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Ground measurements and satellite observations of soil moisture over the Tibetan Plateau

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The importance of the Tibetan Plateau for the atmospheric circulation and the development of large-scale weather systems over the Asian continent has been widely acknowledged. Due to its wide extent and high elevation, the Plateau plays a critical role in directing moist air from the eastern Indian Ocean and Bay of Bengal towards central China. Heat and moisture sources from the Plateau affect the flow of moist air from the ocean and seas creating a so-called “air pump” that influences the onset and maintenance of the Asian monsoon. In a changing climate, global warming will also change the partitioning of radiation into sensible and latent heat over the Plateau and, thus, the Tibetan air pump.

A key land surface state controlling interactions between the land surface and atmosphere is soil moisture. Being highly variable in both space and time, it is not feasible to base large-scale soil moisture monitoring programmes on in-situ measurements alone. Hence, estimates derived from satellite observations can complement ground measuring networks by providing insight into spatial soil moisture distributions across large scales.

In this study, we report on the development of large-scale ground measuring soil moisture/temperature networks across the Tibetan Plateau and their application in validating soil moisture retrieved from both active and passive microwave observations. An Advanced Synthetic Aperture Radar (ASAR) data set consisting of 150 scenes collected in the period from April 2005 to September 2007 is used as a demonstration of high resolution (100 m) soil moisture mapping over the central part of the Tibetan Plateau. Special Sensor Microwave/Imager (SSM/I) passive microwave observations from 1987 to 2008 are utilized to derive long-term soil moisture trends across the entire Tibetan Plateau. The soil moisture estimates from both ASAR and SSM/I are in agreement with our in-situ measurements. This study highlights the complementary information that can be provided by earth observations and their potential for improving our understanding of the water and energy budgets of the Tibetan Plateau.