SMOS Data Assimilation Study / Progress Meeting 1

Participants
ESA: Susanne Mecklenburg (SM), Steven Delwart (SD)
ECMWF: Matthias Drusch (MD), Patricia de Rosnay (PdR), Erik Andersson (EA),
        Peter Bauer (PB), Jean-Noel Thepaut (JNT), Klaus Scipal (KS)
Météo-France: Fatima Karbou

Agenda
09:15 - 10:15 Introduction / status of the project / hand over (MD)
10:15 - 10:30 Coffee
10:30 - 11:15 CMEM technical overview (WP 1300, WP 1400, PdR)
11:15 - 12:00 CMEM sensitivity study on local and regional scales (WP 1300, PdR)
12:00 - 12:45 Global scale study (WP 1300, MD)
12:45 - 14:00 Lunch
14:00 - 14:30 Discussion on CMEM and RTTOV (WP 1300, WP 1400, WP 1500, MD)
14:30 - 15:00 Sea Surface Salinity and Temperature (WP 1200, MD)
15:00 - 15:30 Synergy Active - Passive Microwave (KS)
15:30 - 15:45 Coffee
15:45 - 16:15 Wrap-up

Presentations
The presentations are available under:
http://www.ecmwf.int/research/ESA_projects/SMOS/cmem/cmem_pres.html
(under "Workshops").
General information

a) Personnel
MD will leave ECMWF on April 30th. His position has been opened and he will be replaced in August / September 2008. EA will resign as the head of the Data Assimilation Section on the 30th of June to commence his new position as head of the Meteorological Division.

b) Mission Status
The initial DA study schedule has been based on a launch date in October 2008 (see annexes 1 and 2). Currently, the SMOS (unconfirmed) launch date is foreseen for December 2008. ESA will update us on SMOS launch status in July.

Introduction / status of the project / hand over (MD)
The work to be performed by ECMWF under this contract with ESA includes two parts for SMOS monitoring and assimilation. The SMOS monitoring is to be performed over both Land and Ocean surfaces, while the assimilation study will be performed over land. MD presented the original project schedule, the WPs repartition between the ESA / SMOS consultant (PdR) and ECMWF, and the project status with respect to WP 1100 to WP 1500. The schedule of the project has been adjusted to take into account the current status, the delayed launch and the changes in personnel (annexe 2).

Action: ESA to confirm the SMOS launch date in July and to provide necessary updates in activities directly affected by the launch date (meeting dates, schedule of WP 1630, WP 1700, WP 2110 and WP 2120). SD proposed to meet at the IGARSS conference (SM, SD, PdR).

CMEM forward operator and scientific results
(WP 1200, WP 1300, WP 1400)
- Concerning ocean salinity the current approach used in CMEM is based on the Fresnel reflectivity model and it needs to be updated with a more physically based approach. SD indicated that the use of the LOCEAN model is the reference and it is available without copyright issues (see Jacqueline Boutin at LOCEAN and Emmanuel Dinnat currently at NASA with David Le Vine). Concerning the hand-over with the next data assimilation consultant (following MD), MD proposed to update the WPs schedule and shift the work on salinity (WP1200) to the SMOS's consultant (see annexe 2).

- Recent CMEM developments on land surfaces were presented by PdR. The code is structured in modular components, interfaced with grib, ascii, netCDF input/output (I/O) and the vegetation tiling is updated in agreement with the SMOS ATBD. The first tagged version of CMEM was available in December 2007 (v1.1), followed by v1.2 in March (including a land-sea mask and other utilities). CMEM is also modular in terms of physical parameterizations. It was updated to account for the recent Mironov dielectric model and the Wigneron’s 2007 vegetation opacity model. SD mentioned that the level2 algorithm dielectric model will also be updated. CMEM can be used in ‘LMEB’ configuration, for which the codes convergence has been studied with the L-MEB F90 version of Météo-France. CMEM fully modular code is freely accessible through the ECMWF web site where a SMOS project item has been added (research / ESA_projects / SMOS). PdR presented the CMEM web site. SD agreed to advertise to the SMOS Validation and Retrieval

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1 Update on 7 April 2008: ESA informed ECMWF that the SMOS launch will not occur until mid April 2009.
Team. ECMWF is aware that this can lead to requests from users. SD recommended having a FAQ section on the Web site. PdR and SD mentioned that providing a test data set, including input/output examples in the three formats, would be useful for the users to ensure the implementation of CMEM has been accurate.

Action: PdR adds I/O test data set on the web site and a FAQ section. (done Apr 2nd).

- Presentation of scientific results: PdR presented results of L-band background errors on the SMOSREX site. She also presented results obtained over West Africa in the framework of the ALMIP-MEM study. In this study, background errors were investigated at C-band by comparing C-band AMSR-E satellite data with different configurations of NWP/GCM land surface models (TESSEL, HTESSEL, CTEESSEL, ISBA, JULES, ORCHIDEE) coupled with CMEM. MD presented results over America at L-band, using the Skylab satellite data. Although they were performed at different spatial scales, different frequencies and incidence angles, and with different land surface models, these three studies are consistent in that the Kirdyashev vegetation opacity model used with the Wang dielectric model lead to best agreement with passive microwave measurements. KS presented results from the H-SAF study using ERS and ASCAT Soil Wetness Index products.

ESA is fully satisfied by the current status of the project and the work performed at ECMWF. Recent technical developments of the forward model make it fully flexible in terms of parameterizations and interfaces. Scientific studies performed with CMEM to evaluate background errors of the forward approach, using actual and past measurements (AMSR-E, Skylab, SMOSREX), are of high interest for NWP and SMOS communities.

CMEM implementation
(WP 1610 and WP 1500, Apr-Sep 2008)
This work is starting now in the framework of WP 1610 and WP 1500. CMEM will be interfaced to RTTOV (interactions between data assimilation and satellite data sections of ECMWF). The monitoring will be processed in the 4Dvar through RTTOV. To this end, Top of Vegetation brightness temperature will be the interface variable between RTTOV and CMEM. The atmospheric part of the RT model will be unchanged with respect to the higher frequencies. In case scientific developments are required in RTTOV (e.g. new specific RT regression predictors for the L-band), then this work will need to be coordinated with the NWP-SAF (PB). The current assumption is that this will not be necessary.

Commissioning phase
The SMOS commissioning phase will last approximately 6 months after launch. SD indicated some of the SMOS calibration targets: global Ocean (involves colleagues from IFREMER, and form Aquarius mission), Antartica with the DOMEX measurements (stable negative temperature of -55 C at 10m depth), Amazon forest. PdR indicated that the SMOS NRT BUFR specification is already defined in agreement with Deimos and a corresponding official document was established by ECMWF and sent to ESA. Deimos will deliver BUFR file to ECMWF. A sample file will be provided by Deimos to ECMWF in June.
**Contract extension to phase II**

ESA expressed that the contract extension will depend on results from WP 2200. The impact of SMOS data on the ECMWF forecast quality should be evaluated using real data of good quality following launch. EA expressed ECMWF’s need to ensure continuity of staff on the SMOS activities. ECMWF requires an indication about ESA’s intention for a contract extension prior to the end of the current contract, especially if further launch delays are to be expected. An ESA-ECMWF meeting will be scheduled in early 2009 to address this issue.

**Next progress meeting**

If SMOS launch is not delayed, a SVRT meeting will take place in early November 2008 at ESTEC. In this case, SD proposed to merge the PM2 meeting and the SVRT meeting. The main issue to be addressed during this meeting will concern the science issues suitable for cal-val studies (point on monitoring preparation). If SMOS launch is delayed, we will have to plan the progress meeting 2 (PM2) in autumn 2008.
Annexe 1

**Work packages**
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
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
Annexe 2

Initial schedule of the project

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Proposed updated schedule of the project

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**New MD**