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Geocarto International Special Issue on NASA Earth Science Satellite Data for Applications to Public Health

Background

- ◆ **At the 2011 Applied Sciences Air Quality and Public Health review in Santa Fe, NM, it was announced that a special issue of the journal *Geocarto International* (*Geocarto*) would be published focusing on “NASA Earth Science Satellite Data for Applications to Public Health”**
- ◆ **This special issue would be edited by Dr. Dale Quattrochi (NASA/MSFC). John Haynes (Program Manager for NASA Air Quality and Public Health), and Sue Estes (NASA Deputy Program Manager for NASA Air Quality and Public Health)**
- ◆ **7 papers have been selected to appear in this special issue**
- ◆ **The special *Geocarto* issue is set to be published in early 2014**



Summary of Papers

“Climate Change and Human Health: NASA and Centers for Disease Control (CDC) Collaborate to Develop New Tools”. (Invited) George Luber (CDC)

- Founded in 2009, the mission of the Climate and Health Program at the Centers for Disease Control and Prevention is to build capacity to anticipate the health threats of climate change and prepare the nation’s public health infrastructure to meet this challenge.
- With the understanding that climate impacts will be place-specific and path-dependent (Hess et al. 2008), one of our principal priorities is to develop spatially explicit approaches to assessing vulnerability to climate-sensitive health threats.
- NASA’s remote sensing assets are playing a central role in our efforts to build tools that link exposure, health outcome, and vulnerability in a spatial scale consistent with public health data, typically from the census tract or at the county level.





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“Use of Earth Observations in Public Health “(Invited). Qihao Weng (Indiana State U.), Bing Xu, (U. of Utah), Xuefei Hu (Beijing Normal U.), and Hua Liu (Old Dominion U.)

- The Earth Observation (EO) data with their advantages in spectral, spatial, and temporal resolutions have demonstrated their great value in providing information about many of the components that comprise environmental systems and ecosystems for decades that are crucial to the understating of public health issues.
- This paper is a literature review This literature review that shows how in conjunction with in situ data collection, EO data has been used to observe, monitor, measure, and model many environmental variables which are associated with disease vectors and air quality.





**Geocarto International Special Issue on NASA Earth Science Satellite
Data for
Applications to Public Health**

“Improving Decision-Making Activities for Meningitis and Malaria”. Pietro Ceccato (Earth Science Institute, Columbia University)

- Public health professionals are increasingly concerned about the potential impact that climate variability and change can have on infectious diseases
- The International Research Institute for Climate and Society (IRI) is developing new products to increase the public health community’s capacity to understand, use, and demand the appropriate climate data and climate information to mitigate the public health impacts of climate on infectious diseases, in particular Meningitis and Malaria
- This paper presents and improved product that has been developed for monitoring dust for forecasting risks of Meningitis, and for monitoring temperature and rainfall and integrated into a vector capacity model for forecasting risks of Malaria epidemic





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“Meteorological parameters as predictors for seasonal influenza”. Rabina P. Soebiyanto (USRA/GSFC) and Richard Kiang (NASA/GSFC).

- Seasonal influenza causes 5 million severe illnesses and 500,000 deaths annually worldwide. Among the factors that have been linked to influenza transmission are meteorological parameters, especially temperature and humidity. Low temperature and humidity have been associated with influenza seasonality in the temperate regions, whereas the tropics typically observe higher influenza transmission during rainy season.
- Low temperature and humidity have been associated with influenza seasonality in the temperate regions, whereas the tropics typically observe higher influenza transmission during rainy season.
- This study assesses the role of meteorological factors on influenza transmission using both satellite-derived and ground station data for temperate and sub-tropical regions. Several techniques – including Auto Regressive Integrated Moving Average (ARIMA) and Neural Network (NN) – were employed to assess the meteorological indicators and for forecasting.
- Findings show that measures of temperature, humidity, rainfall and solar radiation can be used as indicators to forecast influenza. We also found that rainfall can be used as a predictor for sub-tropical region, but not all in all temperate regions. Overall, our models can predict the timing of influenza peak.





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“Statistical Data Fusion of Multi-sensor AOD over the Continental United States”. Sweta Jinnagara Puttaswamy (Emory U.), Hai. M. Nguyen (Jet Propulsion Laboratory), Amy Braverman (JPL), and Yang Liu (Emory U.)

- This paper illustrates two techniques for merging daily Aerosol Optical Depth (AOD) measurements from satellite and ground-based data sources to achieve optimal data quality and spatial coverage.
- The first technique is a traditional universal kriging approach employed to predict AOD from multi-sensor aerosol products that are aggregated on a reference grid with AERONET as ground truth.
- The second technique is Spatial Statistical Data Fusion (SSDF); a method designed for massive satellite data interpolation.
- In this study, we use aerosol data products from two satellite instruments: the Moderate Resolution Imaging Spectrometer (MODIS) and the Geostationary Operational Environmental Satellite (GOES), covering the continental United States.





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“Spatiotemporal Variations in Heat-Related Health Risk in Three Midwestern U.S. Cities Between 1990 and 2010”. John Webber, Daniel P. Johnson, and Vijay Lulla (Indiana University/Purdue University at Indianapolis).

- Mortality from extreme heat is a leading cause of weather-related fatality, which is expected to increase in frequency with future climate scenarios.
- Numerous researchers utilizing one dimensional time series datasets of the mortality signal have examined temporal variations in heat-related mortality. However, there is a lack of studies examining the spatiotemporal dynamics of heat-related health risk
- This study examines the spatiotemporal variations in heat-related health risk in three Midwestern cities in the United States between the years 1990 to 2010; cities include Chicago, Illinois, Indianapolis, IN, and Dayton, OH
- In order to examine these variations we utilize the recently developed Extreme Heat Vulnerability Index (EHVI) that uses a principal components solution to vulnerability
- The EHVI incorporates data from the U.S. Decadal Census and remotely sensed variables to determine heat-related vulnerability at an intra-urban level (census block group).





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“Environmental Public Health Applications Using Remote Sensed Data”.
**Mohammad Al-Hamdan (USRA/NSSTC), William Crosson (USRA/NSSTC),
Sigrid Economou (CDC), Maury. Estes (USRA/NSSTC), Sue. Estes (USRA/
NSSTC), Sarah Hemmings (USRA/NSSTC), Shia Kent U. of Alabama at
Birmingham), Mark Puckett (UAB), Dale Quattrochi (NASA/MSFC), Doug
Rickman (NASA/MSFC), Gina Wade (Von Braun Center for Science and
Industry/Huntsville, AL) and Leslie McClure (UAB).**

- This paper describes a remote sensing and GIS-based study that has three primary objectives:
- (1) characterize fine particulate matter (PM_{2.5}), insolation and land surface temperature using NASA satellite observations, EPA ground level monitor data and North American Land Data Assimilation System (NLDAS) data products on a national scale;
- (2) link these data with public health data from the REasons for Geographic And Racial Differences in Stroke (REGARDS) national cohort study to determine whether these environmental risk factors are related to cognitive decline, stroke and other health outcomes; and
- (3) disseminate the environmental datasets and public health linkage analyses to end-users for decision-making through the Centers for Disease Control and Prevention (CDC).

