2026-2027 Twinning Program Projects

PROJECT: Comparative Analysis of Slab-edge Driven Upwelling in Cascadia and the Pacific Ring of Fire System

Project Director:
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Twin Mentor:
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Project Summary:
With advances in computational resources, geodynamic models have been able to incorporate increasing levels of complexity into the model design, thus enabling a more realistic representation of subduction zones in numerical simulations. This is especially important as the three-dimensional slab geometry, including slab edges, gaps, and intersections, has been shown to have a first-order effect on the flow dynamics. The CRESCENT researcher will use an automated framework to compare the flow results from numerical simulations of the Cascadia subduction zone with the flow results from previously run simulations of other subduction zones in the Pacific Ring of Fire system. This comparison and contrast approach will allow for differing styles of slab-edge driven upwelling to be analyzed, specifically in terms of driving anomalous off-axis volcanism in subduction zones, with the goal of identifying processes unique to the north and south slab edges in Cascadia. In addition, the researcher will plot shear wave splitting results from Cascadia and the comparative subduction zones, using seismic anisotropy to further constrain the slab-edge driven flow dynamics. This will be a joint effort supervised by a geodynamicist and seismologist, with over 20 years experience working on the dynamics of subduction systems from both a geodynamic and seismic perspective. The undergraduate researcher will gain experience learning to program in MATLAB and python, with the programming skills easily transferable to future projects. In addition, the student will gain experience in the fundamentals of numerical modeling, seismology, and constraints from rock deformation experiments, as they relate to mechanisms of slab-edge driven volcanism and hazards in Cascadia.

Role and probable activities for a student researcher in this project:
The CRESCENT sponsored undergraduate researcher will use an automated framework to compare flow results from models of the Cascadia subduction zone with flow results from other subduction zones along the Pacific Ring of Fire previously run by PI Jadamec's team. In addition, the researcher will plot shear wave splitting observations from Cascadia and the comparative subduction zones in the Pacific Ring of Fire, building on a previously compiled database of splitting observations from Cascadia. The compilation of splitting will be led by PI Long. The researcher will gain experience in data synthesis, using scientific workflows, learning the software development method, and leveraging newly learned programming skills to analyze geodynamic and seismic data from subduction zones. The researcher will also learn how to process and parse scientific literature.

Preferred Skills
Desired intern qualifications and technical skills include (a) completed coursework in Geophysics, Structural Geology and/or Global Tectonics, and Physics I and II and (b) an interest in subduction dynamics and learning to program.