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Determination of the Earth's lithospheric magnetic field using vector gradient data from the Swarm satellite constellation

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One of the main goals of the Swarm three-satellite constellation mission is to determine the lithospheric field globally with the best possible resolution. To achieve that, explicit advantage of the constellation aspect of Swarm has to be taken by using gradient estimates. We derive lithospheric field models using more than one year of East-West and North-South magnetic gradient data, approximated by first differences of field vector data between the two lower Swarm satellites and along each satellite orbit, respectively. Despite the current relatively high altitude of 450 km of the Swarm satellites, the results are promising. We find that Swarm gradient data are less sensitive to large-scale external field fluctuations and enhance the resolution of the determined lithospheric field compared to only vector data. The derived models agree very well with previous models derived from CHAMP data, serving as an initial validation of the Swarm mission.