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The Antarctic and Greenland ice sheet contribution to global sea level rise

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Fluctuations in the mass of ice stored in Antarctica and Greenland are of considerable societal importance. The Ice Sheet Mass Balance Inter-Comparison Exercise (IMBIE) is a joint-initiative of ESA and NASA aimed at producing a single estimate of the global sea level contribution to polar ice sheet losses. Within IMBIE, estimates of ice sheet mass balance are developed from a variety of satellite geodetic techniques using a common spatial and temporal reference frame and a common appreciation of the contributions due to external signals. The project brings together the laboratories and space agencies that have been instrumental in developing independent estimates of ice sheet mass balance to date.

In its first phase, IMBIE involved 27 science teams, and delivered a first community assessment of ice sheet mass imbalance to replace 40 individual estimates. The project established that (i) there is good agreement between the three main satellite-based techniques for estimating ice sheet mass balance, (ii) combining satellite data sets leads to significant improvement in certainty, (iii) the polar ice sheets contributed 11 ± 4 mm to global sea levels between 1992 and 2012, and (iv) that combined ice losses from Antarctica and Greenland have increased over time, rising from 10% of the global trend in the early 1990's to 30% in the late 2000's.

Demand for an updated assessment has grown, and there are now new satellite missions, new geophysical corrections, new techniques, and new teams producing data. The period of overlap between independent satellite techniques has increased from 5 to 12 years, and the full period of satellite data over which an assessment can be performed has increased from 19 to 40 years. It is also clear that multiple satellite techniques are required to confidently separate mass changes associated with snowfall and ice dynamical imbalance – information that is of critical importance for climate modelling.

In the years since the first IMBIE assessment, more than 80 new estimates of ice sheet mass balance have been published. These studies point to continued mass losses from both ice sheets. In Greenland, the rate of ice loss stabilized in 2013, consistent with changes in the local meteorological conditions which have led to reduced melting and increased snowfall. In Antarctica, the latest measurements from CryoSat-2 point to further increases in ice losses. In light of all of these developments, it is now time for an updated community assessment of ice sheet mass balance. This presentation outlines the approach for the second phase of IMBIE, including the project organisation, the work programme and schedule, the main science goals, and its current status, and reviews the recent and historical contributions that the Antarctic and Greenland ice sheets have made to global sea level rise

