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Geophysical and geomorphological observations of the glacier-covered, subantarctic Mount Michael volcano (Saunders Island), South Sandwich Islands

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The nine active volcanoes of the sub-Antarctic South Sandwich Islands are a particularly remote region of active volcanism. Remote sensing methods, including satellite monitoring and aerial surveys, besides rare ship visits during austral summers, are the only means of investigating the uninhabited and largely ice-covered volcanoes. Mount Michael volcano on Saunders Island hosts a permanent active lava lake within its summit crater, a sure indicator of the existence of a shallow magmatic storage and transport system of unknown architecture and depth. Also, more than 75 % of the island's area is glacier covered, which makes the island an important study site for investigating volcano-glacier interactions in the sub-Antarctic climate zone.

We describe new data for the active Mount Michael volcano on Saunders Island, including marine bathymetric and satellite-derived observational data, UAV-derived topographic data, and infra-red camera observations. This data together provide a much higher resolution understanding of the topography, geomorphology, glacial state and dynamics, as well as status of volcanic activity than has been previously achieved. We present a geomorphological and structural analysis of the outer subaerial and shallower submarine flanks of Saunders Island, estimate glacier volumes, morphologies and motion rates, and relate this to the underlying volcano morphology, structural architecture, and edifice stability. All of this is pioneer work at a remote volcano that can be largely regarded as terra incognita. With this study we highlight the unprecedented detail and the valuable information that can be retrieved from modern generation satellites, such as TerraSAR-X and Sentinel-2, as well as UAV-based photogrammetry in particularly remote and inaccessible locations on Earth.