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Sensitivity of Antarctica to Topographical Marine Ice Sheet Instabilities

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Large uncertainties remain in the estimation of Antarctic ice sheet contribution to future sea level rise. Amongst others, glaciers located in the Amundsen sea sector have considerably accelerated and thinned during the last decade, leading to an increase discharge of ice to the ocean. These observations, suggesting a leading role of the dynamics of outlet glaciers to ice-sheet mass balance, coupled together with recent theoretical and modeling efforts tend to confirm the old hypothesis that marine ice-sheets resting on an upward sloping bed cannot find a steady position. Here, using compilation of bedrock topography data over the whole continent, we determine the location of regions which are currently unstable. This allows us to establish a sensitivity map of the Antarctic ice-sheet to grounding line retreat and estimate the eustatic land ice contribution that may rise from a collapse of the previously defined unstable regions. Two main results will be discussed: (i) the remarkable agreement between the location of regions subjected to topographical instability with the location of fast flowing ice areas, (ii) many poorly surveyed glacier of East Antarctica, particularly in the Victoria Land sector, appears to be in an unstable configuration with potential important effect on the sea-level budget.