

Future work and cooperation in GSICS for Microwave Lunar Calibration

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During the GSICS Lunar Calibration working Group meeting on Nov 18, four topics about lunar microwave calibration were presented by scientists from EUMETSAT, University of Hamburg and University of Maryland. The topics cover the following study works currently in progress:

1. Lunar contamination correction method for microwave imager and sounding instruments, as presented by Francesco De Angelis from EUMETSAT.
2. Channel co-registration, pointing error identification, and antenna beam width characterization, as presented by Roberto Bonsignori and Martin Burgdorf.
3. Lunar disk-averaged microwave brightness temperature spectrum from satellite observations and model simulations, as presented by Martin Burgdorf and Tiger Yang.

These topics reflect the most recent progress for lunar microwave calibration in GSICS community. According to the reported research results and the related publications, it is confident to say that some of the research work are pretty mutual and the methods can be recommended to the GSICS community, such as antenna characterization and pointing error identification by using lunar observations from instrument space view. While some work has made encouraging progress, there is still challenging work to be done. Based on the above understanding, we recommend the following future works and cooperation in lunar microwave calibration for GSICS community:

1. A recommendation letter from GSICS group to different satellite agencies to put lunar observation related parameters in L1 data products for current and future microwave imager and sounding instruments. These include lunar elevation/azimuth angle, Moon phase angle, Sun-moon distance, lunar contamination flag etc. A consistent definition for these parameters is needed to be provided for different satellite agencies.
2. Encourage scientists in GSICS microwave group to use lunar observations to investigate the channel co-registration, antenna beam pointing error, as well as the antenna beam size characteristics for different instruments, such as MWTS and MWHS, MWRI from CMA, AMSR-2/3 from JMA, Metop AMSU/MHS from EUMETSAT, and SNPP/NOAA-20 ATMS from NOAA. The method in Roberto's and Martin's publications can be taken as reference

(Roberto Bonsignori, 2018, Martin Burgdorf et al., 2018). Request results from ground tests of these satellites, similar to what EUMETSAT supplied for MHS on Metop.

(https://www-cdn.eumetsat.int/files/2020-05/pdf_mhs_char_data_des.pdf)

The comparison with the performance in flight will be an important check of the trustworthiness of ground tests.

3. In the meeting, Francesco reported on the use of the lunar intrusion correction algorithm for future EUMETSAT EPS-SG microwave imagers (Francesco De Angelis, “Future EUMETSAT Microwave Missions and Plans for Making Use of Lunar Observations”). We encourage GSICS scientists to review and report their lunar intrusion identification and correction method to GSICS community. This will help a consistent lunar intrusion algorithm being used across different satellite agencies. The publications by Tsan Mo and Hu Yang can be taken as reference for this work (Tsan Mo et al., 2007; Hu Yang et al., 2016,2018)
4. A comprehensive microwave lunar model is not only important for future lunar microwave calibration, but also is necessary for improvement of current lunar Tb model in LI correction algorithm. In the meeting Martin and Tiger Yang reported lunar disk-averaged Tb spectrum from AMSU and ATMS (Martin Burgdorf et al., 2019; Hu Yang et al., 2020). We noticed that in previous GSICS-lunar working group meeting (Xi’An, China, 2018), Scientist from CMA reported lunar observations from China Chang’e microwave sensor. Since the lunar orbit microwave satellite observation is important for lunar model development, we hope that CMA can share the Chang’e data to GSICS community. The progress of TB model development will also be reported to the GSICS community in next workshop meeting.
5. The exchange of information with colleagues working on lunar calibration of instruments operating in the thermal infrared should be continued. This is particularly relevant for future missions in the far infrared like FORUM.

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