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Discrimination between Internal and External origin contributions from LEO satellite magnetic field data

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The evaluation of the external origin contribution (B_EXT) in geomagnetic field satellite observations in the near Earth location (1.2 R_E<R<1.5 R_E; RE being the Earth radius) during active magnetic conditions is one of the key problem in the Space Weather context. We propose an innovative algorithm able to discriminate the external from the internal origin (B_INT) contributions in real time. Differently from the currently implemented procedure, which relies on models based on statistics of several months of data, the proposed algorithm will generate directly from Level 1 magnetic data a level 2 product made up of B_INT and B_EXT. The algorithm is based on the Adaptive Local Iterative Filtering (ALIF) technique [Cicone et al., 2016; Piersanti et al., 2017]. ALIF is able to decompose non-stationary time series into several intrinsic mode functions (IMFs) which are functions oscillating around zero, but not necessarily with constant frequencies and amplitudes. Then, by applying the statistical test described in Alberti and Piersanti [2016] and by a multiscale statistical analysis, the algorithm discriminates between the different intrinsic "macro-scales" of LEO satellite observations. Consequently, the algorithm is able to separate B_INT from B_EXT with high efficiency. We applied this algorithm to SWARM magnetic field data. We compared the evaluated B_INT with CHAOS-6 model obtaining comparable results, leading the possibility to increase the accuracy of CHAOS-like models. Concerning B_EXT, our results lead to the identification of different magnetospheric current systems through which each satellite orbits (such as the Ring Cur-rent, the Tail current and the Magnetopause current). Finally, the correct identification of the magnetospheric field in LEO satellite is of crucial role for the identification of the ionospheric origin field contribution.