

C04a - Progress in Quantifying Ice-Sheet Surface Mass Balance: Past, Present and Future

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## **On the height stability of subglacial Lake Vostok and its implications for mass balance studies in Antarctica**

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Lake Vostok, central East Antarctica, is the largest subglacial lake on Earth. Height changes of the ice surface above the lake reflect the integral effect of the processes active within the ice sheet and the subglacial aquifer. The floating ice sheet above the lake offers unique conditions for the determination of components of the local ice-mass balance. The hydrostatic equilibrium attenuates the manifestation of spatial variations in the ice-thickness change in observable surface height changes. We combine different geodetic observation techniques (permanent and campaign GNSS observations, kinematic GNSS profiling, satellite altimetry) to determine height changes above Lake Vostok over more than a decade. Our results demonstrate the stability of the surface height above Lake Vostok throughout the observation period. Rates of surface accumulation, firn densification, basal accretion and local ice-mass balance estimates are derived by introducing observed quantities into the continuity equation of mass flow. Lake Vostok qualifies as a target area for the calibration of satellite laser altimetry over ice, essential for the inference of elevation and mass changes of polar ice sheets from ICESat and ICESat-2 data. We show the influence of ICESat calibration parameters on mass balance estimates. Furthermore, the presented results also constrain the physical conditions in the Lake Vostok system, contribute to our understanding of the influence of the subglacial hydrology on the dynamics of the ice sheet and assist in the interpretation of the Vostok ice core.