A Spatial and Temporal Continuum Remotely Sensed Soil Moisture Dataset of the Tibet Plateau From 2002 to 2015

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Introduction

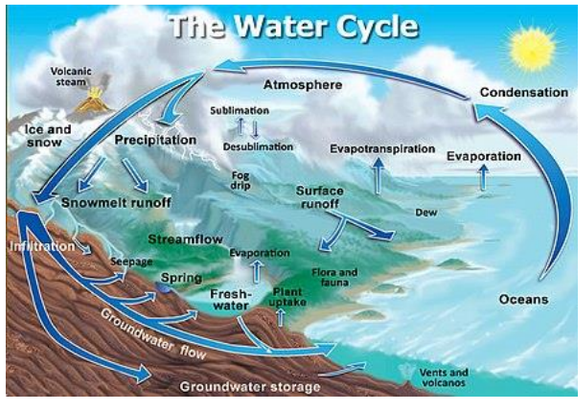

Figure 1. Grand Challenge: To observe and predict the storage, movement, and quality of water across space-time scales

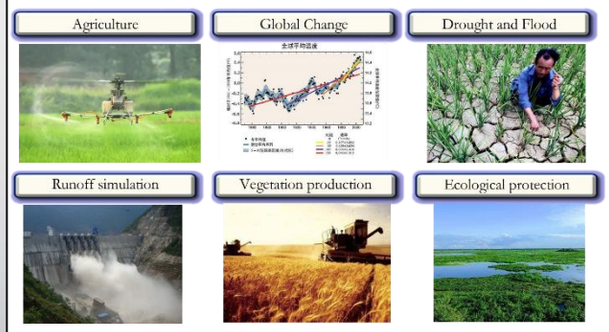

Figure 2. Applications.

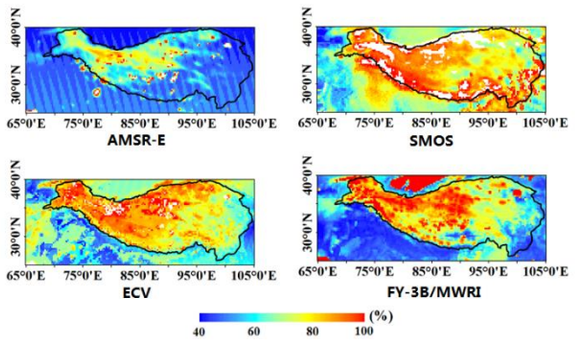

Figure 3. The percentage of data gaps over TP is more than 40%, and even more than 80% in the central and western TP.

Method and Data

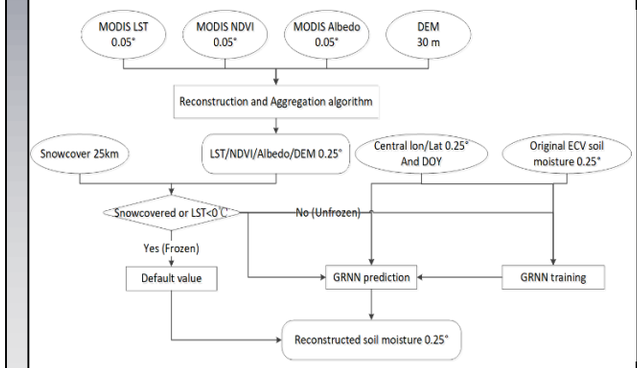

Figure 4. Flowchart for producing spatio-temporal continuous soil moisture dataset based on General Regression Neural Network (GRNN) method using ECV product.

Table 1. Input data

Name	Spatial Resolution	Temporal Resolution	Period
MODIS LST	0.05°	Daily	2002-2014
MODIS NDVI	0.05°	16-Days	2002-2014
MODIS Albedo	0.05°	16-Days	2002-2014
DEM	30 m	--	--
ECV V0.42	0.25°	Daily	2002-2014

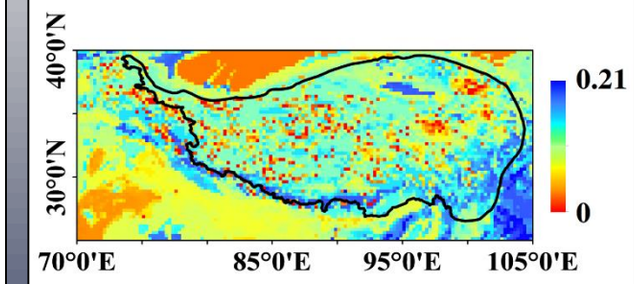

Figure 5. The default value, taking as the smaller one in the minimum value of time series data 2 and the volumetric water content at -1500 KPa in the soil map.

Results & Conclusions

1. Pre-process

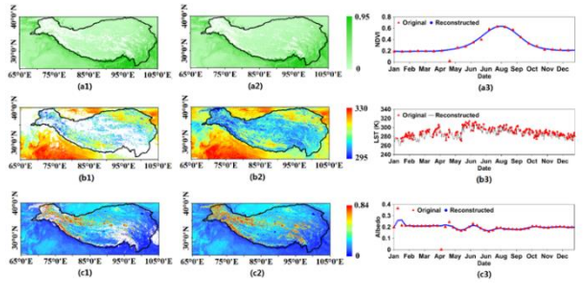

Figure 6. Results of reconstructed optical products: (a):NDVI, using Hants; (b): LST, using multi-temporal robust method; (c): Albedo, using statistical method based on temporal filtering

2. Comparison

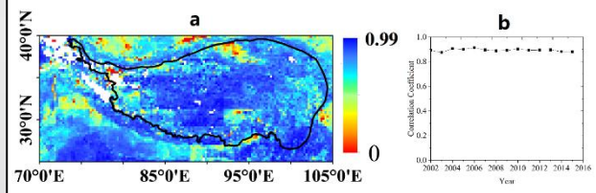

Figure 7. With the original ECV products: In more than 99% available area, the correlation coefficient is greater than 0.6; The area-averaged correlation coefficient form 2002 to 2015 shows enough stability

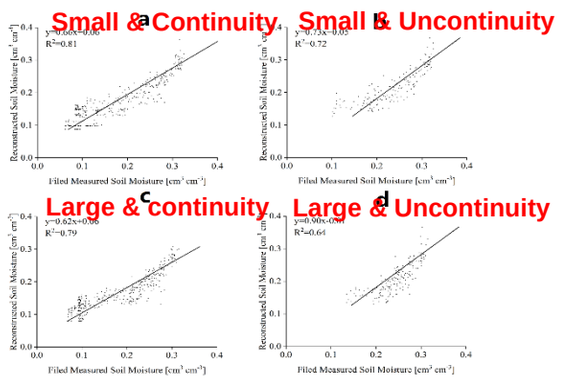

Figure 8. With In-situ measurements. For the small (0.25°×0.25°) and large (1°×1°) network, the R^2 of our dataset is 0.81 and 0.79, respectively, which is higher than the original product (0.72 and 0.64, respectively); The validation results based on the Spatiotemporal discontinuity dataset should be improved.

3. Trend Analysis

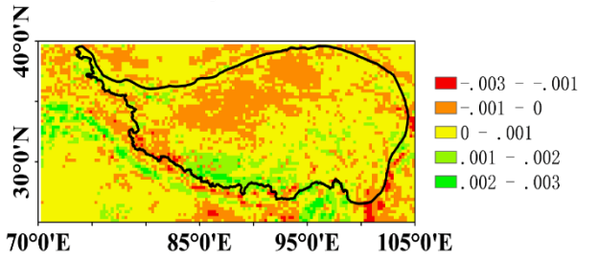

Figure 9.Trend of soil moisture: 2002-2015. The area rate with increasing trend of soil moisture is about 72.5%; The plateau is becoming more and more humid.

Abstract: Surface soil moisture is a key variable in the exchange of water and energy between the land surface and the atmosphere. The Tibetan Plateau (TP), known as "The third pole of the world", exerts huge influences on and sensitive to global climates. Longer time series of soil moisture can provides sufficient information to understand the role of the TP. This paper presents the first comprehensive dataset (2002–2015) of spatio-temporal continuous soil moisture at 0.25° resolution, based on satellite-based optical (i.e. MODIS) and microwave (ECV) products using a machine learning method named general regression neural network (GRNN). The dataset itself reveals significant information on the soil moisture and its changes over the TP, and can aid to understand the potential driven mechanisms for climate change over the TP.

References:

1. Yaokui Cui, & Yang Hong, et al., 'Validation and Reconstruction of Fy-3b/Mwri Soil Moisture Using an Artificial Neural Network Based on Reconstructed Modis Optical Products over the Tibetan Plateau', Journal of Hydrology (2016).
2. Yaokui Cui, & Yang Hong et al., 'A Spatio-temporal Continuous Soil Moisture Dataset over the Tibet Plateau From 2002 to 2015', Scientific Data (Under Review), 2018.

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