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A low-cost device for measuring local magnetic anomalies in volcanic terrain

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Reconstructions of the past behavior of the geomagnetic field critically depend on the magnetic signal stored in extrusive igneous rocks. These rocks record the Earth's magnetic field when they cool and retain this magnetization on geological time scales. In rugged volcanic terrain, however, the magnetic signal arising from the underlying flows may influence the ambient magnetic field as recorded by newly formed flows on top. To measure these local anomalies in the Earth's magnetic field directly we developed a low-cost field magnetometer based on a flux gate sensor. To improve the accuracy of the obtained paleomagnetic vector and user friendliness of the device we combined this flux gate sensor with tilt and GPS sensors to rotate the measured magnetic vector to true North, East and down. The data acquisition is done using a ruggedized laptop and data are immediately available for first order interpretation. The first measurements done on Mt. Etna show local variations in the ambient magnetic field larger than expected, and illustrate both the accuracy (certainly < 0.5 degrees in paleomagnetic direction) and potential of our new device.