Structure and tsunamigenic potential of the Lesser Antilles accretionary prism

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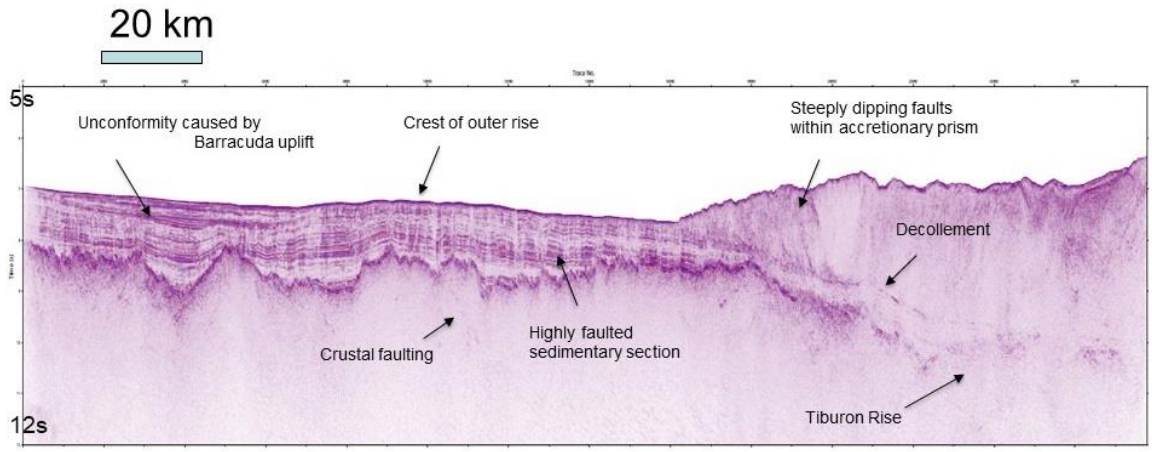
Some of the most damaging earthquakes happen offshore if they are associated with tsunamis. However, the conditions under which a large earthquake propagates to the surface and disrupts the seafloor in a manner that generates a tsunami (or not) is unclear. In this project we will focus on the Lesser Antilles subduction zone, where offshore earthquakes represent a significant (but currently poorly quantified) hazard to populations both within the Caribbean and the eastern USA. This project will constrain the structure of the accretionary prism at the front of the subduction system, where large thrusts present significant risk. This work will allow better mechanical modelling of the environmental hazard.



Methods: The student will use high-quality multichannel seismic reflection data and 4-component ocean-bottom seismometer data collected by us in 2017. The aim is to determine the internal structure of the accretionary prism and look for evidence at the seabed for present-day deformation. The student will conduct a travel time inversion of interpreted picks from the ocean-bottom instruments to produce a p-wave velocity model. Next, they will investigate converted waves at the base of the prism (the decollement – a critical surface along which the earthquake slip propagates and either continues to slide or sticks) to determine the fluid conditions. Finally, they will produce a migrated stack of the seismic reflection data within ProMax to image the thrust faults and detect past deformation. The student will combine these results with more regional observations to generate a new framework for understanding hazard/ tsunamigenic risk in the region.

Training: The SSCP DTP programme provides comprehensive personal and professional development training alongside extensive opportunities for students to expand their multi-disciplinary outlook through interactions with a wide network of academic, research and industrial/policy partners. Specific training will include:

- Inverse methods applied to large datasets
- Seismic reflection processing using ProMAX software
- Scripting and use of GMT and ArcGIS for geographical data processing and manipulation
- Programming in relevant languages such as Python/Matlab

The project would suit a numerate geoscience graduate.
If you would like further information please contact Jenny Collier (jenny.collier@imperial.ac.uk).