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Crustal structure variation along the Lesser Antilles Arc

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Subduction zones are the major location for the formation of continental crust. Therefore, an investigation of the crustal and mantle structure variation of these areas helps understanding the process of continental crust growth.

Here we focus on a seismological investigation of the Lesser Antilles Arc. This island arc system is built by the relatively slow subduction ($\sim 2cm/yr$) of the North and South American plates beneath the Caribbean plate.

From the island of Grenada in the South to the Virgin Islands in the North significant variations in sediment load, petrology and volcanism are observed along the arc. The abundance of broadband seismic stations on the Lesser Antilles islands in combination with the abundance of cumulated samples allows for a link between the seismic methods with a detailed petrological analysis. We use data from three-component broadband stations located on the individual islands along the arc.

We investigate crustal structure using receiver functions to determine Moho depth and V_P/V_S ratio. The ratio gives an idea about the material of the subsurface as well as its water and its melt contents. We use the extended-time multitaper frequency domain cross-correlation receiver-function (ETMTRF) by Helffrich (2006) to compute the receiver functions. This method has the advantage of resistance to noise and gives stable solutions for the data, despite its large amount of oceanic noise. Our results show clear along-arc crustal properties. There are regions where the Moho is not very sharp due to a low velocity contrast.

The real data results are then compared to synthetic receiver functions based on plausible models. We compute a range of synthetic crustal models and receiver functions based on petrologic constraints from cumulates. The seismic velocities are obtained from experimental data using different temperatures and pressures to simulate different depths. The initial water content was also varied to model dry and wet slab conditions. Our results suggest that receiver functions are very sensitive to the amount of water in lower-crustal assemblages in arc settings.