

# An enhanced Soil Moisture product from the ERS Scatterometers

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## Motivation

The first global soil moisture product from the scatterometer (ESCAT) on-board the ERS-1/2 missions was derived in the year 2002, by making use of the TU Wien Soil Moisture algorithm [1, 2]. The ERS missions, especially ERS-2, underwent a number of major mission events (Figure 1) affecting the final Soil Moisture retrievals [3]. In the framework of the ESA funded project SCIRoCCo, this data archive was reconsidered with the objective to create the most complete and consistent ESCAT soil moisture dataset, taking full advantage of state of the art scatterometer processing facilities.

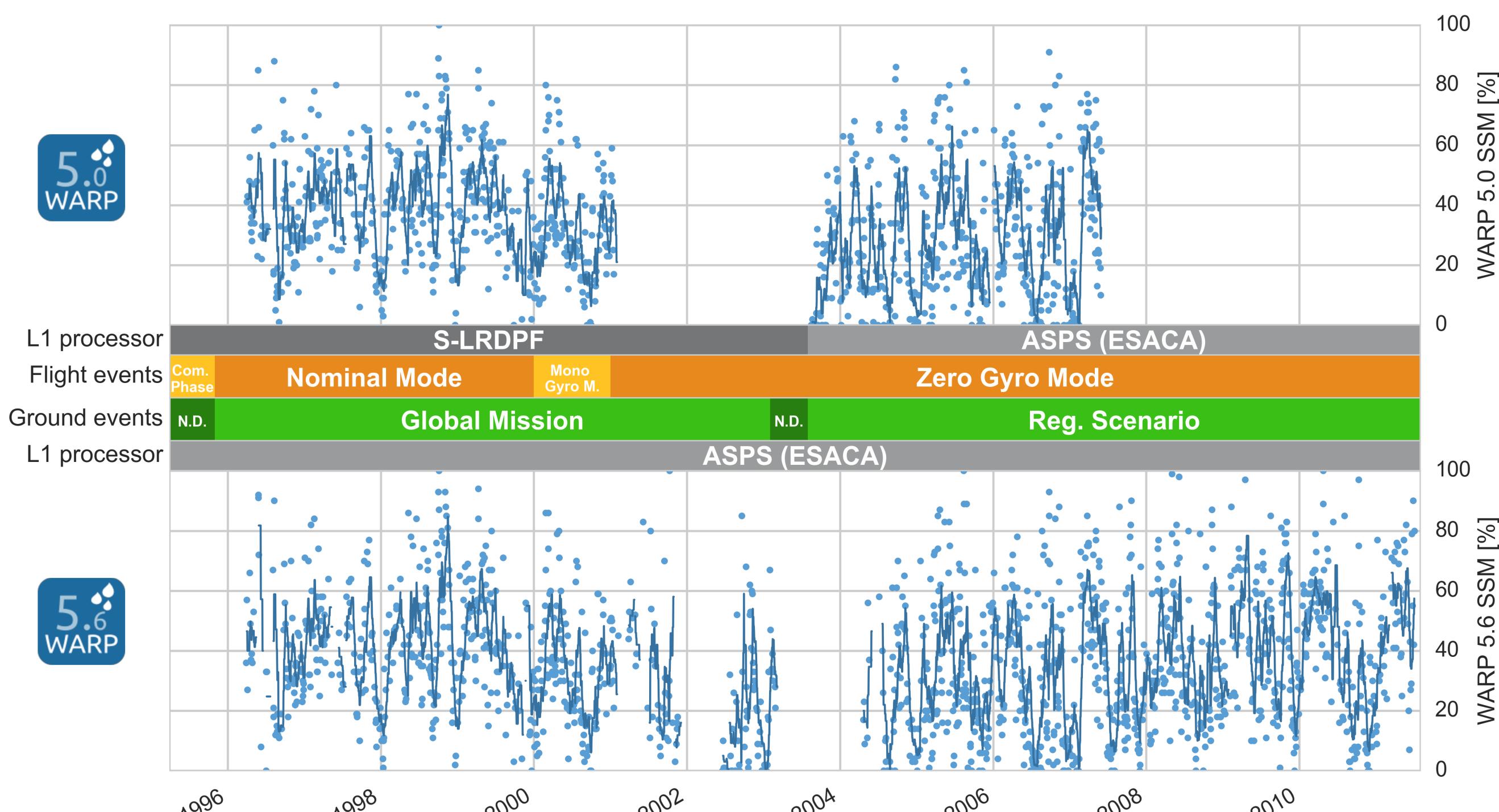


Figure 1: Major mission events of ERS-2 and their effect on the final soil moisture retrievals from ESCAT. Two major mission events should be noted, the loss of the 5 gyroscopes leading to the so called Zero Gyro Mode, and the on-board tape recorder failure resulting in the Regional Mission Scenario.

## The WAter Retrieval Package (WARP)

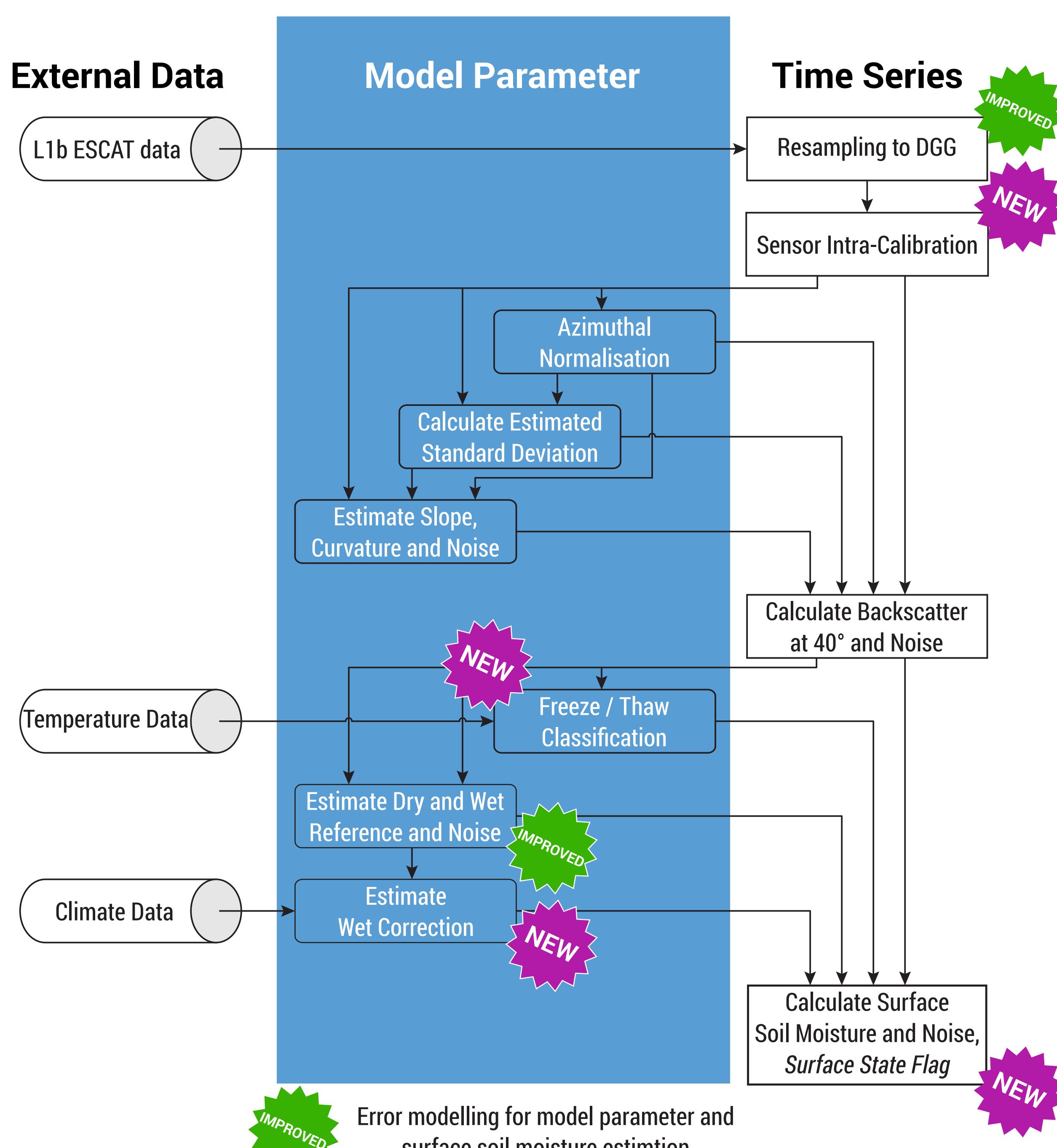


Figure 2: Flow chart of the TU Wien soil moisture retrieval algorithm implemented in the WAter Retrieval Package (WARP). Indicated algorithmic changes and improvements are given with respect to the previous derived ESCAT soil moisture products based on WARP 5.0.

Data Access: <http://scirocco.sp.serco.eu>  
Educational Material: <http://esa-scirocco.github.io>

## Product Overview

Soil moisture products from ERS ESCAT have been re-processed resulting in a Swath-Grid and a Time-Series product to cover the wide range of applications (see Figure 3). The Swath-Grid product is aimed for NWP centers in support to NWP re-analysis and climate monitoring activities (see Figure 4). For research and climate change studies a Time-Series product is accessible located on a discrete global earth grid (see Figure 1). Both soil moisture products are available at two different spatial resolutions with a sampling of 12.5 and 25 km (see Figure 4), and will be disseminated in NetCDF following the CF-conventions.

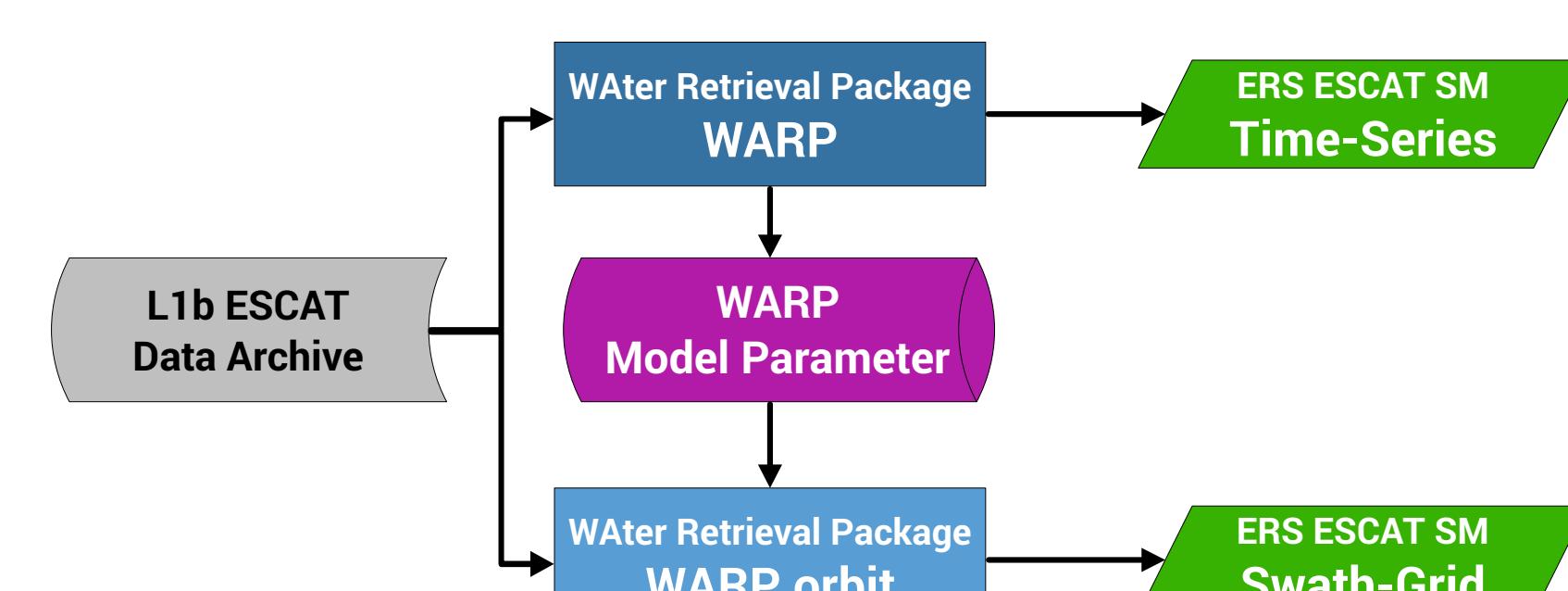


Figure 3: ERS ESCAT soil moisture product generation flow chart depicting the relationship between the Swath-Grid and Time-Series products.

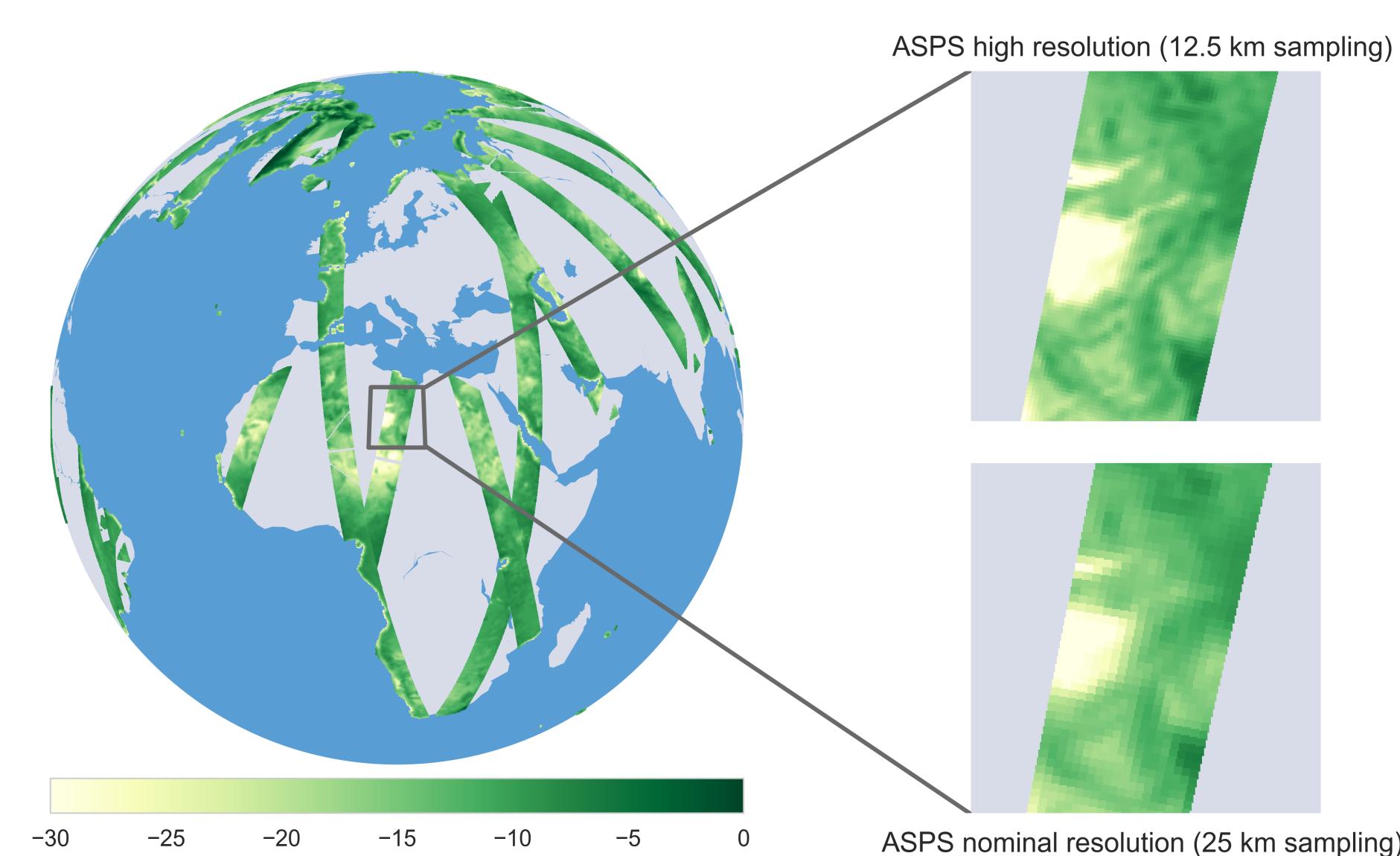


Figure 4: Illustration of the different spatial resolutions of the Level 1 input dataset used for soil moisture retrieval at TU Wien.

## Validation Results

A validation study has been carried out in order to analyze the performance of the re-processed ESCAT soil moisture products. The products have been validated against in-situ observations from the International Soil Moisture Network (ISMN) (see Figure 5) and ERA-interim modeled soil moisture (see Figure 6).

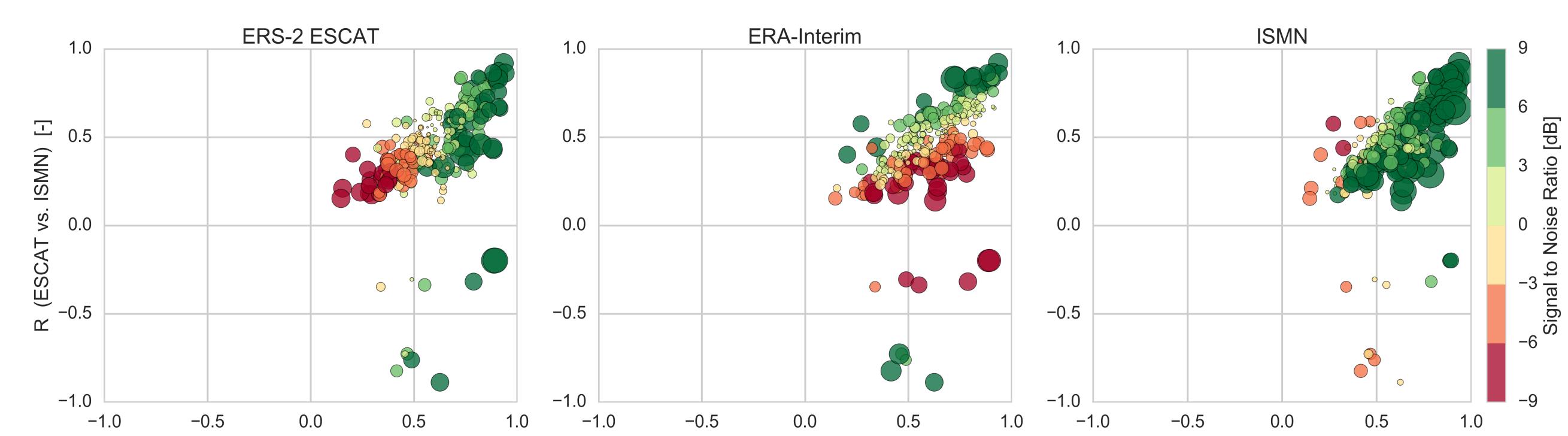


Figure 5: ISMN validation results utilizing Triple Collocation technique to estimate the Signal to Noise Ratio (SNR) in addition to Pearson R coefficient. Results are only shown for statistical significant correlations ( $p > 0.05$ ).

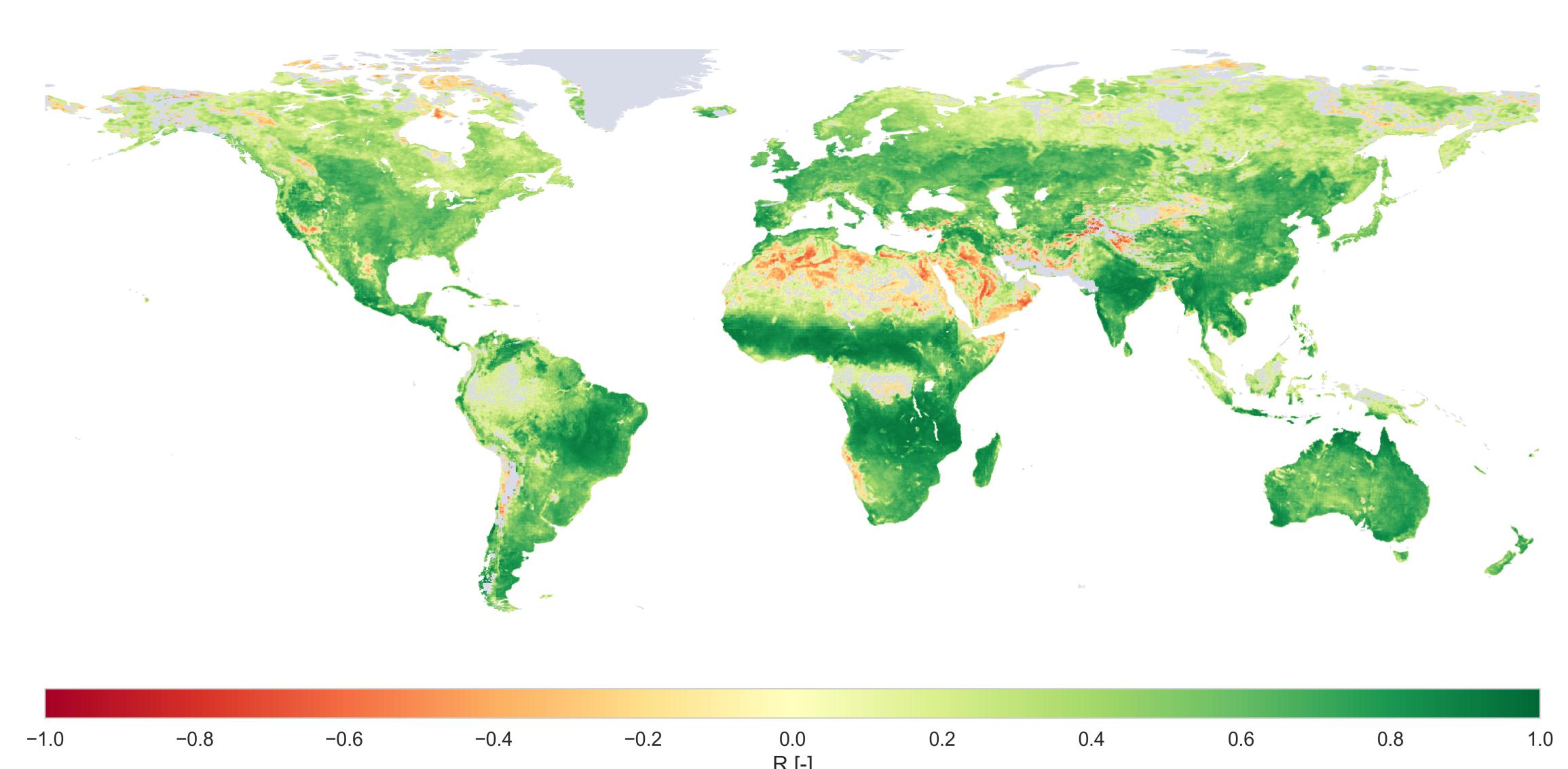


Figure 6: Pearson correlation coefficient R between the derived ESCAT soil moisture Time-Series and ERA-interim modeled soil moisture. Results are only shown for statistical significant correlations ( $p > 0.05$ ).

[1] W. Wagner, G. Lemoine, and H. Rott, A method for estimating soil moisture from ERS scatterometer and soil data, *Remote Sensing of Environment*, vol. 70, no. 2, pp. 191–207, 1999.

[2] K. Scipal, W. Wagner, M. Trommler and K. Naumann, The global soil moisture archive 1992-2000 from ERS scatterometer data: First Results, *Geoscience and Remote Sensing Symposium IGARSS*, vol. 3, pp. 1399-1401, 2002.

[3] R. Crapolicchio, G. De Chiara, A. Elyouncha, P. Lecomte, X. Neyt, A. Paciucci and M. Talone, ERS-2 Scatterometer: Mission Performances and Current Reprocessing Achievements, *IEEE TGRS*, vol. 50, no. 7, pp. 2427-2448, 2012.

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