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ADMAP-2: The next-generation Antarctic magnetic anomaly map

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The Antarctic Digital Magnetic Anomaly Project compiled the first international magnetic anomaly map of the Antarctic region south of 60ºS (ADMAP-1) some six years after its 1995 launch (Golynsky et al., 2001; Golynsky et al., 2007; von Frese et al., 2007). This magnetic anomaly compilation provided new insights into the structure and evolution of Antarctica, including its Proterozoic-Archaean cratons, Proterozoic-Palaeozoic orogens, Palaeozoic-Cenozoic magmatic arc systems, continental rift systems and rifted margins, large igneous provinces and the surrounding oceanic gateways. The international working group produced the ADMAP-1 database from more than 1.5 million line-kilometres of terrestrial, airborne, marine and satellite magnetic observations collected during the IGY 1957-58 through 1999.

Since the publication of the first magnetic anomaly map, the international geomagnetic community has acquired more than 1.9 million line-km of new airborne and marine data. This implies that the amount of magnetic anomaly data over the Antarctic continent has more than doubled. These new data provide important constraints on the geology of the enigmatic Gamburtsev Subglacial Mountains and Prince Charles Mountains, Wilkes Land, Dronning Maud Land, and other largely unexplored Antarctic areas (Ferraccioli et al., 2011, Aitken et al., 2014¸ Mieth & Jokat, 2014, Golynsky et al., 2013).

The processing of the recently acquired data involved quality assessments by careful statistical analysis of the crossover errors. All magnetic data used in the ADMAP-2 compilation were delivered as profiles, although several of them were in raw form. Some datasets were decimated or upward continued to altitudes of 4 km or higher with the higher frequency geological signals smoothed out. The line data used for the ADMAP-1 compilation were reprocessed for obvious errors and residual corrugations. The new near-surface magnetic data were corrected for the international geomagnetic reference field and diurnal effects, edited for high-frequency errors, and levelled to minimize line-correlated noise.

The magnetic anomaly data collected mainly in the 21-st century clearly cannot be simply stitched together with the previous surveys. Thus, mutual levelling adjustments were required to accommodate overlaps in these surveys. The final compilation merged all the available aeromagnetic and marine grids to create the new composite grid of the Antarctic with minimal mismatch along the boundaries between the datasets. Regional coverage gaps in the composite grid will be filled with anomaly estimates constrained by both the near-surface data and satellite magnetic observations taken mainly from the CHAMP and Swarm missions.

Magnetic data compilations are providing tantalizing new views into regional-scale subglacial geology and crustal architecture in interior of East and West Antarctica. The ADMAP-2 map provides a new geophysical foundation to better understand the geological structure and tectonic history of Antarctica and surrounding marine areas. In particular, it will provide improved constraints on the lithospheric transition of Antarctica to its oceanic basins, and thus enable improved interpretation of the geodynamic evolution of the Antarctic lithosphere that was a key component in the assembly and break-up of the Rodinia and Gondwana supercontinents.

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