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Extreme hydrometeorological events, a challenge for geodesy and seismology networks

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The use of seismometer and gravimeter captures complementary data and brings a new understanding of the July 2021 catastrophic floods in Belgium. A sudden increase in seismic noise coincides with the testimony reporting on a “tsunami” downstream of the Membach geophysical station, along the Vesdre valley. Concurrently, the gravimeter evidenced a rising saturation of the weathered zone, thus showing less and less water accumulation. When rain re-intensified after a 3-hour break, the saturated state of the subsoil induced an accelerated increase of the runoff, as revealed by the Vesdre River flow, in a much stronger way than during the rainy episodes just before. We show that a gravimeter can detect in real-time the saturation of the catchment subsoil and soil. This saturation resulted, when the rain re-intensified, in a sudden, devastating and deadly flood. This opens perspectives to use real-time gravity for early warnings of such events.

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