Peculiarities of geomagnetic field measurements at Lampedusa island in relation with geomagnetic activity, seasons and tidal modes: possible link with the sea level rise and current flows in the Mediterranean

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In the frame of the geomagnetic depth sounding (GDS) using Single Station Induction Arrows (SSIA), data from an island and nearby coastal sites can provide useful information regarding the surrounding crust structure. In this regard, ultra low frequency (ULF, 1 mHz–5 Hz) waves, originated by solar wind-magnetosphere interactions, represent a natural probing source of the ground from sea-crust surface down to the mantle due to their skin depth in the salt water (1-D infinite half space) of the order of $\sim 10^4$ m for a frequency of $\sim 1$ mHz and a conductivity of $\sim 3$ S/m. The INGV geomagnetic observatory installed at Lampedusa island (geographic coordinates 35°31’N; 12°32’E, altitude 33 m a.s.l.), and operating since 2007, offers a great opportunity for probing the Earth's crust in the frame of 1-D models. In this work, geomagnetic field variations collected from 2017 to 2021 are examined by using spectral approaches, providing evidence of the influence of sea salt water with the SSIA approach in relation to different geomagnetic activity levels, seasons and tidal modes. We also study a possible relationship with the sea level variations driven by astronomical tides. A possible link between SSIA variations with water flow modifications, probably linked to the induced electric field of sea salt water flows embedded into the main Earth's magnetic field, is shown.