MISSION EXPERTS DIVISION (EOP-SM)
DIRECTORATE OF EARTH OBSERVATION PROGRAMMES

date	reference	number of pages
16 December 2003	EOP-SM/0993/MB-dr	Page 1 of 13

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Subject: **Minutes of the 13th SMOS SAG Meeting held at ESA-ESTEC, Noordwijk, The Netherlands, 1 & 2 October 2003**

Dear Colleague,

Enclosed you will find the minutes of the thirteenth SMOS SAG meeting held at ESA-ESTEC, Noordwijk, The Netherlands, 1 and 2 October 2003. Please note that this document is also available in PDF format for downloading on the SMOS SAG ftp server. The version on the ftp site also contains the presentation viewgraphs used during the meeting.

As usually I already now would like to ask you to mark the dates for our next SAG meeting. The dates as identified at the last meeting had to be postponed due to an on-going SAG membership review and renewal. Tentatively **3-4 March 2004** were identified as new meeting dates with the option to combine the meeting with a first coSMOS campaign planning meeting on **5th March**. In addition **19-23 April 2004** were identified tentatively as meeting dates for the Aquarius-Hydros-SMOS Joint Science Meeting. Further details will be send to you in due time.

Should you have any questions concerning the minutes, please feel free to contact me.

I also would like to take this opportunity to wish you and your families nice and relaxing Christmas vacations and a Happy, Healthy and Prosperous 2004.

Yours sincerely,

Dr. M. Berger
Land/Surfaces Unit
Mission Experts Division

MINUTES OF THE

THIRTEENTH

SOIL MOISTURE AND OCEAN SALINITY (SMOS) MISSION
SCIENCE ADVISORY GROUP MEETING

1 & 2 October 2003

ESA ESTEC, Noordwijk, The Netherlands

Participants:	Y. Kerr, J. Font, M. Peichl, P. Waldteufel, M. Hallikainen, D. LeVine, N. Skou, P. Viterbo
Excused:	G. Lagerloef, T. Jackson, P. Ferrazzoli
Guests:	T. Elfouhaily, N. Reul, A. Colliander
ESA:	A. Hahne (part time), E.-A. Herland (part time), E. Attema, P. Wursteisen (part time), M. Martin-Neira, H. Rebhan, M. Drinkwater, N. Floury, M. Berger, B. Duesmann (part time), M. Rast (part time), J. Benveniste (part time), E. Dinnat, M. Rijkeboer, J. Lakhinen (part time)

1. Welcome and Introduction - Objectives of the Meeting

Y. Kerr and M. Berger welcomed the SMOS SAG members and their guests to the 13th SMOS SAG meeting.

G. Lagerloef, T. Jackson and P. Ferrazzoli were excused.

The main objectives of the meeting were:

- to inform the SAG on the status of the project, in particular the PB-EO decision and the next steps to be taken,
- to discuss requirements of field radiometers which procurement would be supported by the project,
- to discuss sea state perturbing effects and possible correction schemes.

2. Approval of Draft Agenda

M. Berger introduced the draft agenda.

The agreed agenda is attached to the minutes (Annex A).

3. Actions from the Last Meeting

Action items from the last meeting were reviewed and their status updated.

No.	Category	Subject	to	due	Status
1.26	Promotion	To provide planned promotion activities/publications to MB	all		On-going
3.9	Promotion	To draft GEWEX article - PV and GL to provide inputs	YK/PV /GL	15/10	Re-issued
6.10	MRD	To update MRD on OS requirements	JF/GL	30/9	closed
8.6	Cal/Val	To draft a calibration scheme and a validation plan	YK	30/9	closed
8.13	Science Report	To draft Science Report	MB	30/9	On-going
9.3	Studies	To draft requirements for an assimilation study	PV	31/10	Re-issued
10.4	Instrument	To provide a TN/presentation on the validity of NIRs to the SAG at their 13th meeting	MMN	2/7	closed
10.5	Cal/Val	To forward draft ELDAS validation plan to YK	PV	1/9	closed
10.6	Cal/Val	To provide detailed feedback to the draft cal/val document which will be distributed by YK	SAG	1/11	Re-issued
11.5	Studies	To send the GOCE ATBD to the SAG	MD	1/4	open

12.1	Instrument	To check involvement of SAG experts in instrument design review boards	MB	1/9	closed
12.2	Reconstruction	To ask I. Corbella for a pre-copy of the article introducing the new term in the visibility function	MB	15/9	closed
12.3	SEPS	To ask B. Duesmann to clarify the activation of the DLR algorithm	MB	15/9	closed
12.4	GS	To ask the product of a definition/examples of higher level requirements	MB	15/9	closed
12.5		To refurnish and distribute the minutes of the French user group meeting	HR	15/9	Open – re-issued

4. Project Status - PB-EO decision, next steps, MDPP, HUT-2D

A. Hahne reported that SMOS was unanimously approved for the next phases at the 97th meeting of the PB-EO. Currently the industry phase C/D proposal is being reviewed. This is being followed by an internal requirement review and by the PDR at instrument level which marks the end of the industrial phase B activities. Assuming an approval by IPC end of November, Phase C/D will be kicked-off by mid December. A MoU with CNES is currently being prepared.

The SAG was also informed that a data loss of 10-15% due to other usage of the X-band antenna at VILSPA (see minutes of previous SAG meeting) is not acceptable. The project is currently looking into this subject. The use of another ground station for time periods when the X-band antenna would be unavailable for SMOS need to be assessed considering technical aspects (non standard SMOS data packages, EMC during data downlink) and their impact on the operations and costs.

M. Martin-Neira reported on the status of MDPP. The pilot projects 1 & 2 are completed. A total of 12 receivers were built. Also the NIR, the correlator unit and the calibration CAS system were developed within the MDPP 1 and 2 activities. Within the pilot project 3 further image validation tests are foreseen which includes a new Image Validation Test at INTA EMC chamber. In addition, ESTEC is preparing the Image Validation Test 4 (IVT-4) to take an image of the Milky Way from Dwingeloo (NL) site.

M. Hallikainen reported on the status of the HUT-2D development. The new digitizing boards show performance improvements. Currently correlation tests are being performed. In general good results were achieved but some problems were noted at short baselines. These are likely due to coupling effects which are responsible for feeding correlated noise from one receiver to the receivers next to it. First flight tests are planned for end of November. In the following discussion N. Skou reported on his experience with antenna coupling effects and surface waves. It was proposed to make the subject an agenda point for the next SAG meeting.

5. Radiometer Procurement – Discussion on the Requirements, Next Steps

N. Skou outlined technical requirements for field radiometers which procurement could be supported by the project. A high sampling rate seems to be mandatory in order to detect and correct for RFI contaminated data in a post processing manner. The radiometer should be build modular allowing a flexible deployment including the use of different antenna designs (horn, dish, patched array) according to the different aperture requirements. Details of the requirements are given in his viewgraphs attached to the minutes.

In the discussion on the scientific requirements Y. Kerr agreed to draft a list of requirements based on the campaign document and open issues which need to be addressed.

6. OS Retrievals – Accounting for Sea State Effects (N. Skou, T. Elfouhaily, E. Dinnat, N. Reul)

N. Skou again addressed the wiggling effect as observed by LOSAC and also by US experiments. Scaling experiments show that the unexplainable fluctuations/wiggles are seemingly present in data with spatial resolution up to 10 km. Whether the effect disappears at higher spatial resolution is still unclear. It was agreed that this effect needs to be explained with priority, e.g. by a dedicated campaign if needed. N. Skou reported that a dedicated meeting to discuss this subject with US scientists is foreseen in the near future. He will keep the SAG informed.

T. Elfouhaily presented some results from his research on roughness effects in microwave surface scattering. His model approach to describe the roughness of a scattering surface starts with the assumption of a locally flat surface (Kirchhoff-Theory) and introduces further correction terms which are derived from the second derivatives of surface slopes (curvature). He argued that the curvature approach would lead to a more uniform electromagnetic modelling approach and would explain the polarization sensitivity to surface roughness. Some results were presented with Normalized Radar Cross Section (NRCS) versus scattering angle in comparison with a Kirchhoff- and a Small-Scale-Approximation (SSA) model. The differences were noticeable for large scatter angles only. In the discussion it was noted that differences in electromagnetic modelling are possibly less dominant than differences in roughness description. E. Dinnat proposed to plot the results in Tb rather than NRCS for a better comparison of the modelling results.

E. Dinnat presented the study he is currently undertaking as an ESA research fellow. He introduced his presentation with a short review of the results that he and his co-workers obtained concerning the influence of SSS, SST and roughness on Tb at L-band. He presented also the expected uncertainty on retrieved salinity from SMOS measurements (without taking account the error coming from the image reconstruction). Roughness is identified as a major source of uncertainty (much more than SST), comparable to radiometric noise under most circumstances. Issues concerning the correction of the roughness-induced Tb by means of sea spectrum models were briefly exposed, and the possibility of using active measurements to correct for the roughness effect on Tb was discussed. Theoretical and empirical arguments for the feasibility of the later method were exposed, and a qualitative comparison of the influence of the various sea scales on Tb and NRCS was done, leading to the conclusion that

various "sea state estimations" should be necessary (e.g.: wave models and altimeters for gravity waves, scatterometers for gravity-capillary waves).

N. Reul reported on his work concerning sun reflexion within the SMOS path. His findings are not agreeing with the findings of B. Duesmann. In the discussion it was recommended that N. Reul and B. Duesmann should re-assess the calculations which was done in the meantime (see email note sent by N. Reul – a separate report will follow).

7. Level 1/2 Requirements

Y. Kerr introduced the draft level 1/2 requirement document. In the discussion it was noted that two processors, one for SM and one for OS with different apodisation windows, would be required. Open issues on auxiliary information requirements such as different sea-ice types were addressed. Feedback from some SAG members was given on the spot. The SAG was encouraged to provide inputs to the draft within one week.

8. Cal/val Plan (Discussion of the Draft, the Role of 2D Interferometers - Presentation by M. Martin-Neira)

The cal/val plan as drafted by Y. Kerr was briefly discussed. The SAG again was encouraged to provide feedback in order to improve the first draft. In particular, much more needs to be done with respect to the validation plan and its implementation. The discussion will be led in the next weeks together with the preparatory discussion for the coSMOS campaign (see further down).

In this context M. Martin-Neira presented ideas of the role of 2D-inteferometers for the SMOS validation and how the 13-element MIRAS system from MDPP could be refurbished as an aircraft instrument (MIRAS-A = MIRAS-Airborne). A. Hahne noted that this activity would favour the risk reduction and therefore the Project is willing to support the MIRAS-A development, although the SAG expressed some concerns.

9. Studies & Campaigns (Status of the IR Study, coSMOS, coSMOS Precursor)

M. Peichl reported on the status of the IR study. A first progress meeting took place together with a progress meeting of the Portuguese level-1 processor development activities at which different image reconstruction techniques were discussed at length. Three different techniques were agreed for implementation and further analysis. In addition, figures of merit for the assessment of the different techniques were agreed. The next progress meeting is planned for December also combined with a progress meeting of the Portuguese level-1 processor development activity.

The status of the coSMOS (campaign for validating the operation of SMOS) was discussed. It was stated that preparatory activities should already start in 2004 which could include first test flights of refurbished airborne instruments and site preparatory activities. In the discussion it was noted that an imaging device based on an interferometric concept is not considered mandatory for the long-term experiment. A real aperture instrument with e.g. two antennae for two different viewing angles is considered suitable.

M. Berger noted that it is planned to have a first coSMOS-planning meeting with all potential partners invited at the beginning of next year.

10. AOB (Principles of NIRs (by A. Colliander), IPY (M. Drinkwater), azimuthal signal over land (N. Skou), next WS – Aquarius-SMOS joint WS, new visibility function, new SAG membership composition for Phase C/D)

Principles of the NIRs:
A. Colliander from HUT presented the principles of the Noise Injection Radiometers and outlined the status of the development.
A NIR breadboard based on the LICEF receivers has been developed by HUT Laboratory of Space Technology, Ylinen Electronics and Toikka Engineering. The final review was at the end of October 2003. The purpose of NIR is to calibrate MIRAS by measuring the absolute polarimetric brightness temperature of the scene and by measuring the noise temperature level of the calibration network. Various measurements proved the concept and showed that the main requirements are met. The results are encouraging considering NIR as a provider of an accurate reference for MIRAS. By the breadboard activity further experience could be gained which is considered essential for further development work.

IPY:
M. Drinkwater introduced the history of the International Polar Year (IPY) and Geophysical Year and the concept for a bi-polar IPY4 in 2007/8. The International Council of Science (ICSU) recently appointed a Planning Committee to put together a concept for IPY4. Its Chairman recently contacted ESA to draw together ideas on ESA's EO contribution to the International collaborative effort. Importantly IPY provides a focus for in-situ activities in the cryosphere and links to satellite remote sensing data acquisition. SMOS Cal/Val activities may be of particular interest during this period, with the 2004/05 Station Concordia (Dome C), Antarctic pilot L-band in-situ campaign providing a natural link to preparations for a calibration monitoring site. M. Drinkwater is the ESA Earth Observation Programmes Directorate point of contact for IPY4.

Azimuthal signal over land:
N. Skou reported from azimuthal signal observed over land during the Avignon experiment. The differences are up to 10 K likely due to surface structure such as ploughing, planting etc. These effects are believed to average-out at coarser spatial resolution, and at a SMOS footprint effects like land undulation and relief take over. It was further reported that topographic effects are e.g. addressed in a CCN of the soil moisture requirement study.

SMOS Orbit update:
B. Duesmann reported on new findings in fine-tuning the orbit definition. An increase of the orbit altitude to 761 km (instead of 755.5 km) fulfils better the revisit requirement for the narrow swath.

Next SMOS WS – Aquarius-SMOS joint WS:
J. Font reported that an Aquarius Science Team meeting is planned for beginning of next year, which would collide with the SMOS workshop plans (see previous minutes). The Aquarius team invited the SMOS team for a joint workshop end of April in Miami which would be an ideal forum to discuss synergistic aspects of the two missions. The SAG

received the idea very well and therefore it was decided to postpone the next European WS towards the end of 2004 (date tbd).

SMEX update:
D. LeVine reported on behalf of T. Jackson about an experiment planned for next year in New Mexico (called SALSA) and asked if European scientists would be interested in contributing. D. LeVine was asked to find-out if an experiment plan exists and if so, to forward it to the SAG.

New visibility function:
A side meeting took place at the end of one SAG meeting day to discuss the new visibility term as introduced by I. Corbella. The discussion was not conclusive and it was decided to further discuss the subject using email.

New SAG membership composition:
M. Berger informed the SAG that it is common practise to review the SAG membership at the end of a Project phase with respect to the advice requirements for the next Project Phase. For SMOS Phase C/D the SAG shall provide advice for the ground segment development, the retrieval schemes and their implementation, image reconstruction techniques as well as calibration and validation activities and product assimilation techniques. Considering these tasks, the SAG membership will be reviewed and adopted accordingly. This procedure will not apply for the US SAG members and the LIs.

11. Date & Place of Next Meeting

The next SAG meeting was scheduled for 21 and 22 January 2004 at ESTEC.

Summary and Conclusion

Y. Kerr and M. Berger thanked the SAG for attending the meeting.

List of Actions:

No.	*Category*	Subject	to	due	Status
1.26	Promotion	To provide planned promotion activities/publications to MB	all		On-going
3.9	Promotion	To draft GEWEX article - PV and GL to provide inputs	YK/PV/ GL	15/10	Re-issued
8.13	Science Report	To draft Science Report	MB	30/9	On-going
9.3	Studies	To draft requirements for an assimilation study	PV	31/10	Re-issued
10.6	Cal/Val	To provide detailed feedback to the draft cal/val document which will be distributed by YK	SAG	1/11	Re-issued
11.5	Studies	To send the GOCE ATBD to the SAG	MD	1/4	open
12.5		To refurnish and distribute the minutes of the French user group meeting	HR	1/12	Open – re-issued
13.1	Promotion	To distribute SMOS logo	MR	1/11	
13.2	Campaigns	To draft a list of field experiment requirements to identify the requirements for the radiometer procurement	YK	31/10	
13.3	Retrievals	To keep to SAG informed about the brainstorming meeting with the US scientists	NS	1/1	
13.4	GS develop.	Feedback to Yann on the draft level 1 –2 req. docs	SAG	15/10	
13.5	campaigns	To send SALSA experimenters plan to the SAG	DLV	1/12	

13th SMOS SAG Meeting

1-2 October 2003

ESA-ESTEC, Noordwijk, The Netherlands

Agenda

1. Welcome and Introduction - Objectives of the meeting
2. Approval of draft agenda
3. Actions from the last meeting
4. Project status – PB-EO decision, status of the project, next steps, MDPP, HUT-2D
5. Radiometer procurement – discussion on requirements, next steps
6. OS retrievals – accounting for sea state effects (N. Skou, T. Elfouhaily, E. Dinnat, N. Reul)
7. Level 1/2 requirements
8. Cal/val plan (discussion of the draft, the role of 2D interferometers - presentation by M. Martin-Neira)
9. Studies & campaigns (status of the IR study, coSMOS, coSMOS precursor)
10. AOB (Principles of NIRs (by A. Colliander), IPY (M. Drinkwater), azimuthal signal over land (N. Skou), next WS – Aquarius-SMOS joint WS)
11. Date & Place of next meeting (21 & 22 Jan – 28 & 29 Jan 2004 tbc)

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