Inter-comparison of state-of-the-art MSS and geoid models in the Arctic Ocean

State-of-the-art Arctic Ocean mean sea surface (MSS) and geoid models are used to support sea ice freeboard estimation from satellite altimeters, and for oceanographic studies. However, errors in a given model in the high frequency domain, e.g. due to unresolved gravity features, can result in errors in the estimated freeboard heights, especially in areas with a sparse lead distribution in consolidated ice conditions. Additionally these errors can impact ocean geostrophic current estimates and remaining biases in the models may impact longer-term, multi-sensor oceanographic time-series of sea level change. This study, part of the ESA CryoVal Sea Ice project, focuses on an inter-comparison of various state-of-the-art Arctic MSS models (UCL13/DTU13/ICEn) and commonly-used geoid models (EGM08). We show improved definition of gravity features, such as the Gakkel ridge, in the latest MSS models. We quantify remaining errors due to unresolved gravity features and inter-satellite biases within commonly-used models and we show the implications of these potential error sources on freeboard derivation. To identify and quantify the spatial effect of the unresolved features, primarily in the high-frequency domain, we combine a climatology of lead distributions with the gradient of the slope of the sea surface anomalies. The differences between the models are analyzed and used to support improvements in future models.

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