Geophysical Research Abstracts
Vol. 16, EGU2014-11427, 2014
EGU General Assembly 2014

Satellite based Global Flood Detection System – strengths and limitations

Beatriz Revilla-Romero (1,3), Peter Salamon (1), Jutta Thielen (1), Tom De Groeve (2), and Zuzanna Zajac (1)

(1) European Commission Joint Research Centre, Climate Risk Management Unit, Ispra, Italy, (2) European Commission Joint Research Centre, Crisis Monitoring and Response Technologies Unit, Ispra, Italy, (3) Utrecht University, Faculty of Geosciences, Utrecht, The Netherlands

One of the main problems for global hydrological models is that for many regions only very limited or no observational data for a model assessment is available. This problem could be overcome with filling the gaps using information derived from satellite observations. Thus, an evaluation of the remote sensing signal of the Global Flood Detection System (GFDS) against observed discharge data was performed in order to test the use of this data in sparsely gauged river basins.

The study was carried out at 398 locations near the main rivers and in Africa, Asia, Europe, North America and South America. After evaluating different methodologies for extracting the satellite signal, a temporal (4 days) and spatial (4 GFDS pixels) average was chosen to proceed with the analysis. For the 340 stations with a concurrent time series longer than seven years for both, the signal and the in situ observed discharge (obtained mainly from the Global Runoff Data Centre), a calibration based on monthly linear models was carried out. The validation was executed and several skill scores were calculated such as the R2, Nash-Sutcliffe (NSE), and Root Mean Square Error (RMSE). It is important to highlight that, for this study, 230 stations globally had Nash-Sutcliffe efficient score higher than zero, indicating that for specific conditions the satellite signal as used in GFDS can fill the gaps where observations are not available. For example, several locations in African catchments have good performance as in the Niger, Volta and Zambezi for which Nash-Sutcliffe is greater than 0.75.

It is known that a number of factors affect total upwelling microwave brightness from a mixed water and land surface measured by a single image pixel. Aiming to better understand how some features of the sites could affect the satellite signal and the correlation with in situ observations, apart from the dependency on the river geometry, a multivariate analysis was carried out between the skill scores (NSE and R2) obtained from the validation and the local characteristics of the site. The potential affecting factors that were studied were the land cover, leaf area index, climatic areas, the flood extent maps, mean runoff, presence of dams and permafrost layer, as well as the upstream area. Results showed that many of the stations which received poor skills scores were due to low flow conditions. Importance of the outstanding local characteristics affecting will be explained. The work undertaken provide us with a better understanding of the impact of the local conditions on the performance of the satellite signal and give us guidance on the best locations and limitations for estimating discharge values from daily satellite signal.