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The distribution of the ring current: opportunities for the swarm mission.

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The combined magnetic effect of the Earth's ring current (RC), the system of connecting field aligned currents (FACs) and the ionospheric polar currents, forms the dominant external influence on the measured Geomagnetic field. These induced magnetic signals have significant effect at low Earth orbit (LEO), and will be surveyed by the three Swarm spacecraft. SWARM observations will benefit from other spacecraft information, however, and present indices, such as Dst, are presently not good indicators (the RC can be different during storm development and recovery for similar Dst). A space based indicator is needed, for example, which maps RC response, in particular, to better define these influences and provide corrections to the main geomagnetic field models. In anticipation of the direct comparison of SWARM and other spacecraft, preliminary study of the influence of the RC using Cluster, Champ and other LEO data is in progress, including a full-circle determination of the RC vector directly from Cluster 4-spacecraft perigee observations, under non-storm conditions (Dst > -30 nT). The results confirm that the in situ average measured current density (in the radial range 4–4.5RE) is asymmetric in MLT, ranging from 9 to 27 nAm−2 (growing from 10 to 27 nAm−2 as azimuth reduces from about 12:00MLT to 03:00 and falling from 20 to 10 nAm−2 less steadily as azimuth reduces from 24:00 to 12:00MLT). This result is consistent with the operation of region-2 field aligned-currents (FACs), which are expected to flow upward into the ring current around 09:00MLT and downward out of the ring current around 14:00MLT. We note, however, that it is also consistent with a possible asymmetry in the radial distribution profile of current density and that part of the enhanced current could reflect an increase in the mean AE activity (during the periods in which Cluster samples those MLT). A specific problem is therefore to match the interpretation of the magnetic signals seen at LEO and those measured directly within the central RC region, where dawn-dusk RC asymmetries, seen both under storm and non-storm conditions, have some discrepancy between near-Earth and in-situ estimates. This could result from FAC connectivity, but at least call for a new consideration of the Dst correction in main field modeling.