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Marine induction studies based on measurements of vertical gradient of scalar magnetic field. A concept and 3-D model studies

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Most of marine EM studies are based on sea-bottom vector measurements which are logistically and instrumentally demanding and rather expensive. Recently Kuvshinov et al (2013) proposed and proved a low-cost and easy-to-deploy magnetic survey concept which exploits sea surface scalar measurements. The concept is based on responses that relate variations of the scalar magnetic field at offshore survey sites with variations of the horizontal magnetic field at onshore base site. These responses are a mixture of elements of tipper and horizontal magnetic tensor, and thus they can be used to probe the electrical conductivity of the Earth.
In the present work we introduce alternative responses that relate variations of vertical gradient of the scalar magnetic field at survey sites with variations of the horizontal magnetic field at a base site. We show that these responses are a mixture of elements of inter-site magnetotelluric tensor, and thus they also can be exploited for EM sounding of the Earth. We discuss the results of 3-D model studies aimed to investigate the sensitivity of the newly introduced responses to hypothetic plume structure beneath Hawaii islands.