

# Cross-disciplinary study of the possible link between space weather, geomagnetic storms and cetacean mass strandings

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Cetacean (whales, dolphins and porpoises) mass strandings are a longstanding mystery in the field of marine biology and continue to be recorded in coastal environments around the world. It is unclear whether these events are generally increasing in number or whether the increase is due to increased observer and research efforts, or both. In cetacean mass strandings anywhere from a few to several hundred otherwise healthy animals strand in onshore environments, often for no apparent reason. In some instances, cetacean mass strandings have been attributed to impacts caused by naval sonar and, recently, a post-event analysis has implicated the use of multi-beam echosounders. However, these anthropogenic influences still do not explain the vast majority of cetacean mass strandings. Theories as to the cause of these cetacean mass strandings include magnetic anomalies and meteorological events, which are thought to disorientate the cetaceans. It has been speculated that due to the possible magnetic field sensing utilized by cetaceans, magnetic anomalies, of internal and/or external origin, could be at least partially responsible for the strandings. Internal magnetic anomalies are caused by localized structures primarily in the Earth's crust and the external, sometimes large-amplitude, magnetic anomalies are caused by geomagnetic storms. Geomagnetic storms having widely varying spatiotemporal signatures are caused by active solar and space weather phenomena.

While the possible link between cetacean mass strandings and magnetic anomalies has been speculated previously, no definitive work exists for quantifying this idea. In this paper, our cross-disciplinary NASA-BOEM-IFAW team composed of space weather experts, marine mammal biologists and marine mammal stranding response experts will report the initial results of the first detailed quantification of the possible link between space weather, spatiotemporal signatures of geomagnetic storms and cetacean mass strandings. We use mass stranding data from a number of "hotspots" around the globe and correlate the events with both global and local geomagnetic activity indicators. A number of statistical techniques are deployed to extract information about possible statistical association between mass strandings and space weather.

Keywords: geomagnetic storms, cetacean mass strandings