High-resolution meteorological data assimilation using smartphone observations

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Background Information

Today, there are nearly one hundred million Android and IOS smartphones with atmospheric pressure sensors, with the number to reach a billion with a few years. Such pressure observations offer the potential to describe the fine-scale structures of the atmosphere in an unprecedented way, leading to substantially better weather prediction of key weather phenomena, such as severe convection. Atmospheric pressure can also provide improved determination of the elevation of smartphones, with uses far beyond meteorological prediction. The proposed research will evaluate the value of smartphone pressures for these applications, making use of the limited real-time smartphone pressure data now available from two small private sector firms. Improved quality control algorithms will be created and new approaches for using atmospheric pressure for determining the height of the phones will be developed and evaluated. The resulting atmospheric pressures will be used to initialize high-resolution atmospheric models to evaluate whether smartphone pressures can contribute to improved weather prediction. The data assimilation will be done through a large (50-100) ensemble of high-resolution numerical weather forecasts, thus the request for substantial Google Cloud computing.

Objective

To develop robust approaches for the quality control and determination of the vertical position of smartphone pressure sensors, and the development and testing of data assimilation approaches for the use of such pressures in numerical weather prediction.

Outcomes

1. Demonstration that large quantities of smartphone pressures can be gathered using commercial apps.
2. Demonstration that the quality control algorithms developed in the project can produce a high-quality atmospheric pressure dataset.
3. Demonstration that the accurate elevations can be determined from algorithms that makes use of high-resolution terrain data sets and intelligent use of high-frequency pressure (and possibly accelerometer) data.
4. Demonstration that pressure and pressure change observations from smartphones can be used to significantly improve high-resolution weather forecasts, with specific evaluation for severe convection and weather phenomena near terrain.