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Investigation of temporal magnetic field variations on the Aeolian Islands by applying the equivalent source technique

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Aeromagnetic data from the Vulcano-Lipari complex are available for the years 1999, 2002 and 2004. In addition results from a magnetic survey, implemented by Agip in the year 1985, are available.

Temporal magnetic field variations in volcanic areas can be caused by e.g. changes in the geothermal system or by tectonic processes and are determined by comparing the results of different epochs. However, as both horizontal and vertical coordinates differ between the magnetic data sets of different airborne surveys, data interpolation in 3D is the key issue. An effective way to compare the data sets obtained on different levels is the method of field-continuation between irregular surfaces by applying the equivalent source concept.

Previous investigations have shown that the method by Ivan (1994) represents a very suitable tool and has been implemented for the use of unevenly distributed scattered data. Two features of the algorithm are important for the present demands:

1. Field-continuation between arbitrary surfaces allows continuation to a surface very close to the magnetic sources, which means that also small anomalies that are located at very shallow depths just underneath the topographic surface are registered.

2. The possibility to use unevenly scattered data is very important, because no (a priori) gridding is necessary and therefore the quality of the original data remains unchanged. Since the airborne magnetic data is recorded along spatially

separated flight lines (every few meters along track, but about 200 m across track), gridding could cause falsified results as it inherently implies a cross-line over-sampling.

The accuracy of the field continuation depends on the sampling and truncation effects that inherently appear in the practical realization of equivalent source methods. This problem is studied in more detail in order to determine the significance of magnetic field variations and to avoid wrong conclusions. For this purpose magnetization models of the area have been constructed to test the algorithm on synthetic data.