Mantle convection: clues from lithosphere sinking at subduction zones and numerical modelling.

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Subduction zones show a worldwide asymmetry that can be observed in slab dip, kinematics of the subduction hinge, morphology, structural elevation, gravity anomalies, heat flow, metamorphic evolution, subsidence and uplift rates, depth of the decollement planes, mantle wedge thickness, magmatism, backarc development or not, etc. This asymmetry could be easily explained if related to the geographic polarity of the sinking slabs (Doglioni & Panza, 2015). In fact, geophysical and kinematics constraints show that all the plates move "westward". This preferential flow of plates would suggest a relative "eastward" mantle flow. If we look then to subduction dynamics within this set of conditions, this "eastward" mantle flow should have an important role in influencing subduction dynamics itself. Furthermore, along W-subduction zones slabs sink with a higher velocity with respect to the "easterly or northeasterly" directed ones. The faster "westerly" directed slabs determine that the volume of lithosphere recycled into this kind of subduction is larger than that along the converse ones. This should determine a more vigorous counterflow within the mantle below W-directed subductions with respect to the one below E-directed ones. Starting from these observations we attempted to estimate volumes of lithosphere that are currently subducting below the principal subduction zones: our results show that there are about 288 km^3/yr of lithosphere currently subducting below W-directed subduction zones, while only about 78 km^3/yr of lithosphere are currently subducting below E- to NE-directed subduction zones. Then we tried to demonstrate quantitatively the consequent difference in mantle circulation between the two subduction settings using numerical modelling tools (Gerya, 2010), using data coming from our volumetric calculation as input data for the models. Moreover, we tried to look at these volumes with respect to the latitude of subduction zones, being plates velocities strongly linked to the Earth's rotation. In fact, seismicity is latitude dependent and decreases with increasing latitude (Riguzzi *et al.*, 2010; Varga *et al.*, 2012). Our results show that most of the volume currently subducting below worldwide principal subduction zones is concentrated between 30° and -30° of latitude.

References

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