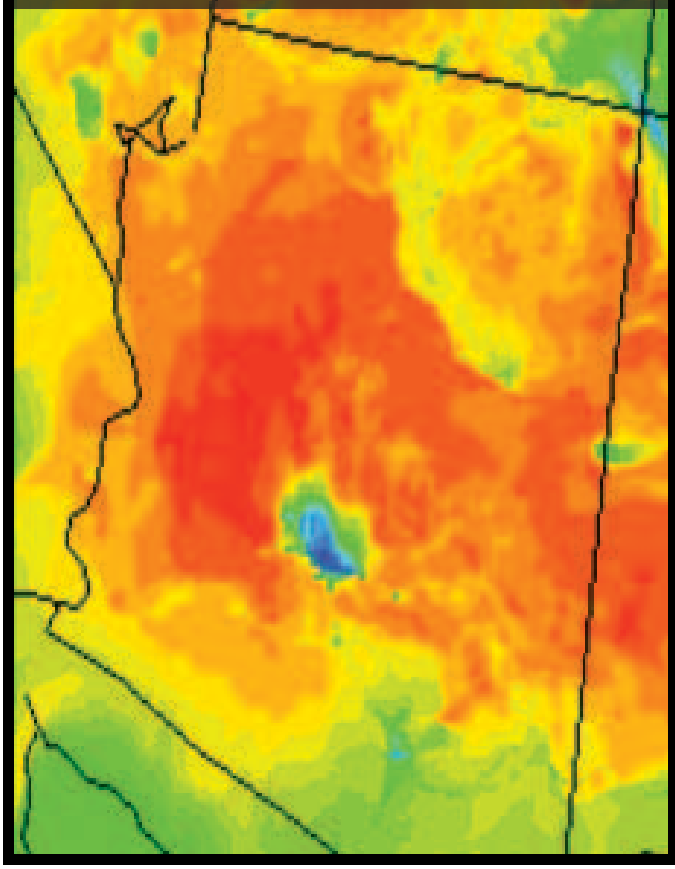
National Aeronautics and Space Administration

Tracking Public Health Impacts from Ozone and Dust in the Southwest United States

A dust storm over Maricopa, Arizona in September, 2007. Dust and the pathogens it carries have been blamed for exacerbating some cardiovascular and respiratory diseases, including asthma.

High concentration of ozone in Arizona, as modeled by Community Multiscale Air Quality Modeling System (CMAQ).



The rate of asthma among children in the northern hemisphere has more than doubled in the last 20 years.

Project Outcomes:

Enhance decision-making for health through timely forecasts of air quality events

Provide running 36-48 hour forecasts of significant quantities of ozone and aerosols via the Internet

Make positive impact on health cost savings and improved decision-making for hospital management

Improve clinical understanding of the development of illnesses related to poor air quality

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Summary

The Environmental Public Health Application Systems (ENPHASYS) project bridges individual and community health by forecasting atmospheric ozone, dust, and other aerosols that trigger asthmatic responses or myocardial infarction (MI). Many airborne contaminants exacerbate existing health problems, increase health care costs, and reduce a person's ability to work, costing communities money. In order to identify incidences of environmentally caused health problems, the Center for Disease Control (CDC) developed the Environmental Public Health Tracking Network (EPHTN). States participate in the EPHTN by providing input to the CDC. New Mexico's system focuses on asthma and MI tracking and surveillance. The ENPHASYS project is working closely with the New Mexico Department of Health to provide dust and aerosol forecast products to Environment Public Health Tracking System (EPHTS). The overarching objective is to assimilate Earth science results from MODIS, GLORY, and CALIPSO into the Community Multiscale Air Quality Modeling System (CMAQ) and Dust REgional Atmospheric Model (DREAM) models to produce ozone, aerosol, and dust forecasts and to generate relevant health-related information for EPHTS public health users.

Societal Benefits

Several important community benefits arise from timely health alerts of pending atmospheric dust and aerosol episodes. With adequate forewarning (36-48 hours), hospitals could adjust staffing needs to cope with periodic increases of inpatients and to provide better care at lower operating costs. Increased lead-time allows emergency room personnel more time to diagnose respiratory cases, thereby reducing the number of false-positive diagnoses for infectious respiratory diseases. With the ability to distinguish among hospital admissions for chronic respiratory and cardiovascular patients and those admitted as a result of air quality episodes, it should be possible to improve longitudinal studies of asthma as a progressive disease of the lungs, and to diagnose those at risk of MI.

Project Details

The project has three components: (1) integrate the DREAM into the Nonhydrostatic Meso Model (NMM) for finer resolution forecasts of dust conditions, and use EPA's CMAQ model to model ozone, fine particulates, and greenhouse gases, (2) develop seasonal dust source maps from NASA satellite products, and (3) transition these outputs into functional New Mexico EPHT and CDC EPHTN tracking capabilities.

DREAM modeling abilities and resolution were greatly improved by the integration of NMM, which takes advantage of National Weather Service developments in prediction accuracy and reliability for health service applications. Comparing DREAM/NMM forecasts of dust source patterns with a bimonthly product derived from NASA satellite data reveals significantly different outcomes. Expectations are that this line of study will lead to great improvements in DREAM and CMAQ forecasts.

Dust source masks are derived from MOD13A2 (a 16-day NDVI product) combined with MCD12Q1 (a new vegetation class from MODIS) to locate barren ground on a bimonthly basis. These masks are assimilated into the DREAM/NMM and CMAQ models to produce hourly forecasts of dust and ozone concentrations in the southwestern United States. Initially, results will be used for qualitative and quantitative comparisons. This assessment will be evaluated against verification and validation tests on DREAM/NMM outputs to assess model improvements.

Working closely with public health officials, model outputs are integrated as data providers within the larger framework of the EPHTN. These products are available to users via web-based application services within EPHT. Though early results are promising, ENPHASYS is in midstream and all results are considered preliminary.

For more information about this project

Stan Morain, EDAC
The University of New Mexico
smorain@edac.unm.edu

Bill Sprigg
The University of Arizona
wsprigg@u.arizona.edu

NASA APPLIED SCIENCES PROGRAM & PUBLIC HEALTH

This application area focuses on the use of NASA assets to support planning and decision making for the public health, medical, and environmental health sectors. The application includes epidemiologic surveillance of infectious disease, environmental health, and emergency response and preparedness. Public Health also explores issues of toxic and pathogenic exposure, natural and man-made hazards for risk characterization and mitigation, and improvements to health and safety

Key Web sites

ENPHASYS Project Homepage:
http://enphasys.unm.edu

Applied Sciences Public Health:
http://appliedsciences.nasa.gov/public-health