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Radar Altimetry for Hydrological Modeling and Monitoring in the Zambezi River Basin

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ABSTRACT FINAL ID: H11K-08

TITLE: Radar Altimetry for Hydrological Modeling and Monitoring in the Zambezi River Basin

SESSION TYPE: Oral

SESSION TITLE: H11K. Remote Sensing Applications in Hydrology I

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Title of Team:

ABSTRACT BODY: Hydrological model forecasts are subject to large uncertainties stemming from uncertain input data, model structure, parameterization and lack of sufficient calibration/validation data. For real-time or near-real-time applications data assimilation techniques such as the Ensemble Kalman Filter (EnKF) can be used to reduce forecast uncertainty by updating model states as new data becomes available. The use of remote sensing data is attractive for such applications as it provides wide geographical coverage and continuous time-series without the typically long delays that exist in obtaining in-situ data. River discharge is one of the main hydrological variables of interest, and while it cannot currently be directly measured remotely, water levels in rivers can be obtained from satellite based radar altimetry and converted to discharge through rating curves. This study aims to give a realistic assessment of the improvements that can be derived from the use of satellite radar altimetry measurements from the Envisat mission for discharge monitoring and modeling on the basin scale for the Zambezi River.
The altimetry data used is the Radar AlTimetry (RAT) product developed at the Earth and Planetary Remote Sensing Laboratory at the De Montfort University. The first step in analyzing the data is the determination of potential altimetry targets which are the locations at which the Envisat orbit and the river network cross in order to select data points corresponding to surface water. The quality of the water level time-series is then analyzed for all targets and the exploitable targets identified. Rating curves are derived from in-situ or remotely-sensed data depending on data-availability at the various locations and discharge time-series are established. A Monte Carlo analysis is carried out to assess the uncertainties on the computed discharge. It was found that having a single cross-section and associated discharge measurement at one point in time significantly reduces discharge uncertainty. To assess improvements in model predictions, a model of the Zambezi River basin based on remote sensing data is set up with the Soil and Water Assessment Tool and calibrated with available in-situ data. The discharge data from altimetry is then used in an EnKF framework to update discharge in the model as it runs. The method showed improvements in prediction uncertainties for short lead times.

KEYWORDS: [1855] HYDROLOGY / Remote sensing, [1874] HYDROLOGY / Ungaged basins, [1847] HYDROLOGY / Modeling, Data Assimilation.

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Additional Details

Previously Presented Material: Some preliminary results were presented as a poster at the Remote Sensing and Hydrology 2010 Symposium (Jackson Hole).

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