

**MINUTES OF**  
**SECOND**  
**SOIL MOISTURE AND OCEAN SALINITY MISSION**  
**SCIENCE ADVISORY GROUP MEETING**

**23<sup>rd</sup>/24<sup>th</sup> May 2000**

**ESA/ESTEC, Noordwijk, THE NETHERLANDS**

Participants: Y. Kerr, J. Font, N. Skou, M. Peichl, P. Ferrazzoli, M. Hallikainen, G. Lagerloef, P. Waldteufel, R. Leitingner, A. Camps

Excused: P. Viterbo

ESA: M. Drinkwater, P. Wursteisen (part time), N. Floury, P. Silvestrin, M. Martin-Neira, H. Rebhan (part time), M. Berger

## **1. Welcome and introduction – Objectives of the meeting**

M. Berger welcomed the SMOS SAG members and their guests to the second meeting.

The SAG members P. Ferrazzoli, M. Hallikainen, G. Lagerloef and the technical advisor of the SMOS SAG P. Waldteufel introduced themselves outlining their field of expertise and their possible contribution to SMOS. M. Drinkwater, the new head of the Ocean Unit of the Earth Science Division at ESTEC introduced himself to the SAG.

The main objectives of the meeting were:

- to review the WISE campaign,
- to discuss Faraday rotation corrections, and
- to review the status of the MRD and the campaign document,

## **2. Approval of draft agenda**

The draft agenda was approved.

It was agreed to discuss the following points under agenda point 9 (AOB):

- dielectric constant – N. Floury
- spatial resolution – P. Waldteufel
- ascending and descending data takes – Y. Kerr
- overview of the US situation – G. Lagerloef
- MIRAS failure assessment – M. Martin-Neira
- uncertainty criteria – P. Waldteufel

## **3. The WISE campaign**

A.Camps from the Polytechnic University of Catalonia (UPC), Spain and WISE prime contractor, outlined the scientific objectives and campaign logistics to the SAG.

Data will be acquired continuously day and night with an increased sequence under certain conditions (e.g. rapid change of foam). It is foreseen to have a team during the entire experiment on the Casablanca tower allowing to immediately react on given situations.

Besides a range of instruments measuring auxiliary data of the sea-state (e.g. stereo imager) the LAURA (L-band AUtomatic Radiometer) will be exploited. LAURA is automatically tilted during a measurement cycle to acquired data with different incident angles. An accuracy of 0.5K is expected.

It was stressed by A. Camps that the UPC developed and built an receiver which will be used for the WISE campaign in case the LICEF receivers are not available in time.

#### **4. TEC measurement and Faraday rotation**

R. Leitinger from the Univ. of Graz, Austria, presented an overview on TEC measurement and Faraday rotation.

The rotation angle of the Faraday rotation is a combination of the Earth's magnetic field and the TEC. Highest Faraday rotation is expected at high solar activities and in lower mid latitudes (towards the peaks of the equatorial anomaly). Since the magnetic field is proportional to  $1/r^3$ , its effect can be ignored above 2000km.

For 2005 (planned SMOS launch) a low solar activity is expected. As rule of the thumb 1/5 of the mean TEC is expected at periods of low solar activities but it was also stressed that a large variability is possible. It was also noted that small scale to medium scale disturbances are likely not to be observed even with dense networks. Scintillations due to plasma instabilities should be negligible for SMOS since these effects normally occur during the first half of the night at equatorial regions. Further, it was stressed that in particular during high solar activities there may be high TEC values even at 18:00 in mid latitude regions. Lowest TEC values are expected at pre-sunrise.

R. Leitinger advised the SAG to use as much measurements as possible (GNSS (GPS) and LEO beacons) and to integrate the measurements into TEC models combined with magnetic field models. He offered to run his models for typical SMOS conditions and to provide the results to the SAG.

N. Skou presented a method to correct Faraday rotation for SSS retrievals directly from dual polarisation data. A tech note outlining the method was circulated during the SAG meeting. In his presentation he stressed that foam was not considered and that the crucial part is the knowledge of the wind condition. Assuming the wind is known the true polarisation ratio could be estimated with good fidelity.

In the course of the discussion it was agreed to follow the subject. N. Flourey will keep in contact with R. Leitinger. He will try to generate a Faraday rotation map for the SMOS conditions and estimate the impact on the brightness temperature fields.

#### **5. Actions from the last meeting**

1.1 all to cross-check email list – [smos\\_sag@jw.estec.esa.nl](mailto:smos_sag@jw.estec.esa.nl)  
closed – N. Flourey and M. Drinkwater were added to the list

1.2 MMN to present MIRAS failure assessment at the next SAG meeting  
closed – covered under AOB

1.3 JF MRD: to provide text on salinity dependency  
closed

1.4 JF MRD: to provide rationale on GODAE requirements  
closed

- 1.5 PS *MRD*: to provide a ‘unified’ figure for the radiometric sensitivity  
**closed**
- 1.6 PV *MRD*: to provide text for the coupled ocean-atmosphere models  
**open**
- 1.7 YK *MRD*: to include rationale such as T equilibrium for better justification  
**closed**
- 1.8 PV *MRD*: to provide text on forecast  
**open**
- 1.9 MB/NF to invite expert to the SAG to report on TEC  
**closed**
- 1.10 MB/YK *MRD*: to compile list of acronyms  
**closed**
- 1.11 YK to draft a definition of SMOS spatial resolution for further iteration with the SAG  
**closed – covered under AOB**
- 1.12 YK *MRD*: to re-write 4.3 – inputs from MH?  
**closed – proposed by Y. Kerr for further iteration with M. Hallikainen and M. Drinkwater**
- 1.13 MB/YK *MRD*: summary of all boxes/ table of requirements after each chapter and executive summary  
**closed**
- 1.14 YK/NS *campaign document*: to include technical details of the instruments – one page each  
**closed – it was agreed to use M. Hallikainen’s table**
- 1.15 YK/JF *campaign document*: to include site description (photos)  
**closed**
- 1.16 MB *campaign document*: to compile a list of abbreviations  
**closed**
- 1.17 NS *campaign document*: to keep master copy of campaign document  
**on-going**
- 1.18 all *campaign document*: to send comments/inputs to NS  
**on-going**
- 1.19 NS *campaign document*: to clarify what is meant by amplitude value (wind direction)  
**closed**

- 1.20 JF *campaign document*: to re-phrase sentence p. 3 2.13 2<sup>nd</sup> para.  
**closed**
- 1.21 YK *campaign document*: to smooth crane requirement in chapter 4  
**closed**
- 1.22 PW to provide the technical note on radome signal loss to MB for circulation within the SAG  
**closed**
- 1.23 YK to circulate a draft list of open questions which needs to be addressed/supported by studies/campaigns  
**closed**
- 1.24 JF to provide YK with the documents which already exists  
**closed**
- 1.25 NF dielectric constant accuracy – to check model and provide feedback to the SAG  
**closed – covered under AOB**
- 1.26 all to provide planned ‘promotion activities’ to MB  
**on-going – it was agreed that articles (preferably in electronic format) should be provided to M. Berger for archiving. Further, it was agreed that Y. Kerr and J. Font bring their SMOS posters to the next SAG meeting**
- 1.27 MB to generate/update the list of planned SMOS promotion activities  
**on-going**

## **6. Status of the project and next steps**

P. Silvestrin provided an overview of the status of the project.

The RFQ for the SMOS extended Phase A was issued and the proposal from the industrial consortium led by CASA (E) is due June 9. Kick-off is expected by end of June.

Further, the RFQ for the SMOS simulator was issued focussing on simulation aspects which are of direct interests for Phase A (MIRAS and system modelling, calibration, retrieval of TB and preliminary simulations such as ‘from SM/SSS to TB’ and ‘from SMOS data to SM/SSS’ considering on-going scientific studies). The proposal from a consortium formed by CASA is due June 16<sup>th</sup>.

The system support study by CNES is currently being discussed and the RFQ is not yet issued.

P. Silvestrin emphasised that there are further funds available for scientific support studies which will be unblocked after the evaluation of the SM study.

In addition to this M. Martin-Neira briefed the SAG on the MIRAS Demonstrator Pilot Project (MDPP) Mid Term Review which took place May 11<sup>th</sup> and 12<sup>th</sup> in Antwerpen (B).

He pointed out that the design phase is already finished. Concerning the manufacturing phase all is up to schedule. The antenna pattern should be available by August.

In the discussion M. Peichl noted that there might be an influence of the antenna to each other. M. Martin-Neira noted that according to simulations the influence is negligible.

In addition to this, M. Martin-Neira outlined planned activities for the future (Pilot Project-II) which includes testing of the deployment of the full antenna arm, characterisation of the arm under load, and new receivers. These activities are planned to start in SMOS Phase B (2002) and are funded by the GSTP-3 programme.

### **7. Status of the MRD and campaign document**

The status of the current version of the MRD (version 4) and the campaign document were discussed. A range of actions were defined which are attached to the minutes. N. Skou and M. Berger agreed to circulate the updates to the SAG reflecting the discussions for further reviewing.

### **8. Support studies and campaigns**

H. Rebhan provided an overview of the status of the salinity study. A consortium of several research institutions all over Europe, led by the Nansen Environment and Remote Sensing Center, NERSC (N) was selected. The study kick-off was May 5<sup>th</sup>. The first progress meeting is planned for September 26<sup>th</sup>. It is envisaged to make use of the data acquired during the WISE campaign.

M. Berger informed the SAG that the closing date for soil moisture ITT was extended until May 15<sup>th</sup>. Proposals received in response to the ITT are currently being evaluated.

The list of scientific questions which needs to be addressed by studies and/or campaigns was introduced by Y. Kerr and J. Font. In the course of the discussion a range of actions were identified which are listed at the end of the minutes.

It was agreed to group the SSS questions into three topics namely; questions related to the performance of the instrument, questions related to research and questions related to retrievals. J. Font agreed to circulate a first draft for further discussions.

Y. Kerr proposed to further discuss priorities for studies addressing the SM questions after 'kick-off' of the soil moisture study.

N. Skou informed the SAG about the L-band Ocean Salinity Airborne Campaign (LOSAC) which will exploit the L-band TUD radiometer on a Herkules C130. The primary objective of this campaign is to assess azimuthal dependency of L-band brightness temperature under different wind conditions. A test site in the middle of the North Sea was selected. LOSAC is planned for spring and autumn 2001. He emphasised that the instrument will also be

exploited on a crane at Avignon for 3 weeks this winter for cal/val purposes, and 3 months in spring 2001 for a campaign over crops and bare soils in Avignon (crane). Further, it is planned to turn on the instrument over land on transfer flights. Data will be made available to the SAG.

## 9. AOB

A total of six topics were covered under AOB.

### *Dielectric constant:*

N. Flourey reported that basically two models, one introduced by Klein & Swift the other by Ellison can be found in the literature. The difference of the two models is a bias, which can be levelled out by means of calibration. In the discussion it was stated that there is no reasoning to select one or the other model. It was proposed by Y. Kerr to stick to the Klein & Swift model since it is published and operational at L-band.

### *Spatial Resolution:*

P. Waldteufel outlined the problem of defining one figure for the spatial resolution of the instrument since its footprint is a pattern of ellipses with different elongation ratios. In the discussion it was stressed by Y. Kerr that a precise definition is required for industry since different definitions may have different implications on the orbit and revisit time. For users the footprint pattern should be made available. Y. Kerr agreed to draft a definition for further iteration.

### *Ascending/descending data takes:*

Y. Kerr explained the rationale of using only one path for determining the revisit time. The morning (6:00) orbit path, independent of ascending or descending, is considered the ideal path for data takes because of minimum Faraday effect, temperature equilibrium and soil moisture equilibrium.

### *US situation:*

G. Lagerloef reported on on-going activities in the US. The next ESSP AO has been delayed and is expected to be released early next year. It is foreseen to propose a salinity mission. A science team led by J. Koblinsky from GSFC as the PI and G. Lagerloef as the Science Team Leader was formed to prepare the proposal. A combination of a passive microwave radiometer and an active SAR acquiring polarimetric data with a spatial resolution of 100km is being discussed. Methods to correct rainfall and to avoid sun glint is foreseen. As a possible platform the Japanese GCOM-2b mission, planned for launch in the timeframe 2008-2010, is considered.

Further, G. Lagerloef expressed the strong interests of the US scientist in the SMOS mission. He stimulated to establish a stronger collaboration by e.g. by including European scientists in the NASA team, to organise joint campaigns and to co-ordinate scientific pre-launch studies. This was highly endorsed by the SAG. In conclusion, the SAG recommended to establish a closer collaboration with the US scientist for the SMOS mission (**R2.1**).

M. Berger corrected a statement made in the minutes of the first SMOS SAG meeting concerning a MoU which is being drafted by an US-ESA working group for collaboration. It was stressed by him that it is not a MoU but a report of recommendation. The draft currently is being finalised for approval by the DGs.

*MIRAS failure assessment:*

M. Martin-Neira reported on the failure assessment of MIRAS-I. In both flights problems with the hardware were encountered. In order to verify the image capability of the instrument, it was later used on a crane in Avignon. Strong contrasts in moisture content (e.g. swimming pool – soil) could be identified but no details. The problem could be due to the antenna coupling and/or the signal response of the single receivers (different frequency responses). He also noted that no funds were available to analyse the failure in detail.

*Uncertainty criteria:*

P. Waldteufel initiated some thought on requirements as stated in the MRD , e.g. soil moisture accuracy of 0.04. The question is for which conditions these requirements apply. Is it the mean accuracy over the FOV? Does it also apply to rugged terrain partly covered by forest? In the discussion it was agreed that the SAG should think about it and to discuss it in a more clean way at a later stage.

**10. Summary and conclusions**

Y. Kerr summarised the main achievements of the meeting which was considered worthwhile attending. Methods to correct Faraday rotation, one of the main objectives of the meeting, will be followed by several identified action.

M. Berger thanked the SAG members for the fruitful discussions. In particular he expressed the gratitude of the SAG and ESA to their guests, A. Camps and R. Leitinger, for their excellent presentations simulating useful discussions and providing guidance for further activities.

**11. Date and Place of the 3<sup>rd</sup>. SMOS SAG meeting:**

Considering that many international conferences are scheduled for July it was agreed to plan the next meeting beginning of September but to complete the actions before the summer vacations (see ‘due time’ in list of actions). 11<sup>th</sup>. and 12<sup>th</sup>. of September were identified as suitable dates.

**List of SAG Recommendations:**

**R2.1:** *The SAG strongly recommends establishing a close collaboration with US scientists.*

**List of Actions:**

No.	Category	Subject	to	due	Status
1.6	MRD	To provide text for the coupled ocean-atmosphere models	PV	1/8	
1.8	MRD	To provide text on forecast	PV	1/8	
1.17	Camp. Doc	To keep master copy	NS		On-going
1.18	Camp. Doc	To send inputs/comment to NS	all	15/6	On-going



1.26	Promotion	To provide planned promotion activities to MB	all	15/6	On-going
1.27	Promotion	To generate/update list of planned promotion activities	MB	15/8	On-going
2.1	Faraday	To circulate VGs and model results from R. Leitinger	MB	1/8	
2.2	Promotions	To provide VGs with SMOS standard figures	YK	15/7	
2.3	Promotion	To bring SMOS posters to next SAG meeting	YK/JF	11/9	
2.4	Promotion	To provide publications to MB for archiving	all	15/6	
2.5	Faraday	To provide an update of the Faraday correction	NS	1/8	
2.6	Faraday	To try to generate Faraday rotation map for the SMOS case	NF	11/9	
2.7	Faraday	To assess the impact of Faraday case on $T_B$	NF	1/8	
2.8	MRD	To draft sentence on challenges requirements for SSS	GL	15/8	
2.9	MRD	To spell out acronyms in the executive summary	MB	11/9	
2.10	MRD	To include sentence for the timeliness of auxiliary data	JF	15/8	
2.11	MRD	To draft a list of definitions	YK	15/8	
2.11	MRD	To circulate MRD update for further reviewing	MB	1/9	
2.12	Camp. Doc	To provide comments to NS	MH/PF	8/6	
2.13	Camp. Doc	To circulated updated version for further reviewing	NS	15/6	
2.14	Instrument	To provide drift requirements as given to industry	PS	1/8	
2.15	Instrument	To draft requirements for short term stability	PW	15/8	
2.16	Studies	To inform SAG of planned US campaign over Greenland	GL	15/6	
2.17	Studies	To re-phrase topic: study of decorrelation	GL/JF	15/8	
2.18	Studies	To group identified questions into topics	JF	1/8	
2.19	Studies	To provide comments on the 'land' list	MH/PF	15/6	
2.20	Studies	To circulate scheduled of planned campaigns	NS	15/6	
2.21	Instrument	To provide a further tech note outlining the spatial resolution showing plots with different configurations	PW	1/9	
2.22	Collaboration	To follow recommendation 2.1	MB/GL		
2.23	Cal/Val	To provide details on Antarctic ice sheet calibration	YK/MD /MH	1/9	