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# Significant geomagnetic differences in both phase and amplitude observed at "conjugate" polar latitudes near the December 1903 Solstice

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During Roald Amundsen's exploration of the Northwest Passage (1903–1906) he conducted systematic measurements of diurnal and seasonal variations of the north magnetic dip pole (NMDP) at Gjøahavn ($\sim$ 68 N, 95 E). The NMDP variations have been largely interpreted as indicating control by the polarity of the interplanetary magnetic field (IMF); the Svalgard-Mansurov (S-M) effect. In Sir Robert Scott's Discovery expedition, geomagnetic observations were made in 1903 from Cape Armitage, Antarctica ($\sim$78 S, 168 E). Unwittingly, the measurements of Amundsen and Scott were acquired near conjugate ends of the same magnetic field lines. While their separation in solar local time is $\sim$ 5 hours, they differ in magnetic local time less than 1/2 hour. However, up to this time no direct comparison of the two sets of magnetic observations has ever been made.

This presentation contains an analysis of magnetic perturbations observed at both locations for comparison with contemporary and present day monthly-averaged diurnal variations, even if the overlap in data among these expeditions is somewhat limited. The near magnetic conjugacy of Gjøahavn- Cape Armitage locations makes these measurements valuable. Our analysis shows: (1) While similar variations appeared at both ends of the joining magnetic field they manifest significant differences in both phase and amplitude, (2) present day NMDP variations appear consistent with the S-M effect analyses when compared with satellite measurements of solar wind/IMF measurements, (3) differences at the "conjugate" locations cannot be explained in terms of the S-M effect alone. The roles of lobe cell and ionospheric conductance at polar magnetically "conjugate" locations are used to explain the observed phase and amplitude differences.