Spatial downscaling of global satellite soil moisture data using temperature vegetation dryness index

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Microwave remote sensing has been largely applied to retrieve soil moisture (SM). An obvious advantage of microwave sensors is that SM can be obtained regardless of atmospheric conditions. However, existing global SM products, based on microwave remote sensing only provide observations at coarse spatial resolution, which hampers its application in regional hydrological studies. On the other hand, the Temperature Vegetation Dryness Index (TVDI) based on high spatial resolution visible and infrared satellite observations has been widely used to monitor the SM status. The aim of this study is to develop a simple and efficient downscaling approach for estimating accurate SM at high spatial resolution. The TVDI calculated from the Moderate Resolution Imaging Spectroradiometer (MODIS) is used as a unique scaling factor to downscale the coarse resolution SM product that has been developed under the framework of the European Space Agency's Climate Change Initiative (ESA CCI) projects. The original and downscaled SM estimates are further validated against the in-situ SM observations collected in Yunnan province (southwest China). It is found that the downscaled estimates can maintain the accuracy of ECV_SM, and have the same spatial resolution of the MODIS datasets. Local hydrological applications such as drought monitoring, and water planning and management will benefit a lot from the possibility of obtaining high resolution SM estimate with the proposed downscaling approach.