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The CrowdMag App – turning your smartphone into a travelling magnetic observatory

Richard Saltus and Manoj Nair
United States (rick.saltus@noaa.gov)

In 2014, we started the "CrowdMag" Project to collect vector magnetic data from digital magnetometers in smartphones. In October 2014, we released our first-generation Android and iOS apps. Currently, the CrowdMag Project has more than 15,000 enthusiastic users contributing more than 12 million magnetic data points from around the world. NOAA's National Centers for Environmental Information (NCEI), in partnership with the University of Colorado's Cooperative Institute for Research in the Environmental Sciences (CIRES) develops magnetic field models to aid navigation, resource exploration and scientific research. We use observatories, satellites and ship/airborne surveys to measure the magnetic data. However, the measurements leave gaps in coverage, particularly for short-wavelength urban noise. Our ultimate goal is to use data from the CrowdMag Project to improve global magnetic data coverage.

Here we present some early results from the analysis of the crowdsourced magnetic data. A global magnetic model derived solely based on CrowdMag data is generally consistent with satellite-derived models such as World Magnetic Model. A unique contribution of the CrowdMag Project is the collection of ground level magnetic data in densely populated regions with an unprecedented spatial resolution. For example, we show a magnetic map (by binning the data collected into 100x100m cells) of central Boulder using 170,000 data points collected by about 60 devices over the duration October 2014- January 2016. The median magnetic field value is consistent with the expected magnitude of the Earth's background magnetic field. The standard deviation of the CrowdMag total field (F) values is much higher than the expected natural (i.e. diurnal and geologic) magnetic field variation. However, the phone's magnetometer is sensitive enough to capture the larger magnitude magnetic signature from the urban magnetic sources. We discuss the reliability of crowdsourced magnetic maps and their applications to navigation, global models, and local geologic or environmental investigations.