It's a wet, wet WAIS: observations of current and historical snow accumulation from the Amundsen Sea sector

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It snows a lot in the Amundsen Sea (AS) sector of West Antarctica – relatively speaking. For instance, the average annual accumulation of approximately 40 cm water equivalence (w.e.) is more than ten times the annual accumulation observed on much of the high East Antarctic plateau. Yet the sector's accumulation is dwarfed in comparison to areas closer to home: it's less than one tenth the annual accumulation on Blue Glacier in Washington State. So what's the big deal?

The sector's average annual accumulation is unimpressive - the paltry 16 inches w.e. that collects in a year was nearly matched in a 24-hour period during a rainstorm on Long Island, NY in August 2014. Its impressiveness, however, lies in its extent. An average of ~40 cm w.e. accumulates each year over an area of ~370 × 103 km2, which is equivalent to 148 Gt. As a result, sea level is reduced every year by nearly half a millimeter due to snowfall becoming trapped in the AS sector, where it begins its slow journey back out to sea. At the same time, ice that began its journey long ago is reunited with the sea – a perfect balance? While snow accumulation over the past few decades and even centuries has remained somewhat stable in the AS sector, warm ocean waters have eroded buttressing ice shelves, causing the glaciers to accelerate and thin near the margins. The losses outweigh the gains.

Here, we discuss snow accumulation from the AS sector of West Antarctica, particularly over the Pine Island and Thwaites drainage area, using a variety of observation techniques. Several firn cores provide insight into the long-term accumulation variations over the past few centuries. Mapping the internal stratigraphy of the upper ~50 m of the ice sheet from airborne radar data allows us to investigate the spatial – and even coarse temporal – variations in accumulation. More specifically, we (1) provide a general overview of the current and recent history of accumulation, (2) discuss how the spatiotemporal variations in accumulation impact the mass balance as well as the interpretation of mass change from surface elevation change, and (3) investigate the strengths and weaknesses of atmospheric models in reproducing accumulation variations in this sector. The geometry of the Pine Island-Thwaites drainage area provides an excellent moisture pathway into the interior, and any accumulation changes in this sector could be illustrative of changes impacting a much larger area of the ice sheet.

Theme: Climate and accumulation (*It Never Rains in California)*