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Developments during 15 years of seismic monitoring in the Caribbean Netherlands

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In the Caribbean Netherlands, on Saba, St. Eustatius and St. Maarten, the Royal Netherlands Meteorological Institute (KNMI) deploys the seismic network NA (Caribbean Netherlands Seismic Network) to monitor local tectonic earthquakes and volcanic seismicity. Saba and St. Eustatius are part of the Lesser Antilles volcanic arc and each host an active but quiescent volcano: Mt. Scenery on Saba and The Quill on St. Eustatius. The network comprises 11 broadband seismometers of which data are a) transmitted to KNMI by DSL, cellular connection and VSAT, b) processed in real-time at KNMI using SeisComP and a coincidence trigger, c) forwarded in real-time to the Pacific Tsunami Warning Center (PTWC) and d) openly available to research and monitoring communities through ORFEUS/EIDA and EPOS via standardized services.

In the past six years we detected and located more than 350 earthquakes with magnitudes ranging from 0.4 to 6 within a 150 km radius from the center of the network. About 230 of these earthquakes were exclusively reported by KNMI as they were probably too small to be detected by, or too distant from, seismic networks operated by other agencies in the region. A previously unnoticed shallow (5-10 km depth) swarm of 22 tectonic earthquakes was detected and located through reanalysis of data from before 2017. This swarm took place in 2008, in the same area as the tectonic swarm of earthquakes in 1992, less than 15 km west of Saba, with magnitudes ranging between 2.3 and 4. One of the challenges for our network is building a reliable detection, identification and location system for volcanic earthquakes, which is hampered by the quiet state of both volcanoes. Another challenge is decreasing the hypocenter uncertainties, which are caused by the complex seismic velocity structure underneath the volcanoes, the large lateral velocity inhomogeneities in the subduction zone and the elongated set-up of the regional seismic networks.