Geophysical Research Abstracts
Vol. 17, EGU2015-8117, 2015
EGU General Assembly 2015

Pattern and evolution of the 3-D subduction-induced mantle flow in the laboratory: from generic models to case studies

Vincent Strak and Wouter P. Schellart

School of Earth, Atmosphere and Environment, Monash University, Australia (vincent.strak@monash.edu)

Three-dimensional self-evolving subduction models have been quantitatively analysed in the laboratory by means of a stereoscopic Particle Image Velocimetry (sPIV) technique. The purpose is (1) to provide information on the pattern of the quasi-toroidal mantle flow induced by subduction, particularly focusing on the location and magnitude of upwellings, and (2) to study the evolution of mantle upwellings in terms of location and magnitude. These generic models simulating a narrow subduction zone of ~750 km wide indicate that 4 types of upwelling are generated by subduction in a Newtonian mantle. One of these upwellings occurs laterally away from the sub-slab domain and is of high magnitude, suggesting that it could potentially trigger decompression melting, thereby producing intraplate volcanism. Another set of experiments has been performed to investigate how slab width controls the pattern of mantle flow. Crucial points to study are (1) how the lateral extent of the slab controls the position and magnitude of mantle upwellings located laterally away from the sub-slab domain, and (2) what is the relationship between slab width and the extent of the toroidal-component cells. We tested slab widths ranging from narrow (e.g., Calabria) to wider (e.g., Tonga-Kermadec-Hikurangi) subduction zones. The models show that both the magnitude of the upwelling occurring laterally away from the sub-slab domain and the extent of the toroidal-component of mantle flow increase non-linearly with increasing slab width.