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NASA GRACE and GRACE Follow-On satellite missions provide the most accurate and reliable information on monthly Terrestrial Water Storage (TWS) change at spatial scales of 300 km and larger. Extraction of an individual water storage component like groundwater or snow form GRACE/FO TWS over smaller regions faces two challenges which require meticulous examination. These challenges are related to the coarse spatial resolution of GRACE TWS observations and relying on auxiliary data such as from hydrological models to isolate the desired water storage component from TWS. If we have accurate, independent information about the desired hydrologic signal (for example from in situ data), this process could also inform us about the inefficacy of auxiliary data used for signal isolation, if we observe a misfit between the GRACE estimates and in situ data. We use Lake Mead as a case study to perform a thorough investigation into the ability of GRACE for observing small-scale hydrologic signals. We start by calculating the volume of Lake Mead surface water from GRACE TWS by subtracting other “unwanted” signals including soil moisture, snow water equivalent, groundwater storage provided by GLDAS NOAH and WGHM hydrological models. There is good agreement between the GRACE-derived and in situ surface water of Lake Mead at interannual timescales. However, GRACE shows much larger variability at seasonal timescale than the in situ data. We then examine the water budget equation using precipitation, evapotranspiration and discharge data to investigate the reason for misfit between GRACE and in situ data, which we speculate might be related to underestimation of soil moisture around Lake Mead by GLDAS NOAH. Our findings help with using GRACE/GRACE-FO data for observing small-scale mass change signals such as the snowpack over Sierra Nevada and groundwater storage changes in Central Valley, California.
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GRACE-FO 2025 Science Team Meeting
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