

2023_31_ESE_Goes: Seismotectonics of the Lesser Antilles Arc

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Department: Department of Earth Science and Engineering

Background:

Subduction zones are the sites of the world's largest earthquakes, sometimes generating devastating tsunamis. The earthquake potential of the Lesser Antilles Arc (LAA) is poorly known, largely because of the challenge of obtaining data along this arc of small islands. Two historic earthquakes are thought to have been classical subduction thrust events, possibly with tsunamigenic potential. However, the extent of megathrust seismic coupling remains debated. The potential risk to large, poorly-protected communities in the Caribbean region is large.

Rationale:

In a recent large consortium grant, VoiLA, we collected new seismic data, including seabed-installed instruments, in and around the LAA. Data from our experiment has been used to image the subduction zone in unprecedented detail. We have compiled a preliminary catalogue of earthquakes detected during our deployment and developed a new moment tensor method to characterise faulting styles. We have been able to track how regions of more extensively hydrated incoming plate correlate with concentrations of small earthquakes and enhanced volcanic productivity along the arc. The next stage is to undertake an in-depth analysis of the VoiLA data to improve understanding of earthquake potential of the LAA.

This project:

In this PhD project the VoiLA seismic data will be used together with thermal and mechanical models of the subduction zone to improve the understanding of the seismic potential and tectonics of the LAA. Machine learning techniques will be used to identify and locate as many events as possible, to characterise the spatial distribution, size-frequency characteristics and where possible styles of events. These results will be combined with existing earthquake catalogues, and then compared with predictions of the thermal structure and subducting plate stresses from models that are tailored based on our detailed imaging of the subduction zone. Given the LAA is an important end-member, where slow-convergence of old, highly hydrated Atlantic lithosphere happens, the project will help to better understand global subduction.

Our Team:

The work would be supervised by Saskia Goes and Jenny Collier, who have led the VoiLA project and have extensive experience in the analysis of (marine) geophysical data and subduction dynamics. The student would join the Imperial Plates, Mantle and Core group working on shallow and deep geophysical imaging, surface processes and mantle dynamics.

Student Profile:

We are seeking a highly motivated individual with a background in geophysics, physics, or geology with a strong quantitative foundation. The successful candidate will be able to work independently and have a keen interest to do interdisciplinary work analysing seismic data and dynamically modelling of plates. For more information on this project please contact Saskia Goes (<mailto:s.goes@imperial.ac.uk>) or Jenny Collier (<mailto:jenny.collier@imperial.ac.uk>).

For more information on how to apply to us please visit: <https://www.imperial.ac.uk/grantham/education>