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Using satellite data to decipher geodynamics of the northeast Atlantic

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We explore the mantle density structure of the northeast Atlantic region by performing constrained linear inversion of the satellite gravity gradient tensor data using statistical prior information. The residual gravity gradient signal and the prior covariance matrix are obtained using a crustal model constrained by updated database of seismic reflection and refraction profiles. We construct a 3D reference density distribution in the upper mantle assuming a pure shear model for lithospheric rifting. The mantle reference density model is consistent with mineral phase equilibria assuming a pyrolitic bulk composition. The forward modeling of the gravity gradients in the 3D reference model is performed on a global scale using a spherical harmonics approach. The northeast Atlantic model is represented using a spherical shell covering the study region down the depth of 410 km. We use tesseroids as mass elements for solving the forward and inverse gravity problem at the regional scale. The relationship between the seismic velocity and density anomalies in the Iceland-Jan Mayen region and the low-density corridor across central Greenland are discussed for understanding the origin of heterogeneities in the upper mantle of the northeast Atlantic region and their possible connections with the Cenozoic Iceland plume activity.