

## CALIBRATION AND VALIDATION OF MICROWAVE REMOTE SENSING DATA FOR WATER CYCLE RESEARCH

<b><i>European Leader Investigator</i></b> Prof. Yann Kerr Center for Spatial and Biosphere of CNES, FRANCE	<b><i>Chinese Leader Investigator</i></b> Dr. Weiguo Zhang National Space Science Center, Chinese Academy of Sciences, CHINA
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### List of Principal Investigators (PIs)

Topic Nr.	PIs	Title
32397_1	Prof. Yann Kerr, Prof. Weiguo Zhang	<b><i>Calibration and validation of microwave remote sensing data for water cycle research</i></b>
32397_2	Prof. Alain Geiger, Dr. Dongkai Yang	<b><i>Calibration and validation of GNSS Remote sensing data for soil moisture and snow water</i></b>

### EXECUTIVE SUMMARY

Multiple global water cycle data products based on microwave data are available and explored by a growing community. However, very significant discrepancies among these different products have been reported. These differences may be attributed to the sensor calibration, algorithm performance, and spatial issues. The temporal-spatial resolution and accuracy of different data products from different sensors, including the ESA Soil Moisture Ocean Salinity (SMOS) and the NASA Soil Moisture Active Passive (SMAP), needs to be inter-compared, and refined for a wider global water cycle application. This project is dedicated to calibrate/validate the current remote sensing products related to water cycle studies including soil moisture, landscape freeze/thaw, snow extent and water equivalent, water vapor, sea ice freeboard height, inland water variation and precipitation etc., and hence to improve the accuracy and temporal-spatial resolution of these products through the synergy use of multi-sources satellite observations from European and Chinese Earth observation data. It is aimed to enhance the application of these satellite products in floods and droughts monitoring, soil erosion assessment, weather or climate forecasting and water resources management. This work is an effort following and expansion of Dragon 2&3 project SMOS calibration and validation over China. The team will face with future space mission challenge and requirements and take advantage of current conditions to consolidate our understanding and cooperation in water cycle measurements. This work is under the funding grant of 973 project Satellite observation and simulation study of the energy and water exchange processes at the global land surface and its impacts on global changes from 2015 to 2019. In addition, the systematic observation of the global water cycle for better understanding of global water cycle changes is supported by a Chinese satellite mission under the Strategic Priority Program on Space Science A feasibility study for the Water Cycle Observation Mission (WCOM), which is designed to launch before 2020. Every year: the capital construction fund of NMC/CMA for supporting the routine work of operational agrometeorological service and research on agrometeorological conditions and disasters assessment, the making and distribution of bulletin of the crop and weather. 2013--2018, the National Basic Research Program of China (2013CB430205), The impact assessment of drought and flood in the background of climate warming, took on the agricultural drought area distinguishing using the satellite data and have established the method of extracting the drought information from the NOAA/AVHRR. Professor Yaqiu Jin (CAS academician, IEEE fellow) and professor Jianchen Shi (IEEE fellow) are advisors of the project for the Chinese side.

<b>ABSTRACT 32397_1: “Calibration and validation of microwave remote sensing data for water cycle research”</b>	
<b>European Principal Investigator</b> Prof. Yann Kerr (CESBIO,France)	<b>Chinese Principal Investigator</b> Prof. Weiguo Zhang (NSSC/CAS,CHINA)
<p>Multiple global water cycle data products based on microwave data are available and explored by a growing community. However, very significant discrepancies among these different products have been reported. These differences may be attributed to the sensor calibration, algorithm performance, and spatial issues. The temporal-spatial resolution and accuracy of different data products from different sensors, including the ESA Soil Moisture Ocean Salinity (SMOS) and the NASA Soil Moisture Active Passive (SMAP), needs to be inter-compared, and refined for a wider global water cycle application. This project is dedicated to calibrate/validate the current remote sensing products related to water cycle studies including soil moisture, landscape freeze/thaw, snow extent and water equivalent, water vapor, sea ice freeboard height, inland water variation and precipitation etc., and hence to improve the accuracy and temporal-spatial resolution of these products through the synergy use of multi-sources satellite observations from European and Chinese Earth observation data. It is aimed to enhance the application of these satellite products in floods and droughts monitoring, soil erosion assessment, weather or climate forecasting and water resources management.</p> <p>This work is an effort following and expansion of Dragon2&amp;3 project “SMOS calibration and validation over China”. The team will face with future space mission challenge and requirements and take advantage of current conditions to consolidate our understanding and cooperation in water cycle measurements.</p> <p>This work is under the funding grant of 973 project “Satellite observation and simulation study of the energy and water exchange processes at the global land surface and its impacts on global changes” from 2015 to 2019. In addition, the systematic observation of the global water cycle for better understanding of global water cycle changes is supported by a Chinese satellite mission under the Strategic Priority Program on Space Science “A feasibility study for the Water Cycle Observation Mission (WCOM)”, which is designed to launch before 2020.</p> <p>Every year: the capital construction fund of NMC/CMA for supporting the routine work of operational agrometeorological service and research on agrometeorological conditions and disasters assessment, the making and distribution of bulletin of the crop and weather.</p> <p>2013--2018, the National Basic Research Program of China (2013CB430205), The impact assessment of drought and flood in the background of climate warming , took on the agricultural drought area distinguishing using the satellite data and have established the method of extracting the drought information from the NOAA/AVHRR.</p> <p>Professor Yaqiu Jin (CAS academician, IEEE fellow) and professor Jianchen Shi (IEEE fellow) are advisors of the project for the Chinese side.</p>	

**ABSTRACT 32397\_2: “calibration and validation of GNSS Remote sensing data for soil moisture and snow water”**

**European Principal Investigator**

Prof. Alain Geiger  
(Institute of Geodesy and Photogrammetry ETH  
Zurich, Switzerland)

**Chinese Principal Investigator**

Dr. Dongkai Yang  
(School of Electronic and Information Engineering,  
Beihang University, CHINA)

GNSS-reflection (GNSS-R) remote sensing is a new category of satellite navigation applications, where GNSS signals reflected from various surfaces are used to study the earth environment and extract useful information of those surfaces. Goal of the project is to further develop the technique of ground based GNSS – reflecto&refractometry, considering the determination of snow and moisture parameters. To make full use of the GNSS remote sensing data for the global water cycling, the calibration and validation tasks will be performed in this project. The methods can be also used to validate other methods such as satellite radar or radiometer measurements. Both the Galileo and Beidou systems will be used in this calibration and validation process.

There are logistical differences between GNSS-R remote sensing and satellite scatterometry and radar altimetry: 1) no additional transmitter necessary; 2) plenty of signal sources permanently available, including GPS, Galileo, GLONASS, and BeiDou system. Especially the BeiDou system’s special constellation, the geostationary orbit (GEO) and inclined geosynchronous (IGSO) orbit, increase the diversity of the signal sources. For example, the GEO satellite provides a 24-hours signal from a constant input angle to the reflecting surface, leading to information with a high temporal resolution. Chinese government is funding the BeiDou system construction and it has already worked well since 2012.

The Galileo satellite signals have the special characteristics different from the GPS to provide better signals for the soil moisture measurement and modeling with high accuracy. European GALILEO system will have the full operation from 2018 and now could give the initial operation capability for this project. European Union and ESA are the main body to perform the GALILEO system construction.