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The Gravity Recovery and Climate Experiment (GRACE) – Measuring Climate Change via Gravity[1]

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The joint NASA/DLR GRACE mission is a pioneering project launched in 2002 to measure large-scale mass redistribution on the Earth through precise satellite-satellite microwave tracking. Using dual frequency K and Ka band microwave carrier phase tracking between the two spacecraft to obtain 5 second Doppler normal points with ∼100 nanometer/second precision, and coupled with precision accelerometers on board each spacecraft, mass changes equivalent to 1 cm of water over regions a few hundred km in spatial extent can be mapped each month over the entire Earth. These monthly GRACE mass maps have provided an astonishing amount of previously poorly known (or unknown) aspects of large scale climate related phenomena, including mass loss rates in Greenland, Antarctica, Alaska, Arctic ocean circulation, water storage in major river basins, pan-Arctic river discharge, and much more. In this talk, we will discuss the design challenges and engineering approaches for GRACE, the current state-of-the-art science results, and look at approaches for improved follow-on missions, including the use of laser interferometry closely related to that envisioned for LISA.

[1]In collaboration with Srinivas Bettadpur, University of Texas Center for Space Research and WIllam Folkner, California Institute of Technology, Jet Propulsion Laboratory.