RainSat : satellite transmissions face to heavy rain and rain rate evaluation via TV Sat Signal Attenuation Measurement

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Face to heavy rains, the usage of satellite transmissions for Flood Early Warning Systems (FEWS) is sometimes confronted to disruption. To give response to this problem, first successful tests were conducted by BRL in 2010 with L-band (1.6 Ghz) and Ku-band (12 Ghz) satellite transmissions. But to reduce the cost of satellite transmission, a new solution using Ka-band was evaluated in 2014. In order to confirm the effectiveness of the "Adaptive Coding and Modulation" features of a new Ka-Sat satellite solution (up link TX < 30 GHz , down link RX 20 GHz), an experimentation was conducted by BRLi with the support of the CESARS Platform (CNES – French Space Agency) from August to November 2014 in Nîmes (South of France – Occitanie Province).

During this experimentation, 10 major events (rainfall > 100 mm in 24 hours) called "épisodes cevenols" affected the territory and cost the lives of 7 people. If these rainy events were localized, the experimental site was sufficiently exposed to allow a rapid acquisition (every minute) of climate parameters (rain, pressure temperature, wind) and conditions of satellite transmission (signal-to-noise ratio, data rate). Despite the performance of the various modulations available on the Ka-Sat solution, the communication was disrupted during the campaign until a maximum unavailability of 17 minutes.

Considering this satellite signal attenuation due to clouds and precipitation along the propagation path, a sensor has been design in 2017 by BRLi (using Raspberry PI and Software Defined Radio dongle) for estimating precipitation, by measuring TV SAT signal. First result brings great opportunity to anticipate strong rainfall intensity at short term (10-15 min).