Support of Water Cycle Science with DLR's WaMaPro, Global WaterPack, and Global SnowPack

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Introduction

EO based information has a high potential to support water cycle science at regional (river basin) to global scale. The extent of surface water and its temporal dynamics are key parameters governing the global water cycle. Information on water surfaces such as permanent water bodies, partially inundated regions, and flooded areas, as well as on specific surface water dynamics is considered beneficial for hydrological and hydrodynamic modelling purposes.

Numerous research groups active in hydrological modelling and water cycle science have included surface water datasets derived on the basis of satellite remote sensing in their models for calibration and validation purposes. However, information on global water resources and their dynamics is often lacking. This also applies for the temporal dynamics of snow covered areas globally.

This poster gives an overview on information products developed at DLR-DFD. Regarding high temporal resolution on water and snow coverage the Global WaterPack and the Global SnowPack present daily dynamics at global scale. Furthermore, water surface information at high spatial resolution up to three meters can be derived from SAR data with the WaMaPro tool.

The presented information products aim to support the enhancement of water cycle estimation modelling, the estimation of anthropogenic influences over the last decades, and general of water resource management.

Water Mask Processor - WaMaPro

Waterbody detection from data of different SAR sensors – such as Sentinel-1, TerraSAR-X, and Envisat-ASAR – can be achieved with WaMaPro (Water Mask Processor), a tool that aims to support even non-experts and remote sensing beginners to easily derive water surface information.

Surface water information generated with WaMaPro was already used for the calibration of regional hydrological models, e.g. for the Mekong Delta, Vietnam. The implementation of WaMaPro is based on Python language as a plug-in for the open source GIS software Quantum GIS. Therefore, this software can be shared with interested potential users of a large community without inflicting any license fees.

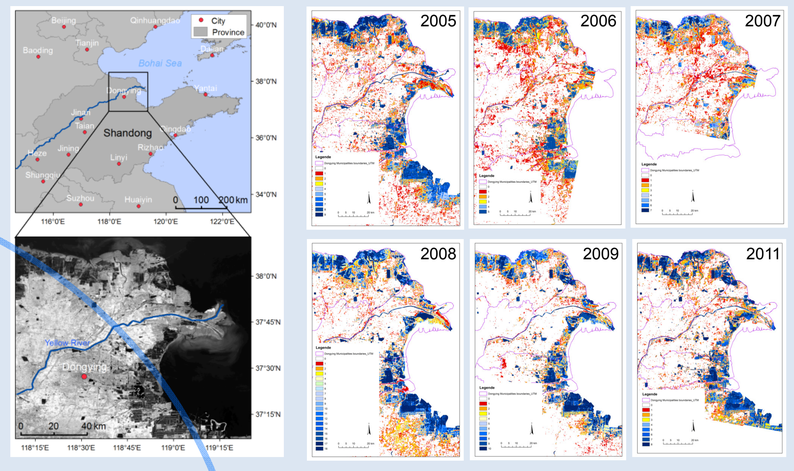

Figure: Inundation frequency maps for the Yellow River Delta, China – derived from Envisat ASAR data for 2005-2011 (not enough data available for 2010) as a combination of watermasks derived with WaterMaskProcessor (WaMaPro), overview map adapted from Kuenzer et. al 2015

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Support Water Cycle Science

Global WaterPack

The Global WaterPack is a dataset of inland water surface extent and dynamics with daily temporal resolution. This product is based on MODIS time series data. It is available at a spatial resolution of 250 meters, and is currently refined and extended to cover the period of 2002-2015. In addition to the daily water maps, several parameters are provided for seasonal, annual and long-term analyses – e.g. minimum and maximum extent, variability, start and end of inundation, water cover duration, and anomalies. The validation of this novel global product is currently carried out, and it is envisaged to adapt the approach to future Sentinel-3 data.

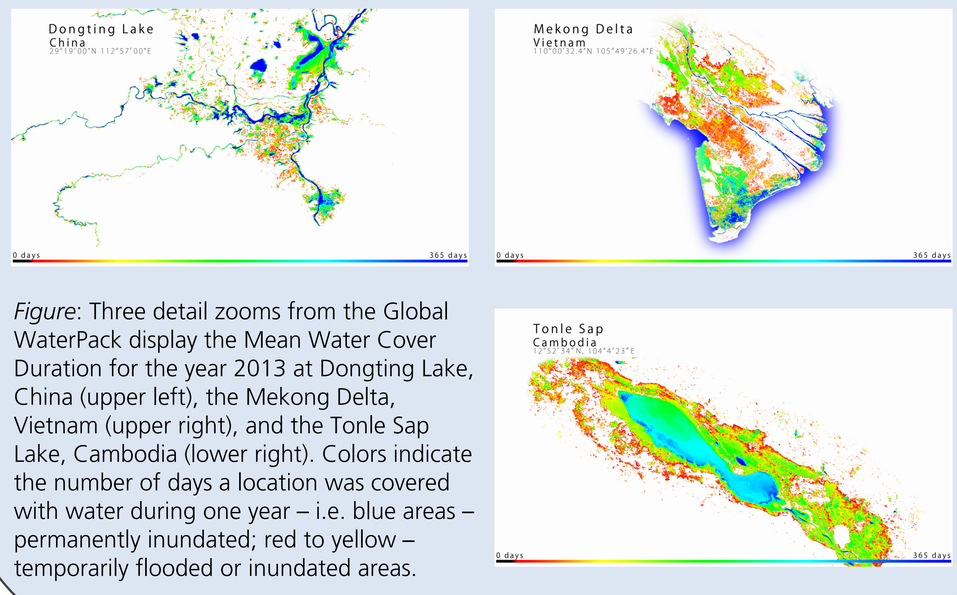

Figure: Three detail zooms from the Global WaterPack display the Mean Water Cover Duration for the year 2013 at Dongting Lake, China (upper left), the Mekong Delta, Vietnam (upper right), and the Tonle Sap Lake, Cambodia (lower right). Colors indicate the number of days a location was covered with water during one year – i.e. blue areas – permanently inundated; red to yellow – temporarily flooded or inundated areas.

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Global SnowPack

The Global SnowPack is a dataset of snow extent and snow cover dynamics with a daily temporal resolution. This product is based on MODIS as well as AVHRR time series data. It is available for the years 2000-2015 at a spatial resolution of 500 m (MODIS) and for some selected regions from 1984 to 2015 at 1km resolution (AVHRR). In addition to the daily snow maps, several parameters are provided for seasonal, annual, and long-term analyses – e.g. early season snow cover duration, late season snow cover duration, variability and anomalies of snow cover duration. The derived parameters can serve applications either in providing indicators for upcoming floods and droughts, the prediction of runoff characteristics during spring, or the assessment of regional variability.

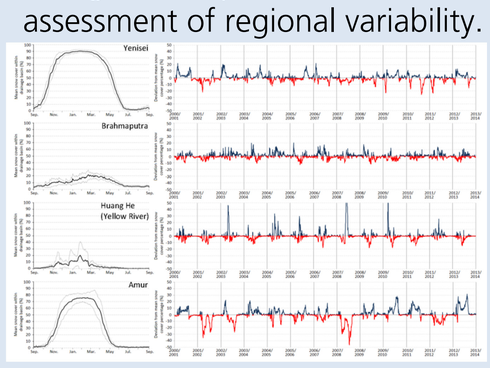

Figure (left): Examples of Snow Cover Variability from 2000-2014 are presented for 4 river basins (Yenisei, Brahmaputra, Yellow River, Amur). The left part of the diagram displays the mean values for the single river basins during the hydrological year.

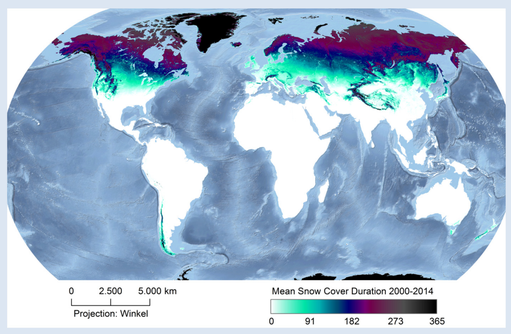

Figure (right): The Mean Snow Cover Duration 2000-2014 displays the coverage of snow on Earth surface from 0–365 days. Purple to black colors indicate areas where snow coverage stretches over a longer period than for the more greenish colored regions.

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