Vidhyarth
Thirumullaivoyal Santhana Kumar
Department of Aerospace Engineering Sciences, University of Colorado Boulder
Khosro Ghobadi-Far, Department of Aerospace Engineering Sciences, University of Colorado Boulder
Oral
Providing reliable errors for static gravity field models is vital for various geodetic and geophysical applications. For instance, error quantification of orthometric heights obtained from the GNSS/leveling technique requires a geoid model with reliable uncertainty estimates. High precision global gravity field modeling involves appropriate data weighting of various satellite and terrestrial data, relying on accurate noise models. Despite extensive development of the global gravity field models, very limited work has been conducted to evaluate the static gravity field model errors. We present a novel framework for validating the errors in the static gravity field models using Line-of-sight Gravity Difference (LGD) obtained from the GRACE-FO Laser Ranging Interferometer (LRI) observations. The LGD LRI residuals referenced to a global gravity field model represent an estimate of the error associated with that model. Projecting the error of the global gravity model into the along-orbit LGD time series and comparison with the error estimate from LRI allows for validation of gravity field model uncertainty. We apply this approach to the following global gravity field models GGM05C, GGM05S, ITSG-Grace 2018s, ITG-Grace2010s, GO_CONS_GCF_2_TIM_R3 and GOCO06s. Results reveal discrepancies in specific frequency bands as well as spatial regions, indicating under- or over-estimated model uncertainties. The ITG-Grace2010s model agrees well with LRI post-fit residuals from degrees 100–180, while GGM05C and GGM05S show only partial agreement in this bandwidth. The GO_CONS_GCF_2_TIM_R3 model agrees well beyond degree 100, as Auto Regressive Moving Average (ARMA) filtering in Satellite Gravity Gradiometry (SGG) processing suppresses time-correlated noise, making data within 5–100 mHz effectively white noise. While the combined SGG and satellite-to-satellite tracking (SST) processing gives less reliable error estimates below degree 100. Our findings demonstrate that the GRACE-FO LRI data offers high sensitivity to static gravity field errors and provides valuable constraints for refining stochastic modeling for future geopotential model development.
Presentation file
thirumullaivoyalsanthanakumar-vidhyarth.pdf
Meeting homepage
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