The Solar and Southern Oscillation Components in the Satellite Altimetry Data - DTU Orbit (05/08/2019)

The Solar and Southern Oscillation Components in the Satellite Altimetry Data
With satellite altimetry data accumulating over the past two decades, the mean sea level (MSL) can now be measured to unprecedented accuracy. We search for physical processes which can explain the sea level variations and find that at least 70% of the variance in the annually smoothed detrended altimetry data can be explained as the combined effect of both the solar forcing and the El Niño-Southern Oscillation (ENSO). The phase of the solar component can be used to derive the different steric and eustatic contributions. We find that the peak to peak radiative forcing associated with the solar cycle is 1.33 ± 0.34 W/m², contributing a 4.4 ± 0.8 mm variation. The slow eustatic component (describing, for example, the cryosphere and large bodies of surface water) has a somewhat smaller peak to peak amplitude of 2.4 ± 0.6 mm. Its phase implies that warming the oceans increases the ocean water loss rate. Additional much smaller terms include a steric feedback term and a fast eustatic term. The ENSO contributes a peak to peak variation of 5.5 ± 0.8 mm, predominantly through a direct effect on the MSL and significantly less so indirectly through variations in the radiative forcing.

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