Geophysical Research Abstracts
Vol. 15, EGU2013-6355-1, 2013
EGU General Assembly 2013

Remotely sensed small reservoir monitoring

Dirk Eilander (1), Frank Annor (1,2), Lorenzo Iannini (1), and Nick van de Giesen (1)

(1) Faculty of Civil Engineering and Geosciences, Delft University of Technology, Delft, The Netherlands (d.m.eilander@student.tudelft.nl), (2) Civil Engineering Department, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

A new 'growing' maximum likelihood classification algorithm for small reservoir delineation has been developed and is tested with Radarsat-2 data for reservoirs in the semi-arid Upper East Region, Ghana. The delineation algorithm is able to find the land-water boundary from SAR imagery for different weather and environmental conditions. As such, the algorithm allows for remote sensed operational monitoring of small reservoirs.

Multipurpose small reservoirs (1–100 ha) are important for many livelihoods in rural semi-arid West Africa. In order to manage and plan these reservoirs and to assess their hydrological impact at a river basin scale, it is important to monitor their water storage fluctuation. Several studies on remotely sensed reservoir mapping have recently been published, but no single method yields good results for all weather and environmental conditions. Detection of small reservoirs from optical satellite imagery using supervised maximum likelihood classification is a well proved method. The application of this method for the monitoring of small reservoirs is however limited because of its dependence on cloud-free day-acquisitions. Delineation from SAR images is promising, but because of difficulties with wind induced Bragg-scattering and low contrast between the water surface and the dried-out surroundings at the end of the dry season, only quasi manual methods have been applied successfully.

A smart combination of optical satellite based detection combined with a delineation method for SAR imagery is proposed. From the optical satellite based small reservoir detection the reservoir window is determined in which the 'growing' maximum likelihood classification on SAR images is performed. A water-class seed and land-class seed are implemented and grown dependent on the likelihood of a pixel to belong to one class. The likelihood is calculated based on the probability distributions of the growing land and water populations. Combinations of single polarizations, polarization ratios and polarimetric parameters are tested for optimal contrast and minimal noise from Bragg-scattering. The seasonal behavior of small reservoirs, i.e. the reservoirs storage is likely to increase in the wet season and decrease in the dry season, is used in the delineation algorithm by including classifications from previous time-steps.

A case study is performed for the Upper East Region in Ghana, where a large number of small reservoirs dot the landscape. For 45 reservoirs, ground truth data is compared with Radarsat-2 SAR imagery based delineation. Preliminary results show that the method is robust for all reservoirs. Further analysis on current and additional forthcoming acquisitions will allow for an improved synthesis of the sensor full polarimetric capabilities, and a more refined tuning of the algorithm with concern to the temporal use of the classification information. As a result, a further enhancement in the delineation accuracy is expected.