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## Tracking storms in the Pyrenees using a dense seismic network

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Data acquired by a dense seismic network deployed in the Cerdanya basin (Eastern Pyrenees) is used to track the temporal and spatial evolution of meteorological events such as rainfall episodes or thunderstorms. Comparing seismic and meteorological data, we show that for frequencies above 40 Hz, the dominant source of seismic noise is rainfall and hence the amplitude of the seismic data can be used as a proxy of rainfall. The interstation distance of 1.5 km provides an unprecedented spatial resolution of the evolution of rainfall episodes along the basin. Two specific episodes, one dominated by stratiform rain and the second one dominated by convective rain, are analyzed in detail, using high resolution disdrometer data from a meteorological site near one of the seismic instruments.

Seismic amplitude variations follow a similar evolution to radar reflectivity values, but in some stratiform precipitation cases, it differs from the radar-derived precipitation estimates in this region of abrupt topography where radar may suffer antenna beam blockage. Hence, we demonstrate the added value of seismic data to complement other sources of information such as rain-gauge or weather radar observations to describe the evolution of ground-level rainfall fields at high spatial and temporal resolution. The seismic power and the rainfall intensity have an exponential relationship and the periods with larger seismic power are coincident. The time periods with rain drops diameters exceeding 3.5 mm do not result in increased seismic amplitudes, suggesting that there is a threshold value from which seismic data are no longer proportional to the size of the drops.

Thunderstorms can be identified by the recording of the sonic waves generated by thunders. We show that single thunders can be recorded to distances of a few tens of kilometers. As the propagation of these acoustic waves is expected to be strongly affected by parameters as air humidity, temperature variations or wind, the seismic data could provide an excellent tool to investigate atmospheric properties variations during thunderstorms.