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Derivation of terrestrial and martian crustal magnetizations using magnetic data

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Modeling magnetic crustal anomalies is an essential tool, as it allows the properties of deep seated magnetic sources to be characterized. However, the relationship between observed magnetic anomalies and magnetic sources is non unique. In this study, forward and inverse methods are compared to investigate the nature of crustal magnetization on Mars and Earth. Simple forward models, such as equivalent dipoles, uniformly magnetized prisms or cylinders, are used to predict the observed magnetic field. The inverse approach considers the sources as dipoles. Here a generalized nonlinear algorithm is used to derive the parameters of one or several dipoles, based on magnetic measurements and on a priori information deduced from the direct approach. First terrestrial aeromagnetic anomalies over the Armorican Massif (Brittany, France) are studied. Seismic surveys were conducted in this area which gives more constraints on the properties of the magnetic sources. Preliminary results show good agreement between geological and geophysical informations and results of both the direct and inverse approaches. This demonstrates the ability of the method to characterize the crustal magnetization at local scale. Martian magnetic anomalies over Terra Sirenum are also studied. The scale (x1000 km), as well as the measurement altitude (100-400 km) are different than in the terrestrial case. The magnetic sources seem to be deep (60 km) and intensely magnetized (50 A/m) in the martian crust. Preliminary results on other martian magnetic anomalies, as well as implications on Mars' evolution will be presented.