Assessing seismic and tsunami hazard offshore Los Angeles
Dr. Rebecca Bell (rebecca.bell@imperial.ac.uk), Dr. Dylan Rood (d.rood@imperial.ac.uk), Dr. Alexander Whittaker (a.whittaker@imperial.ac.uk)

**Background:** High rates of shortening (more than 1 cm/yr) across the Western Transverse Ranges (WTR) in densely urbanized southern California (USA) results in a series of east-striking active reverse faults which extend offshore into the Santa Barbara Channel. In the past 4 decades, all of the earthquakes with magnitudes greater than Mw 6.0 in southern California occurred on such faults. Some of these major structures may be capable of multi-fault earthquake ruptures generating ~Mw 8 earthquakes. As such, these faults represent some of the greatest earthquake hazards to the millions of people living in Los Angeles and vicinity. The seismic and tsunami hazard associated with offshore faults in the Santa Barbara Channel is currently poorly constrained, as the geometry of faults and their slip rates have not been assessed in detail.

**Methods:** In this PhD project the student will integrate numerous vintages of 2D and 3D seismic reflection and well data that have been collected by the hydrocarbon industry over the last 30 years and conduct a full regional seismic-stratigraphic analysis within the Santa Barbara Channel. As well as enhancing our appreciation of seismic and tsunami hazard in California the study will also shed light on how reverse faults grow and link, with implications for seismic hazard assessment in other compressional settings worldwide.

The student will:

1) Build a database containing all available sub-surface data for the Santa Barbara Channel (using Schlumberger Petrel software)
2) Map borehole-constrained horizons throughout the seismic reflection dataset to reveal the extent to which horizons have been deformed by faulting
3) Map fault geometries throughout the Santa Barbara Channel, validating structural interpretations using structural modelling software (Midland Valley MOVE)
4) Assess slip rates by measuring the displacement of horizons for which age information is available from well data or determined from cosmogenic dating methods onshore
5) Conduct field work to investigate the along-strike structure of onshore faults in the Ventura area, which are analogous to the offshore structures that will be studied in seismic data in this project
6) Assess the hazard associated with faults by conducting Coulomb stress change analysis and tsunami modelling
**Outcomes:** The research programme will deliver fault geometry and activity information that can be directly used to improve seismic risk assessment in southern California. In addition, the project will improve our understanding of reverse fault evolution, which will impact our assessment of seismic risk in other areas where reverse faults are a significant seismic hazard. Results will be published in high-profile journals and the PhD student will have the opportunity to present major findings in at least one international conference.

**Training:** The student will receive training in the interpretation of geophysical data and onshore tectonic geomorphology. They will be trained to use a variety of seismic interpretation and structural modelling software including Petrel, Move and Coulomb. The ideal candidate will be interested in seismic reflection data interpretation, structural geology and hazard analysis. A passion for science that matters to society is critical.