

# FIRST RESULTS FROM TAKLAMAGAN DESERT CAMPAIGN FOR SMOS CAL/VAL

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SMOS is a satellite dedicated to measuring soil moisture(SM) and sea surface salinity (SSS) continuously at a resolution around 50km from space for the first time in the history. It is also the first spaceborne mission that carries a synthetic aperture radiometer at L band. CAL/VAL is a big challenge to this kind of mission considering its frequency, resolution scale and imaging characteristics.

Taklamagan desert has been selected as a key site for SMOS CAL/VAL purpose. The original idea is proposed by the author as a response to ESA SMOS AO-1 (Announcement of opportunity, 2005). Then after simulation, discussion, historical data review, field experiment and site visiting, high confidence has been set up to take this place as a potential site that can monitor SMOS' behavior, i.e., its accuracy, stability and sensitivity etc. The rationales behind it are area, homogeneity, radiometric stability and easy to access of the site. Taklamagan desert is the 2nd largest desert in the world. It covers an area almost 1000 km length and 600 km width. This makes it rather useful since SMOS has a comparative scale of snapshot. 85% of the land surface is covered with sand dunes. Other places are mixed with sand and shrubs, mainly distributed in the brim of the desert. Dielectric behavior benefit from its extremely arid climate: annual precipitation is only 25~45mm and concentrated on May-Aug according to statistics of historical meteorology record. Most of the precipitation is tiny rain (0.0~2.0mm) while annual evaporation is about 2100~3400mm. Low frequency (6-37GHz) microwave brightness temperature from center of the Taklamagan desert shows a triangle function relationship with time as an overall trend while fluctuates to some significant extent at the day-to-day temporal scale. A high level road had been built across the sand desert by the government which makes it possible to accommodate a relatively intensive campaign to

investigate the place in detail.

A pathfinder or pioneer field experiment at the site has already been conducted during July to August of 2007. The experiment has measured soil temperature profile and soil moisture profile successfully with specially designed tools. It confirms soil water content is rather low around the site. It also shows clearly some uncertainties need to be clarified by a more labored and intensive campaign.

The Taklamagan desert campaign for SMOS CAL/VAL will focus on the ultimate purpose, i.e., L band emission at different temporal and spatial scales which will be used to derive a method to help the SMOS community to evaluate or monitor performance of the instrument. According to current understanding, microwave emission at L band generated in the desert soil can propagate to a shallow surface layer depending on soil moisture distribution or dielectric behavior in the vertical direction. Inherited from the pathfinder field experiment, some necessary geophysical parameters such as soil moisture and soil temperature profile will be investigated with a clearer objective. Energy cycle or land surface interaction at this place is particularly interesting for the sake of instrument or payload interpretation.

One highlight of the campaign will be output from the specially designed L band radiometer which is scheduled to be operated at the site. The radiometer uses potter horn antenna, direct detection receiver with internal self-calibration. The following specification is required:

Central Freq: 1.4135 GHz

3db Bandwidth: 19 MHz

HPBW:  $\sim 15^\circ$

NeDT:  $< 0.6$  K

Radiometric Accuracy:  $< 2$ K

As SMOS has just been launched and internal adjustment is ongoing at the moment, it is highly expected that Taklamagan desert campaign can be helpful to this innovative mission.

Weiguo Zhang has gained his PhD degree majored on passive microwave remote sensing from Institute of Remote Sensing Applications, Chinese Academy of Sciences in 2004. Since then he worked as an assistant researcher and then associate professor in Center for Space Sciences and Applications Research, Chinese Academy of Sciences. Dr. Zhang's major interesting includes microwave sensor's CAL/VAL, typical and global applications. He is now PI of the SMOS AO-1 "Vicarious calibration of SMOS over Taklamagan desert".