Geophysical Research Abstracts
Vol. 14, EGU2012-11815, 2012
EGU General Assembly 2012

Evaluating trends and anomalies of a multi-sensor soil moisture climate data record

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The importance of soil moisture in the global climate system was recently underlined by the Global Climate Observing System (GCOS) by endorsing soil moisture as an Essential Climate Variable. With reference to GCOS, the European Space Agency (ESA) decided to support the construction and exploration of a satellite-based climate data record of soil moisture through the Water Cycle Multi-Mission Observation Strategy (WACMOS) project and the Climate Change Initiative (CCI) programme. The global dataset is based on various sources of active and passive microwave datasets with the earliest observations dating back as far as late 1978. Currently the data record is available until 2010 but is continuously complemented with recent data sets.

This contribution will firstly briefly summarize the construction of the merged dataset. Next, the dataset is evaluated in terms of observed trends and extremes and cross-validated with other variables that play an active role within the hydrological cycle, such as precipitation and ocean circulation patterns. The trend analysis was performed by applying linear regression to the average yearly soil moisture values over the entire 32-year period. Over the observation period strong negative trends (decreasing soil moisture) were observed, e.g., in Russia and Kazakhstan while strong positive trends were observed over northeast Brazil and southern Africa. The trends observed in the remotely sensed soil moisture largely agree with trends observed in vegetation density and can often be coupled to well-known events of drought and flooding that occurred in recent years. For example, Russia and Kazakhstan have suffered from major droughts over the past years culminating in the strong heat wave of 2010. However, most trends are statistically only weak and are often masked by interannual variations. Also the influence of climate modes and artefacts resulting from sensor intercalibration issues will be critically reviewed in this presentation.