



## **GNSS-R for detection of extreme hydrological events**

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Accurate and continuous measurement of river water levels is a worldwide challenge to obtain continuous estimation of river discharge around the world. But it is quite difficult: in-situ gauges give continuous and punctual measurements whereas satellite altimetry closely monitoring vast territories but with orbital repeat cycle not too short to completely capture extreme and rapid hydrological events (flash flood, tidal bore etc.). We proposed to use an opportunistic remote sensing method based on the analysis of GNSS wave reflection on the river surface. This method well-known as GNSS-R can monitoring the river area around the antenna location but it could also identify new flooded areas. We propose to apply this method on two user cases located in Vietnam. For the first one we located the antenna/GNSS receiver couple of the Red river ( $21^{\circ} 2'44.04''\text{N}$ ,  $105^{\circ}51'48.86''\text{E}$ ) to identify flood events and morphological changes associated to these hydrological events. The second one is located close to the mouth of the Mekong river ( $9^{\circ}31'38.63''\text{N}$ ,  $106^{\circ}12'2.01''\text{E}$ ) where continental water interacts with oceanic water. GNSS-R height retrieval is obtained from SNR multipath, and to increase the number of reflection point we used both GLONASS/GPS constellations. First measurements were done from the 27th July to 12th August 2016, during the period of the first (Mirinae) and second (Nida) storms, on the red river and the second one was done during 23th-31th August 2016. The first results where compare to in-situ tide/river gauge. We demonstrate that the assumption for obtaining useful continuous and spatial measurements of river level from GNSS-R is promising. We obtain not only the height river, but we also retrieve the local slope of the water surface, and flooded areas.