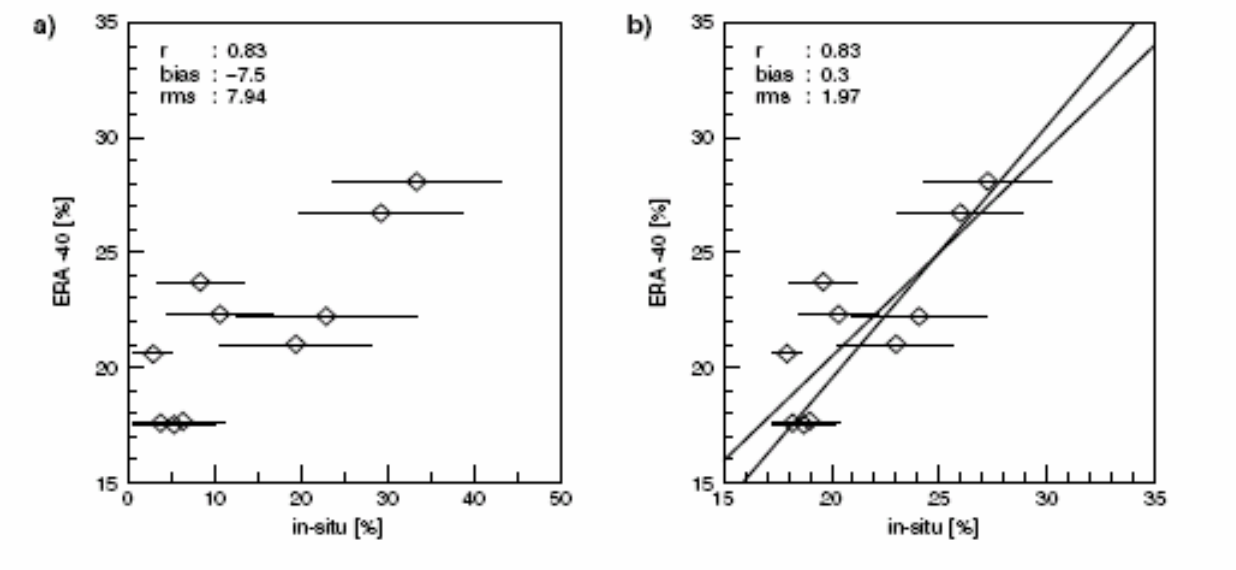
Wigneron et al. 2007 / Wigneron et al. 2007

Wigneron et al. 2001 / Kirdyashev et al. 1979

Skylab vs ERA: Validation Results

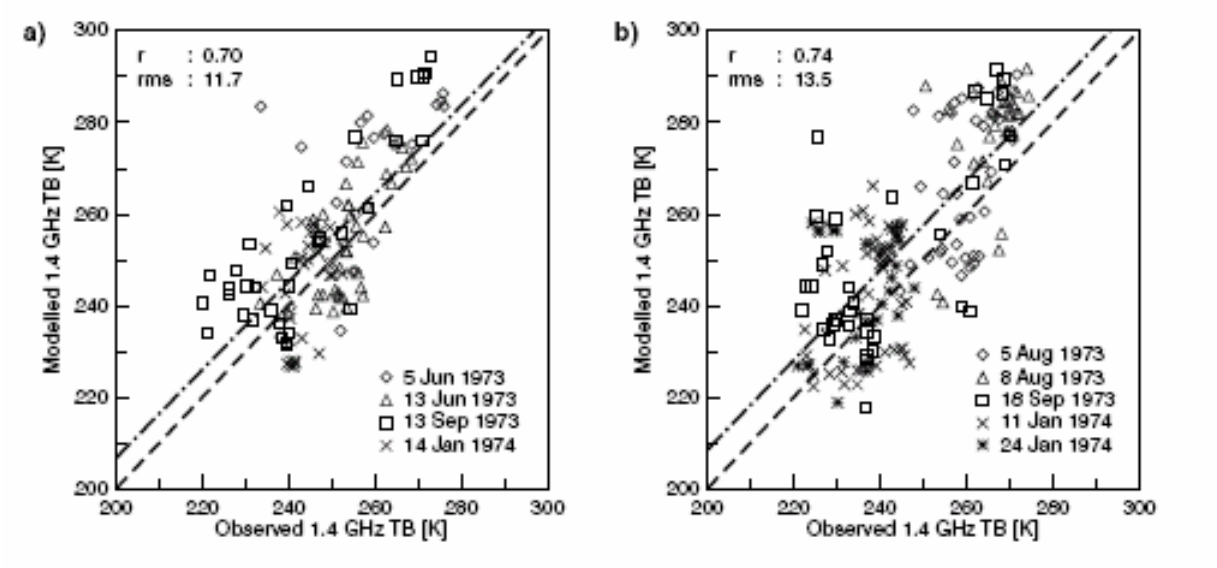


Skylab vs ERA: Soil Moisture Comparison

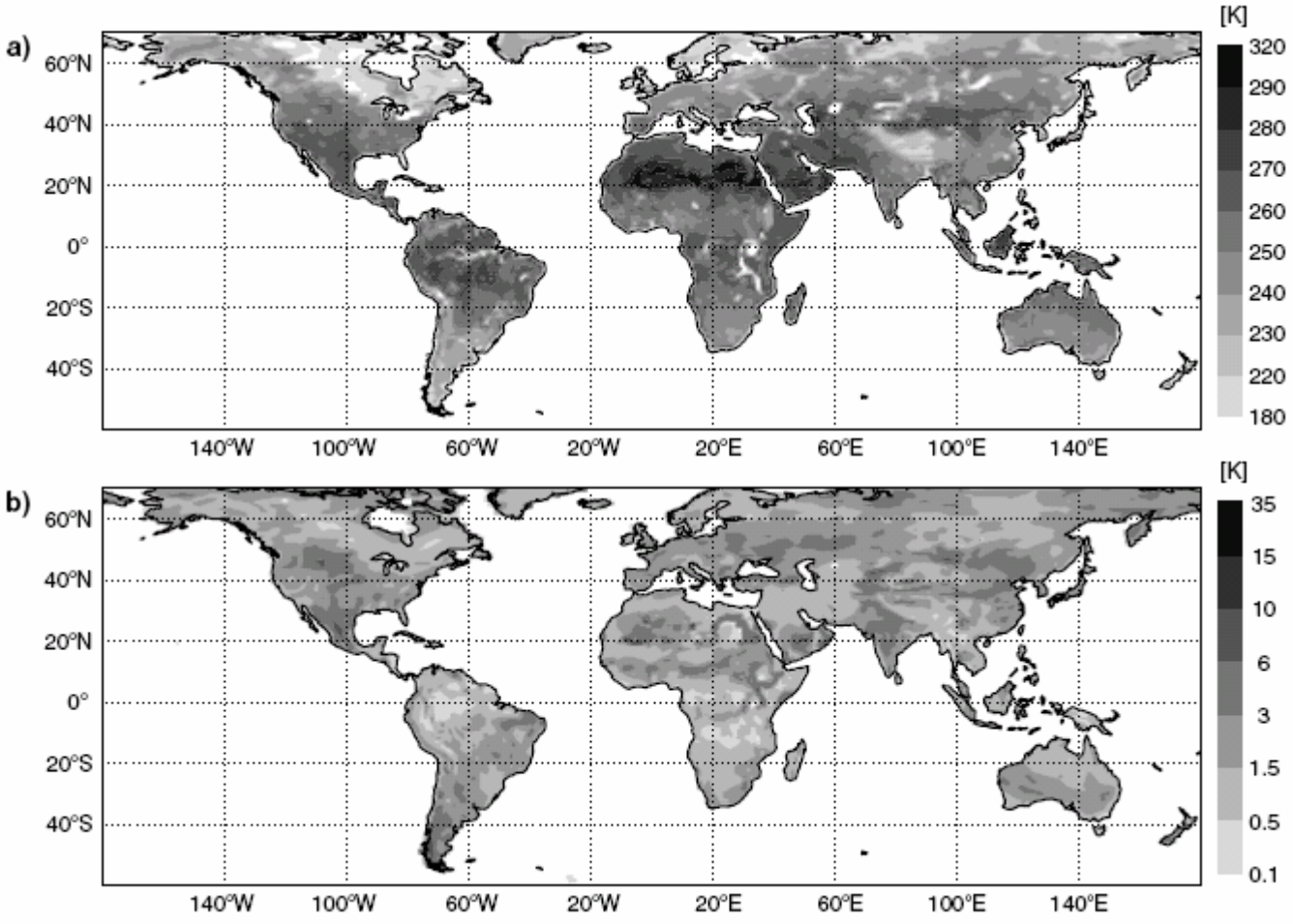


$$\theta_{trans} = \theta_{pwp} + \frac{\theta_{in-situ}}{50}(\theta_{fc} - \theta_{pwp})$$

Skylab vs ERA: Soil Moisture Re-scaling



Skylab vs ERA: L-band Climatology



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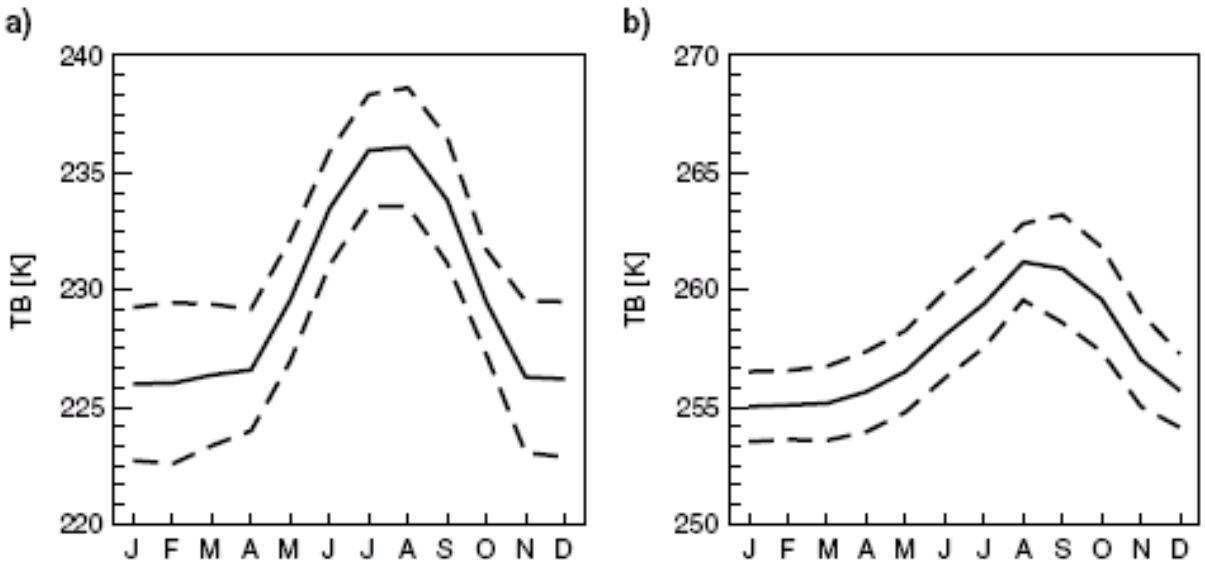
Skylab vs ERA: L-band Climatology



Skylab vs ERA: Conclusions

- It is possible to calibrate the emission model for NWP applications.
- Wigneron et al. (2001) and Kirdyashev et al. (1979) give the best results for roughness and vegetation, respectively. This is consistent with the findings for the AMMA region using C-band observations.
- A bias correction is needed to adjust the dynamical range of model brightness temperatures.
- Large parts of the globe show only limited temporal variability in brightness temperature (when compared against the uncertainty introduced through different parameterizations). A first calibration should be possible shortly after launch.
- Wigneron et al. (2007) did not provide optimal results. A strong collaboration between SVRT members working with (local) in-situ data and the NWP community providing data for the Level 2 algorithm is required.
- Cal/ Val study provides the framework, CMEM is the ideal tool …

WP 1200: SSS (and SST)

- **Ocean Salinity**

  Tasks:

  - aggregation from ocean grid to reduced Gaussian grid
  - introduce SSS as an input parameter for CMEM

- **OSTIA High Resolution Sea Surface Temperature (Optional)**

  Tasks:

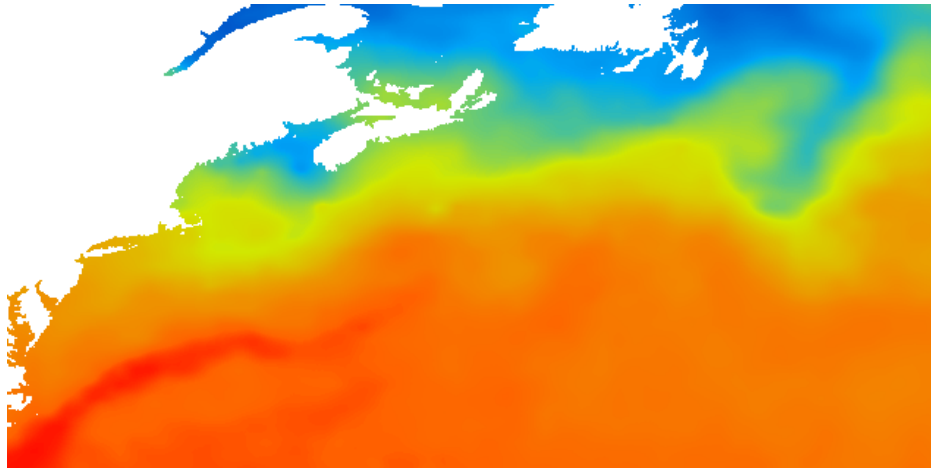
  - aggregation from 0.05 deg regular lat / lon to reduced Gaussian
  - use GHRSST in the IFS to produce consistent input parameters for the ESA SSS retrieval scheme

- **Emissivity Modeling (WP 1300)**

  Task:

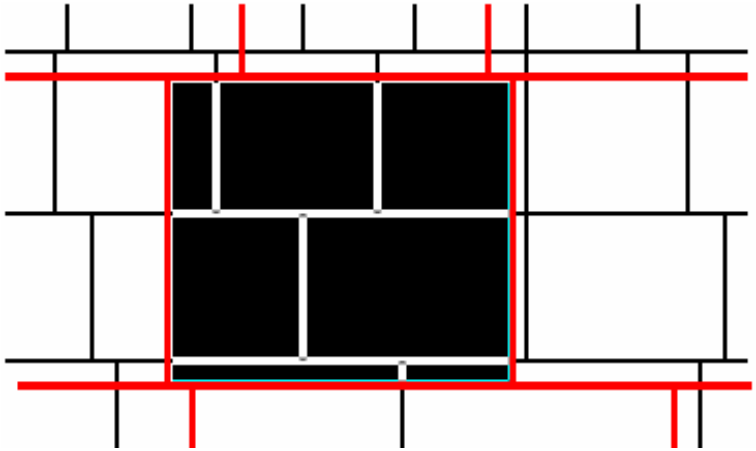
  - implement N. Reul's forward model

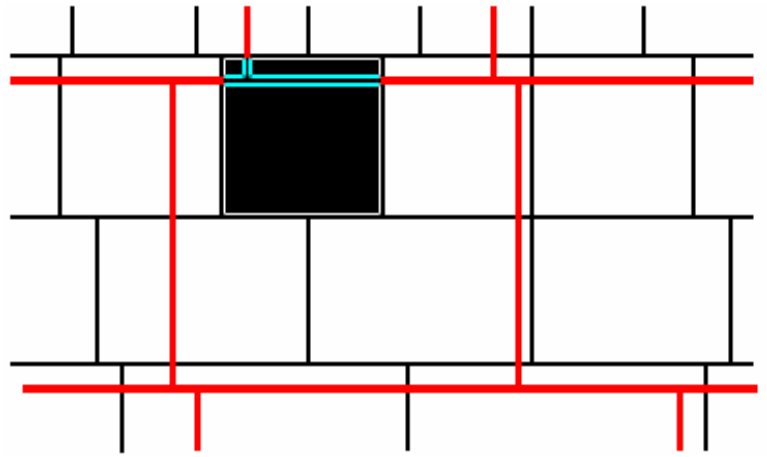
WP 1200: GHRSST high resolution SST



- GHRSST 0.05° deg data provide global SST and sea ice fields
- netCDF to BUFR conversion has been implemented in operations
- spatial integration to reduced Gaussian model grid has been introduced (RD CY32R3)
- impact studies on forecast skill have been started

WP 1200: SSS / SST Aggregation Scheme



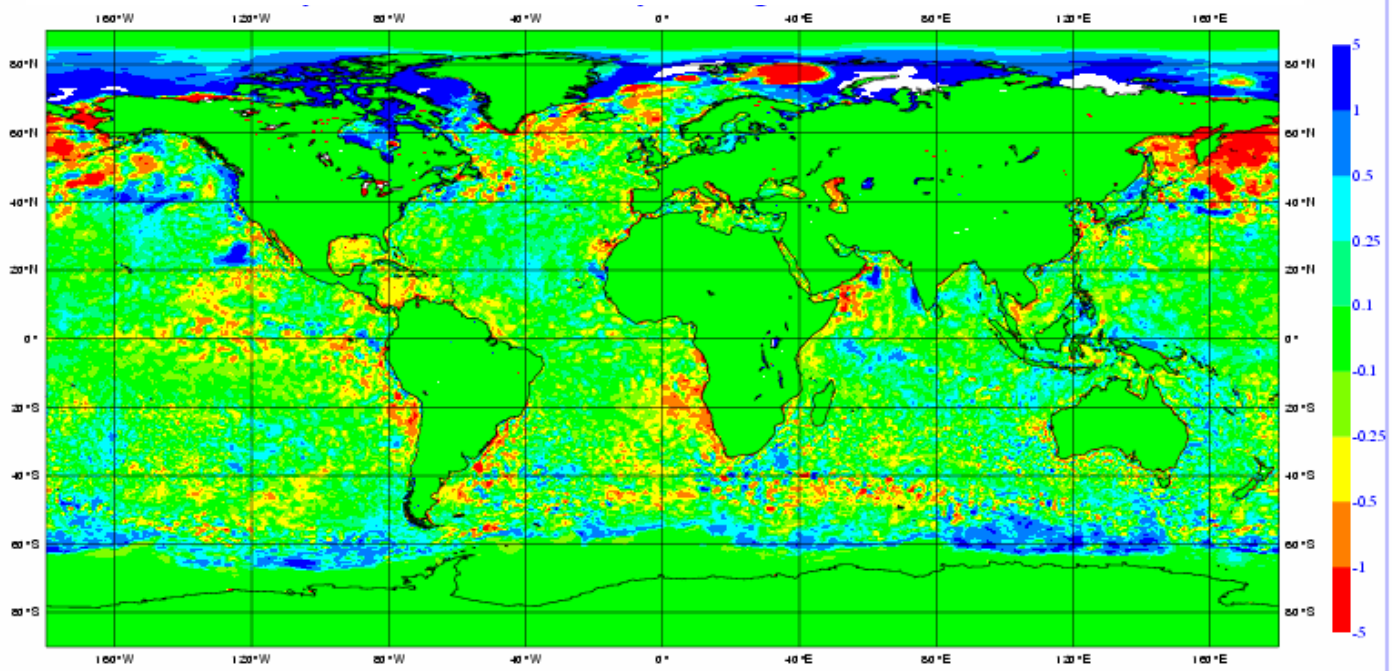


- Instead of point interpolation, the ‘conserved quantities’ within each output gridcell are obtained from an integral over the input grid cells.
- Within each input grid cell, the variables are represented by a multidimensional sub-cell distribution (polynomial, based on neighbouring grid cells).
- For high to low resolution, linear is ok, but higher order is better.
- For low to high resolution, higher order sub-cell distribution is needed.

WP 1200: SST

OSTIA – NCEP (T799)

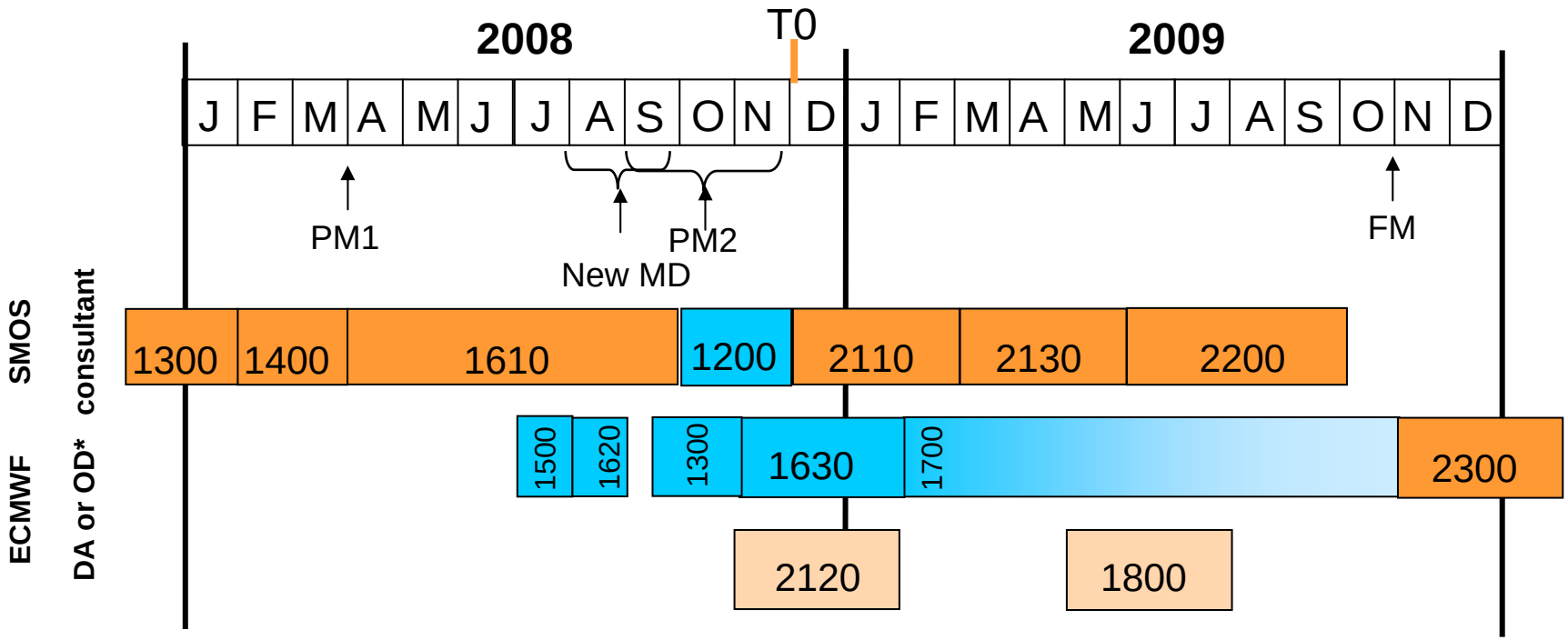
(1.8.2007 – 10.8.2007)



WP 1200: SST & CI Implementation

- Finish RD test based on CY32R3 for T511 (in collaboration with SAT & PA & Wave sections). To be completed end of April.
- Merge with CY 33R1 as soon as it is available.
- E-suite 33R2 in summer, operational implementation end of summer …
- SSS either as part of WP 1610 (June / July) or in October / November 2008 …

Wrap up: Schedule Phase (launch in 12 / 2008)



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