



WGCV Microwave Sensors Subgroup

June 2004 Report

Last Meetings of the Subgroup

The 8th Specialist Meeting on Microwave Radiometry and Remote Sensing Applications (MicroRad-2004), hosted and organized by the Department of Electronic Engineering of the University La Sapienza of Rome, Italy, took place from February 24 to 27, 2004. During this conference, a group of experts on aperture synthesis radiometry met together to address some detailed issues of in-orbit calibration, called in by the CEOS WGCV Microwave Sensors Subgroup (MWS) chairman.

The previous meeting of the subgroup happened during last IGARSS 2003 conference held in Toulouse, last 21-25 July. The main subject of this meeting was Chapter 3 of the document on terminology, which deals with Polarimetric Radiometers. The Chapter is now ready.

The previous meeting of the subgroup had happened during the 2nd International Microwave Radiometer Calibration Workshop (μ Cal-2002) and CEOS WGCV Meeting in Barcelona, during last October 9-11, 2002. The main objective of this MWS meeting was the preparation of the document on "Frequently Used Terms in Microwave Radiometry", as well as the discussion on two recommendations to the CEOS plenary (see below).

Progress since Last Meeting

As an outcome of the meeting during IGARSS 2003, Chapters 1 through 3 of the document on terminology (general, real aperture and polarimetric radiometry) are now "accepted definitions" by the experts and are considered at this stage finished.

Chapter 4 on interferometric radiometers is in progress, following mostly the developments of ESA's approved SMOS mission Phase C/D.

One of the main progress steps from last meeting has been the outcome of the Rome experts meeting mentioned above, where the most disturbing error sources in interferometric radiometers (the ECCOS) was better understood and techniques for calibrating it out demonstrated. More details follow in the Technical News section below.

During μ Cal-2002, the MWS prepared two recommendations that were presented at the WGCV-20 meeting in Hobart (Australia). These were:

Recommendation 1: The Microwave Sensors Subgroup of the CEOS Calibration and Validation Working Group recommends that all future missions carrying a microwave radiometer are designed to allow the view of the cold sky of its primary reflector at least twice in the whole mission taking into account its value against its

cost. A survey of ground sites where the sky is observed at different microwave frequencies of interest in Earth remote sensing should be done (useful at lower frequencies).

Recommendation 2: *The Microwave Sensors Subgroup of the CEOS Calibration and Validation Working Group recommends that an analysis of available microwave radiometer records over different potential cal / val areas of the World is performed, in particular Dome-C in Antarctica (for radiometers in its view), deserts, tropical rain forest and the oceans. Presently flying radiometers should continue gathering data on these areas of interest to continue the research on their suitability as cal/val sites for long-term applications. Study on stable areas on the Earth surface suitable for radiometer inter-calibration purposes should be pursued.*

WGCV-20 considered that the wording of both recommendations had to be amended to include the cost and risk impact to the missions, and to clarify the driving reason for each of them.

To date, these recommendations have not been discussed further within MWS, and so there is no further progress into their amendment. This subject will be included in the agenda of next MWS meeting.

Finally, study work on using Dome-C in Antarctica as a calibration target for external calibration of SMOS as well as other radiometer mission on polar orbit is in progress, both in ESA and NASA. Contact point on this issue is Marc Drinkwater (ESTEC-ESA).

Next Meeting

Next meeting of the MWS group is right now undefined. It will have to take place in conjunction with some other major conference/meeting on microwave radiometry.

Main subjects will be the rewording of the above recommendations and the presentation of the draft Chapter 4 on interferometric radiometers of the document of terminology.

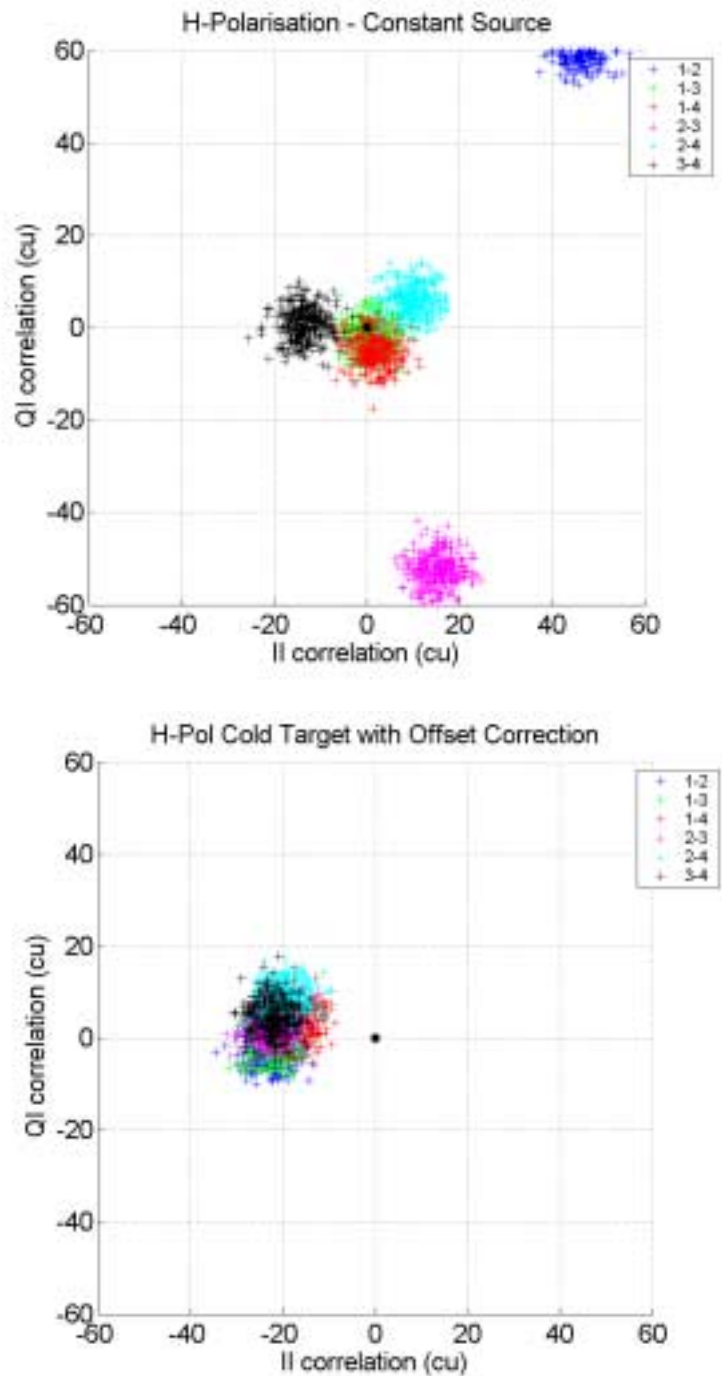
Technical News:

Advance in the Calibration of Interferometric Radiometers

The Technical University of Helsinki (HUT) has successfully demonstrated the cause for the Empty Chamber Correlation Offsets (ECCOS) observed in aperture synthesis radiometry tests. They presented the result at the meeting on aperture synthesis experts in Rome, during MicroRad 2004.

The ECCOS have been traced back to being originated from backward noise coming out of the receiving elements of the interferometer, which couples to neighbour elements, producing unwanted correlation offsets. HUT demonstrated the stability of the ECCOS with respect to temperature as well a

procedure to calibrate them out by using an ambient temperature load in front of the shortest interferometer baselines. The image below shows the 4-element interferometric signature of a liquid nitrogen point target inside an EMC chamber at room temperature before and after ECCOS correction.



Top: Typical correlations of a 4-element interferometer in an EMC chamber, where ECCOS correlation biases are present.

Bottom: Correlations of a point cold target after ECCOS correction; as predicted the correlations lie on the negative axis, and symmetrical to it.

1 c.u. = 10^{-4} (or 0.05 K for $T_{\text{sys}}=500$ K)

(Helsinki University of Technology Courtesy)