SATELLITE WEATHER MONITORING – CAN WE RELY ON REMOTE SENSING TECHNOLOGY FOR FLOOD PREDICTION?

BY YIHAN CHEN
DIVISION OF WATER RESOURCE ENGINEERING
LUND UNIVERSITY, SWEDEN

The Global precipitation measurement mission (GPM) is a new state of the art remote weather monitoring program. Launched in 2014 it is a constellation of satellites that monitor the weather globally in real-time. Although it is state of the art technology, this thesis shows that the GPM fails to provide accurate real-time rainfall data viable enough for flash flood prediction.

As climate change leads to more extreme weather patterns higher demands need to be met to save lives and mitigate damage to society. In China flooding occurs yearly and often with severe consequences to both property and human lives. Prediction of these flooding events are crucial to reduce the severity of its' consequences.

Predicting flooding depends heavily on the type of flood. Flash floods were the main type of floods that this thesis was focused on. This kind of flood often arises due to heavy rain fall in mountainous areas. The main tool used in this study to predict flash floods is the Tsinghua Representative Elementary Watershed model (THREW). THREW is a hydrological model that uses weather information such as, evaporation and rainfall to predict river levels and river flow. The critical component in any flash flood prediction is the rainfall input data. Unfortunately, accurate rainfall data can be very hard to acquire due to its complex nature and limitations of measurement. Hence satellite estimation could be, in theory, used where other source of data is limited.

In this study the upper Han river basin was used as a test area for flood simulations. The upper Han river basin is located in central China with mountainous characteristics and a monsoon-like climate that is typical for flash flood prone areas.

The evaluation period consisted of a little more than a year and takes place between April 2015 and March 2016. For this period actual measured river flows were compared to simulated river flows by the THREW model. The comparisons we done for three scenarios:

1. Actual measured rainfall was used in a THREW simulation and the resulting river flow was compared to actual measured river flow. This scenario is to establish a comparable baseline for the two other scenarios
2. Satellite estimated rainfall (GPM) was used in a THREW simulation and the resulting river flow was compared to actual measured river flow.
3. Combination of actual measured rainfall and satellite estimated rainfall used in a THREW simulation to see whether and improvement could be made compared to the second scenario.

The first scenario proved to be the most accurate scenario as expected in theory. The second performed a lot worse than what it was expected of while the third performed fairly.

Results of this study showed that using the GPM real-time rainfall product is not sufficient by itself to predict flash floods. The technology is simply not accurate enough. The GPM real-time rainfall data product needs to rely on complementary measurements to function accurately.