Developing an infrastructure for real time predictions of personal and poulation based particulate matter exposure

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Atmospheric particular Matter (PM), is a source of concern for human health. Several models for predicting PM concentrations using satellite surface reflectance measurements have beeen developed. To further develop an infrastructure capable of utilizing remote sensing data for monitoring and minimizing personal and population level PM exposure, an iphone/ipad app was created which collects geographical locations and sampling times and uploads the data to cloud storage (Dropbox). Computers connected to Dropbox utilize Python scripts coupled with ArcMap to associate iphone/ipad locations with a data set of satellite surface reflectance values. Values are updated and returned to the iphone/ipad every 5 minutes.

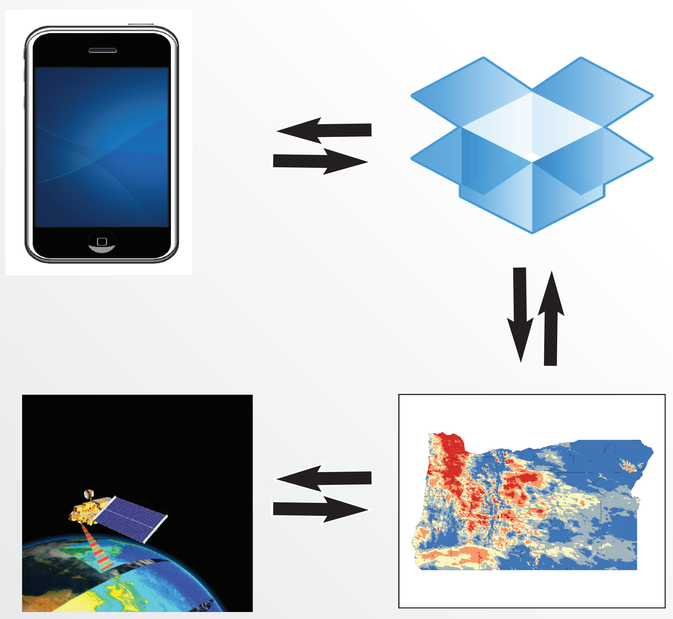

Figure 1: Project overview. Latitude, longitude, and time observations are collected from an ihpone or ipad at regular intervals. Collected data is sent to a cloud storage program (Dropbox). Computers connected to Dropbox check for and process new data every five minutes. Oregon state wide mean and standard deviations maps of Moderate Resolution Imaging Spectroradiometer (MODIS) satellite surface reflectance measurements are sampled at the given locations, and corresponding reflectance values are sent back to Dropbox. Values can then be acessed and downloaded to the iphone/ipad minutes after location data is sent.

Introduction

Method Overview

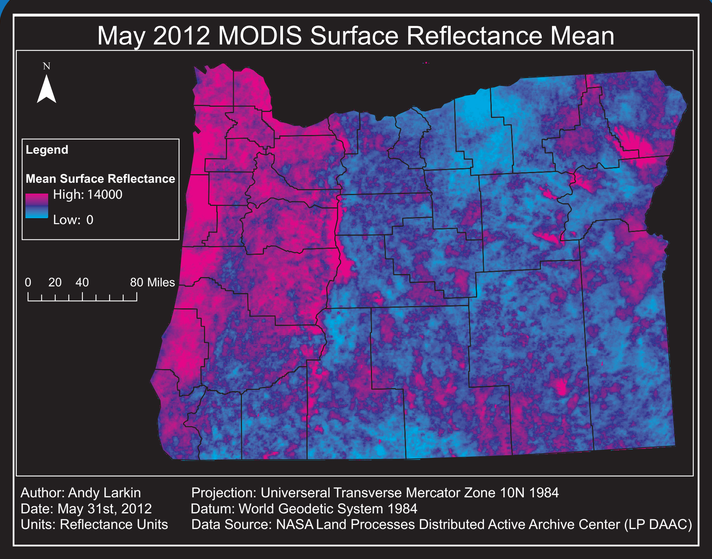

Figure 2: Averaged (mean) MODIS satellite surface reflecatance measurements across Oregon. Aveage raster was created from all MODIS surface reflectance observations between May 1st and May 31st in which Oregon was included in the sampling region (n=52).

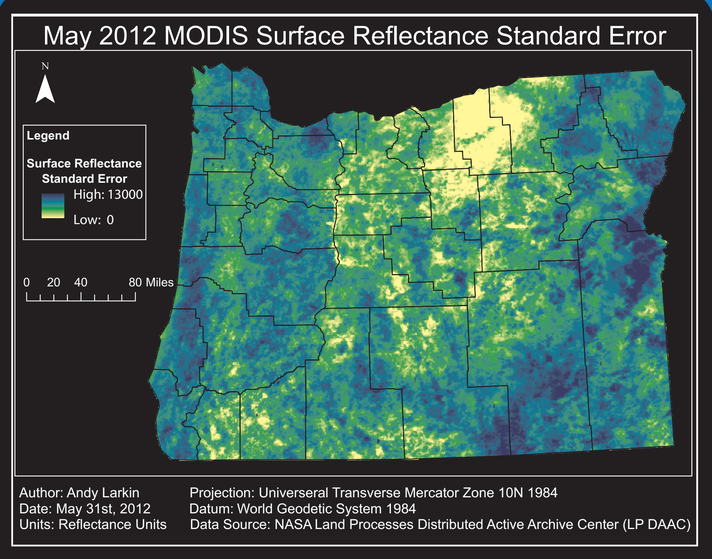

Figure 3: Standard error of MODIS satellite surface reflecatance measurements across Oregon. Standard error was created from the surface reflectance measurements used for surface mean calculation (n=52).

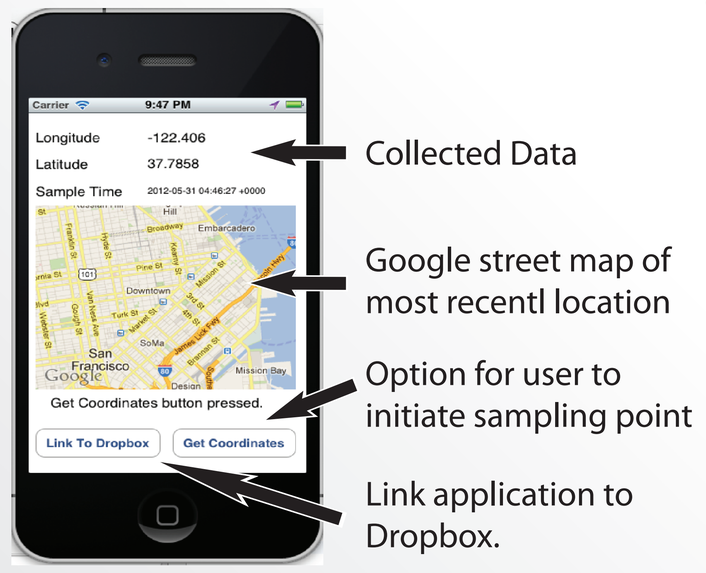

Figure 4: User interface of the iphone application.

MODIS Surface Reflectance

iphone User Interface

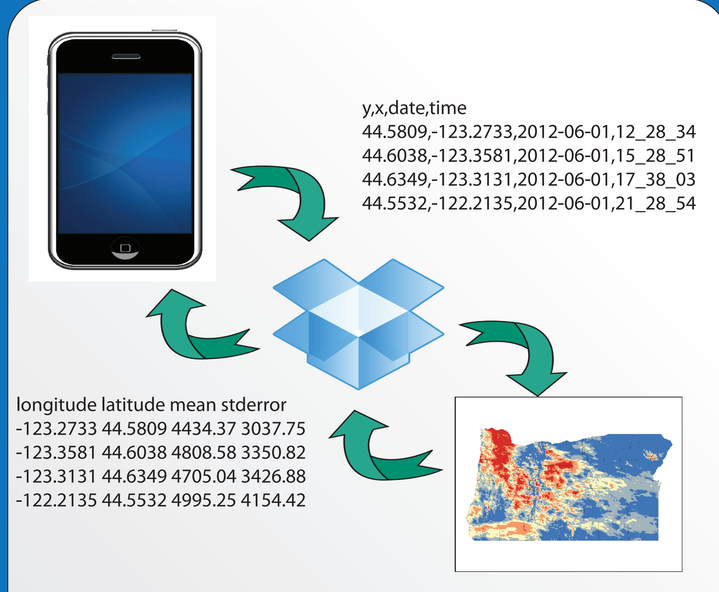

Figure 5: Randomly selected coordinates within 10 km of Corvallis city hall were used as inputs for model testing via the Xcode iphone simulator and computers connected to Dropbox. Files sent from the iphone to the Dropbox (top right) and from Dropbox to iphone simulator (bottom left) delivered expected data.

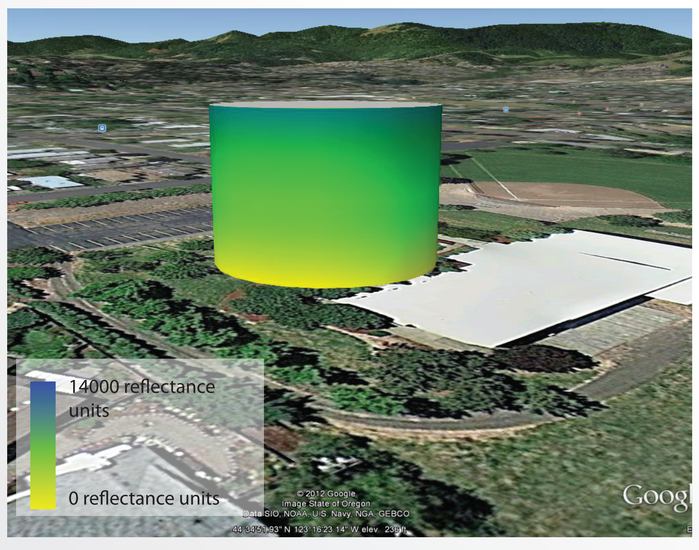

Figure 6: Point 1 from the simulated data set (-123.2733 E, 44.5809 N) shown as a 3-D object in Google Earth. Object width (20m) represents iphone uncertainty with appended GPS unit, height represents time interval until next sample point (10 meters equals 1 hour), and color represents mean value +/-1 standard error.

* An iphone/ipad app was created as part of an infrastructure for modeling PM exposure
* Maps of mean and standard deviation surface reflecatnce measurements were created in order to develop and test the iphone and cloud storage infrastructure components
* Simulations with randomly chosen coordinates suggest the infrastructure recieves location data from and send corresponding reflectance values to the iphone as expected.
* Presenting results in Google maps will allow for user friendly interpretation of future model predictions and uncertainties

Results

Conclusions

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Data Source
MODIS surface reflectance data were obtained through the online data pool at the NASA Land Processes Distributed Active Archive Center (LP DAAC)