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Global marine gravity models from altimetry: a method to quantify the error

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Twenty years gravity models from satellite altimetry missions have widely contributed to the improvement of the knowledge over the oceans. Nevertheless, it has been shown that these models were limited in term of spatial resolution and precision at wavelengths lower than twenty kilometres (for example, Rapp 1998, Rapp et Yi 1997, Featherstone 2002, Denker et Roland 2003, Small et Sandwell 1992, Maia, 2006, Lequentrec-Lalancette et al., 2005). More recently retracking techniques have improved altimetry and decreased limits to 15 km wavelength. Furthermore, they have moved the correct altimetric data closer to the coastal areas (Sandwell et Smith, 2009, Lillibridge et al., 2012).

The aim of this study was to translate these error informations to a quantitative factor that can be included in geodetic or gravimetric computation. The model is divided into different spatial roughness areas that are then "calibrated" from differences between the model value and some marine validated data available. The roughness of the gravity global model has been computed by a method defined by Dreher (2000) from an improvement of the Fox and Hayes (1985) méthodology. The delimitation of the characteristic gravity provinces is done by thresholding of the roughness computed in the wavelengths lower than 50 km.

This methodology has been validated with the EGM08 model in the North Atlantic ocean (Pavlis et al., 2008). In this case, the results can then be compared with the estimated errors of spherical harmonic model EGM08. The method has been generalized on the last version of the Sandwell and Smith (2009) gravity model.