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Structure of North Atlantic upper mantle based on gravity modelling, regional geochemistry and tectonic history

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We study the link between deep geodynamic processes and their surface expression in the North Atlantic region which has an anomalous, complex structure compared to other oceans. We calculate a model of residual mantle gravity between the Charlie Gibbs Fracture Zone and Svalbard. The calculations are based on GOCE satellite data the regional crustal model EUNAseis (Artemieva and Thybo, 2013) ; for the crustal and topography effects, and the global totpgraphy and bathymetry model ETOPO1 from NOAA (Amante and Eakis, 2009). Results are complemented by sensitivity analysis of the various parameters' effects on the models.
Our results identify strong heterogeneity in the upper mantle residual gravity, expressed as a sharp contrasts at the continent-ocean transition, positive mantle gravity below the continental blocks and negative – below oceanic blocks; the MOR has low-gravity anomaly. By introducing regional geochemical data and analysis of the tectonical history, we identify a strong correlation between residual mantle gravity anomalies and geochemical anomalies in Nd and Mg#. This analysis identifies three zones of North Atlantic mantle based on the correlation between upper mantle gravity and ocean floor age. In the area around Iceland, the residual mantle gravity is systematically lower than predicted from the half-space cooling model, and we estimate the thermal anomaly that could cause this shift.