

Summary of third meeting of ISSI team 18 May 2021

Attendees: S. English, J. Boutin, L. Kilic, M. Anguelova, M. Matricardi, M. Kazumori, M. Bettenhausen, S. Newman, A. Stoffelen, B. Johnson, C. Prigent, E. Dinnat, T. Meissner, F. Weng, Lingli He, S. Abdalla.

1. Introduction

Participants were welcomed. As with the third meeting this virtual ISSI team meeting was opened to additional remote participations, and Saleh Abdalla and Lingli He joined as guests. Apologies were received from Christophe Accadia and Nick Nalli. The agenda was agreed.

2. Review Actions from Meetings-1 (20-22 November), 2 (30 April), 3 (7-8 December).

*Red = open, Green = Closed.

Action1_1: All scientific papers to be shared amongst the group, as some are more difficult to obtain. These can be linked to from the ISSI web page.

Status: A number of useful publications have been circulated in the team, it would be useful to accumulate a list on the webpage. A page has been created for this:

<https://www.issibern.ch/teams/oceansurfemiss/index.php/useful-references/>

Action 3_1: All to send an email to Emmanuel to get access to the code.

Status: Done.

Action 3_2: Emmanuel will make available a short user guide for the code.

Status Done. New **Action 4_1:** All Team members to check and provide feedback to Emmanuel. The scientific documentation will be addressed through publications.

Action 3_3: All to suggest suitable name for the model, that captures Emmanuel's massive contribution, the ISSI role and its LOCEAN beginnings.

Status: Done. Name PARMIO tentatively selected, though its weakness is it does not reflect well that its mainly Emmanuel's code and based on the LOCEAN model.

Action 3_4: Steve to identify a contact to discuss about wave models and active / passive remote sensing. [Post meeting note: Saleh Abdalla is testing the model in active mode at ECMWF].

Status: Done. Saleh Abdalla will test the model in active mode at ECMWF alongside other new operator work.

Action 3_5: Jacqueline and Thomas decided they will test the S&T model at higher frequencies and will report to the group.

Status: Done – presentations at this meeting. Conclusion: S&T not recommended for higher frequencies.

Action 3_6: Emmanuel to check if it is the very last version.

Status: Done – latest version confirmed.

Action 3_7: Maggie to provide numbers for the different parameters in the emissivity model.

Status: Done – numbers provided.

Action 3_8: Maggie to generate fortran-90 code for the close form and for the general one of the foam emissivity model, provide code to Github and team members.

Status: F90 code for closed form foam emissivity is ready. I few more checks and will start work with Emmanuel guidance to put it on GitHub. For the general form: F90 code is still work in progress.

Action 3_9: Emmanuel and Lise to compare results and identify causes of differences

Status: Differences were found between code version differences. This has now been resolved.

Action 3_10: Thomas to circulate Meissner and Wentz wind direction signal paper citation, to ISSI team members.

Status : Done http://images.remss.com/papers/rsspubs/Meissner_TGRS_2002_wdir_signal.pdf.

Action 3_11: The wind direction sensitivity in the reference model to be tested and compared to the RSS model.

Status: On-going. Initial evaluation of wind direction sensitivity undertaken, but more needed. Lise, Emmanuel and Thomas to follow up.

Action 3_12: More discussions needed about the reflection / scattering of the atmosphere.

Emmanuel + Thomas + Lise + Catherine + Steve

Status: On going, to be discussed in smaller meeting. Steve to provide more info and then organize a meeting. Ben Johnson added to discussion group.

Action 3_13: Similar to Action 3_4 above, Ad to test radar simulation mode and to discuss with team about radar issues.

Status: Closed. At present Ad noted he has no resources to contribute to these comparisons in his team, but he will continue to actively support the team providing advice on ocean microwave modelling (especially for active sensors).

Action 3_14: A two-step comparison for the S&T model is proposed. Comparison between models first (Jacqueline, Thomas and Emmanuel). Then if OK, we can compare simulations with observations (Lise and Catherine).

Status: Done, see presentations at this meeting.

Action 3_15: ISSI members to view operational monitoring sites and consider how this can be used to better understand differences between more detailed studies.

Status: Close: action was to ensure team members aware of the capability of operational monitoring and to use it as part of the validation and evaluation process, and little to be gained from leaving action open.

Action 3_16: Stu to circulate citation for Rowe (2020) paper to ISSI team.

Action 3_17: Develop and test a unified dielectric model from MW to IR for pure water. Stuart and Nick, with support from ISSI team.

Status: On-going. Begun, see slides from Stu at this meeting, but more work needed.

Action 3_18: Emmanuel, Stuart, Lise and others interested to discuss optimal IR setup for two scale model

Status: On-going. Begun, see slides from Stu at this meeting, but more work needed.

Action 3_19: Wave spectra sensitivity needs to be tested further. Stuart, Nick and others if interested.

Status: On-going. Begun, see slides from Stu at this meeting, but more work needed.

Action 3_20: Undertake a literature review and further test of sensitivity to different foam formulations. Stuart, Nick and others.

Status: On-going. Begun, see slides from Stu at this meeting, but more work needed.

Action 3_21: Catherine and Lise to coordinate small groups to carry forward Actions from this meeting.

Status: Done, new groups proposed for continuing actions.

Action 3_22: All to confirm if 13-14 April 2021 is still OK, or we should re-open to find optimal date.

Status: Done.

Action 3_23: Steve to setup doodle poll to find autumn 2021 date and confirm with ISSI for physical meeting.

Status: Done.

3. Summary of progress since 3rd meeting

3.1. [Dielectric Model](#) (lead: Thomas Meissner)

Thomas gave a broad overview comparing dielectric models from L to G bands. This showed in general Fastem5 and M&W are consistent with each other, and the other models tested by Thomas are in further disagreement, except at L-Band. The exception is salinity dependence at L-band, where the Fastem results diverge and are considered unreliable. Thomas took the departures of M&W from a model considered to be reliable for each band as a proxy for error, and showed typical random and systematic errors are of order 0.1 K at L-band and 0.4K at

Ku/W band. It was noted though that at cold SST and high windspeed the error will be larger, so there is a case to present uncertainty as a function of geophysical variable. Jacqueline presented her latest assessment at L-band: over the SSS, SST range observed over open ocean, BV2020 and GW 2020 are the closest to each other, the largest uncertainty remains at low SST (<~5°C).

3.2. Foam models (lead: Maggie Anguelova)

Maggie presented a discussion of the foam model. She presented the recommended setup for the foam model, based on latest results. New parameters are provided for the foam emissivity, as a function of frequency. Furthermore, it has previously been noted that the foam fraction equation, $W(U)=aU^b$ should be cubic, because this is a strong constraint from the physics of breaking waves. However Maggie noted that the drag coefficient itself is a function of sea state, so this can add an additional complexity to the windspeed dependence. With the new proposed parameters, Maggie showed that the overestimation of T_b at high wind speed for frequencies above 6GHz that were pointed out by Kilic et al. is reduced; she did not test yet the impact at L-band.

Ad noted that density is important in calculations for scatterometer which is arising from the same physics as the stability sensitivity in the passive calculations, and should be compared.

3.3. Code status (Lead : Emmanuel Dinnat)

Having provided the code system and maintaining it on Github there is nothing specific to report, but as noted earlier feedback from users on all aspects (science, documentation, ease of use) is much appreciated, and more feedback is welcome.

3.4. Validation passive (Lead : Lise Kilic)

Lise gave an update on her validation work with ATMS. The ATMS results appear broadly consistent with earlier findings, though Lise noted that to compare directly the ATMS data should be restricted to the edge of the swath where the earth incidence angle is similar to GMI and AMSR-2.

3.5. Validation – active (Lead Lise Kilic and Ad Stoffelen)

Lise showed results that had previously been circulated comparing calculations for active sensors with calculations by CMOD. Ad then placed this in the context of earlier work by Franco Fois. It was noted that the Kudryavstev formulation gave poor results for the active sensors, but the Dursden-Vesecky form provided very encouraging initial results, broadly in line with Fois' findings and showing that the model was performing well for active sensors.

However there remain differences which are large compared to the accuracy requirement (~0.1 dB) and there was a discussion where to look for most likely gains in accuracy. It was noted that the 0.1 dB accuracy implies somewhat varying geophysical errors, depending in particular on wind vector sensitivity to the NRCS.. Several elements were noted including up/downwind sensitivity, more realistic representation of breaking waves and airborne hydrometeors (with a radiative impact not unlike heavy rain). It was also noted that there is uncertainty over what can be considered to be « truth » as ocean buoy winds and lowest altitude dropsonde winds have systematic differences that remain unexplained.

3.6. IR emissivity models (Lead : Stu Newman)

In the 3rd meeting several aspects of the model for IR were noted as meriting development and evaluation. Stu gave an update on the Foam aspect. He noted that the sensitivity to Foam is weak and only an issue for large incidence angle, > 60-70 degrees, for which the emissivity of the foam free ocean becomes significantly lower than the emissivity of the foam covered ocean). Maximum impacts ~ 0.3K. Foam is therefore not an issue for LEO sounders, with maximum EIAs of 60 degrees, but for GEO higher EIA data is used. For example at ECMWF the maximum EIA for SEVIRI ASR and AHI CSR assimilation is 74 degrees. Therefore whilst it is not a major issue, there is value in ensuring a reasonable foam representation is used for the higher latitude GEO data

4. Plan for the future

The meeting identified some issues to be taken forward by smaller sub-groups (see Actions 4_x and 4_x). It was also noted there would be a detailed presentation on the developments in CMA and how these can support the PARMIO model.

It was noted the next (and final) planned meeting is 7-8 December 2021, at ISSI HQ in Berne. It was proposed for now to continue to plan this as a hybrid meeting (by hybrid meaning those able to will meet physically, but others will participate remotely). It was discussed if an earlier virtual meeting is needed, but noting the work going forward in sub-groups, it was felt this probably is not needed, but results can be shared by email. If no physical meeting is possible, Steve to explore with ISSI if we can still meet in 2022.

It was asked what happens after ISSI. The view was that the collaboration can continue under the ISSI umbrella or otherwise. It could well be that ISSI would accept a follow-on proposal, but the collaboration no longer needs this to facilitate it, so the consensus was to continue, but as an independent and informal team. It would also be ideal to lobby for additional funding to support future development and maintenance in all areas.

It is suggested that Steve and Catherine should prepare a list of the key objectives to be met by the end of the ISSI project (Action 4_5).

Open actions

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Action 3_13: Ad: To test radar simulation mode and to discuss with team about radar issues. [*Note: and to compare to Lise's results and work at ECMWF*]

Action 3_17: Stu: Develop and test a unified dielectric model from MW to IR for pure water. Stuart and Nick, with support from ISSI team.

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Action 3_20: Stuart, Nick + others: Undertake a literature review and further test of sensitivity to different foam formulations.

Action 4_1: All: Team members to check code access, documentation, ease of use and provide feedback to Emmanuel. The scientific documentation will be addressed through publications.

Action 4_2 Steve: Share information on requirements of atmospheric multi-stream RTMs for surface emission and reflectance

Action 4_3 Steve: Arrange sub-group discussions about the reflection / scattering of the atmosphere. Emmanuel + Thomas + Lise + Catherine + Steve + Ben (modified from old action 3_12).

Action 4_4 Thomas, Jacqueline, Maggie, Lise, Ad, Stu: To provide slide sets from 3rd meeting that can be uploaded to ISSI website to Steve by end of May 2021.

Action 4_5 Steve + Catherine: Summary of the objectives to be met before the end of the ISSI program.