



NASA Satellite Observations: A Unique Asset for the Study of the Environment and Implications for Public Health

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2006 NASA Strategic Plan

NASA Strategic Goal 3

Develop a balanced overall program of science, exploration, and aeronautics consistent with the redirection of human spaceflight program to focus on exploration.

NASA Sub-Goal 3A:

Study Earth from space to advance scientific understanding and meet societal needs.

*NASA's partnership efforts in global modeling and data assimilation over the next decade will shorten the distance from observations to answers for important, leading-edge science questions. **NASA's Applied Sciences program will continue the Agency's efforts in benchmarking the assimilation of NASA research results into policy and management decision-support tools that are vital for the Nation's environment, economy, safety, and security.** NASA also is working with NOAA and inter-agency forums to transition mature research capabilities to operational systems, primarily the polar and geostationary operational environmental satellites, and to utilize fully those assets for research purposes.*

Applied Sciences Program

Eight Program Elements



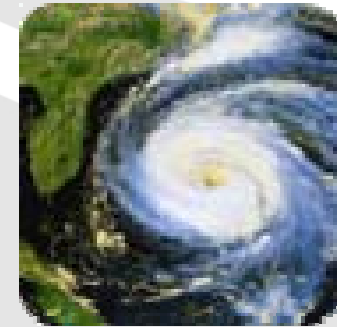
**Agricultural
Efficiency**



Air Quality



Climate



**Disaster
Management**



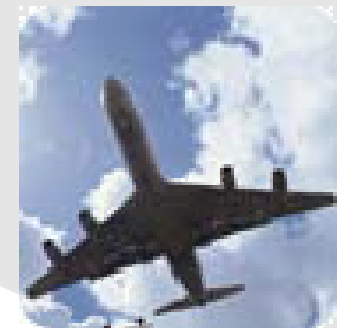
**Ecological
Forecasting**



Public Health

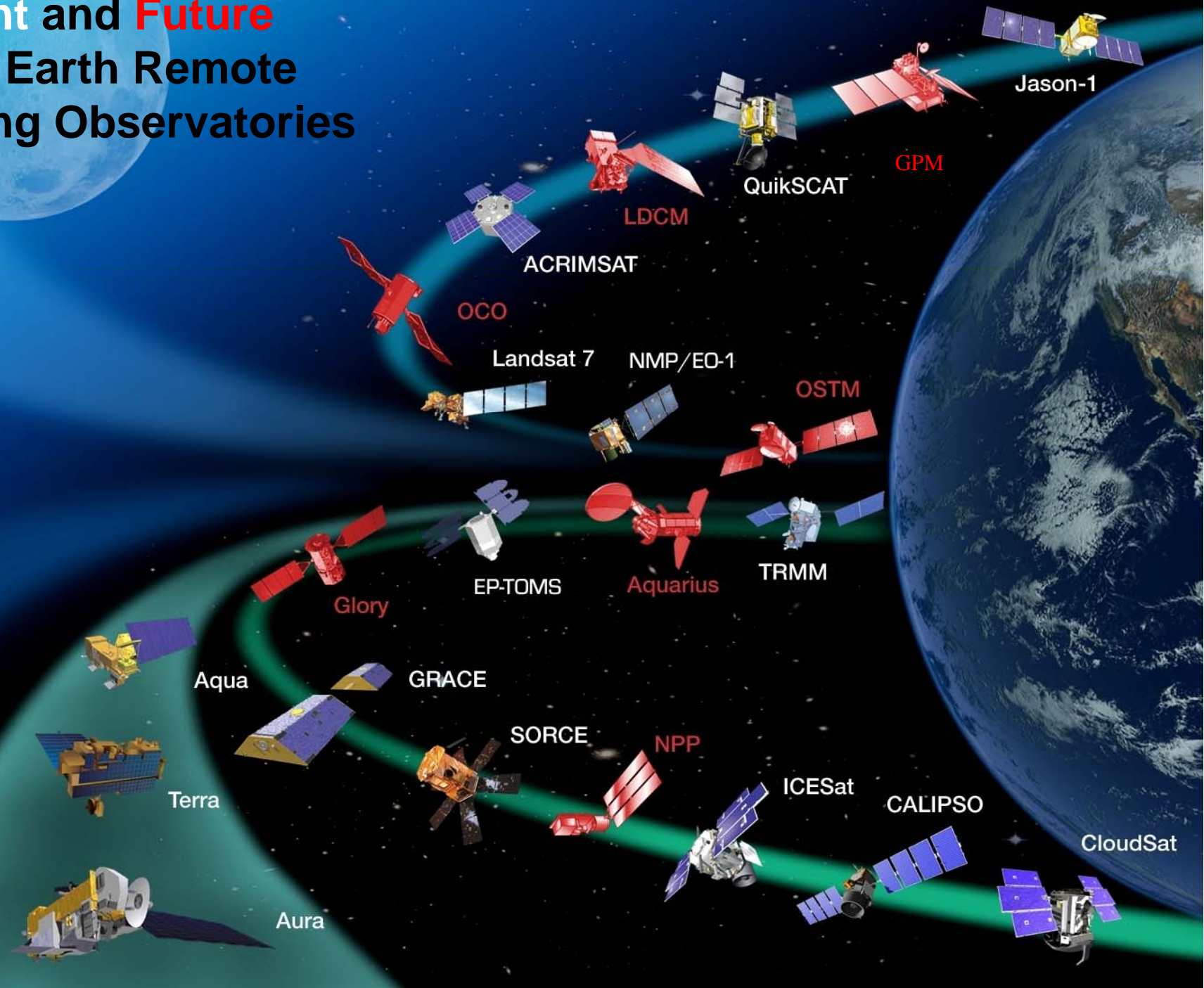


**Water
Resources**



Weather

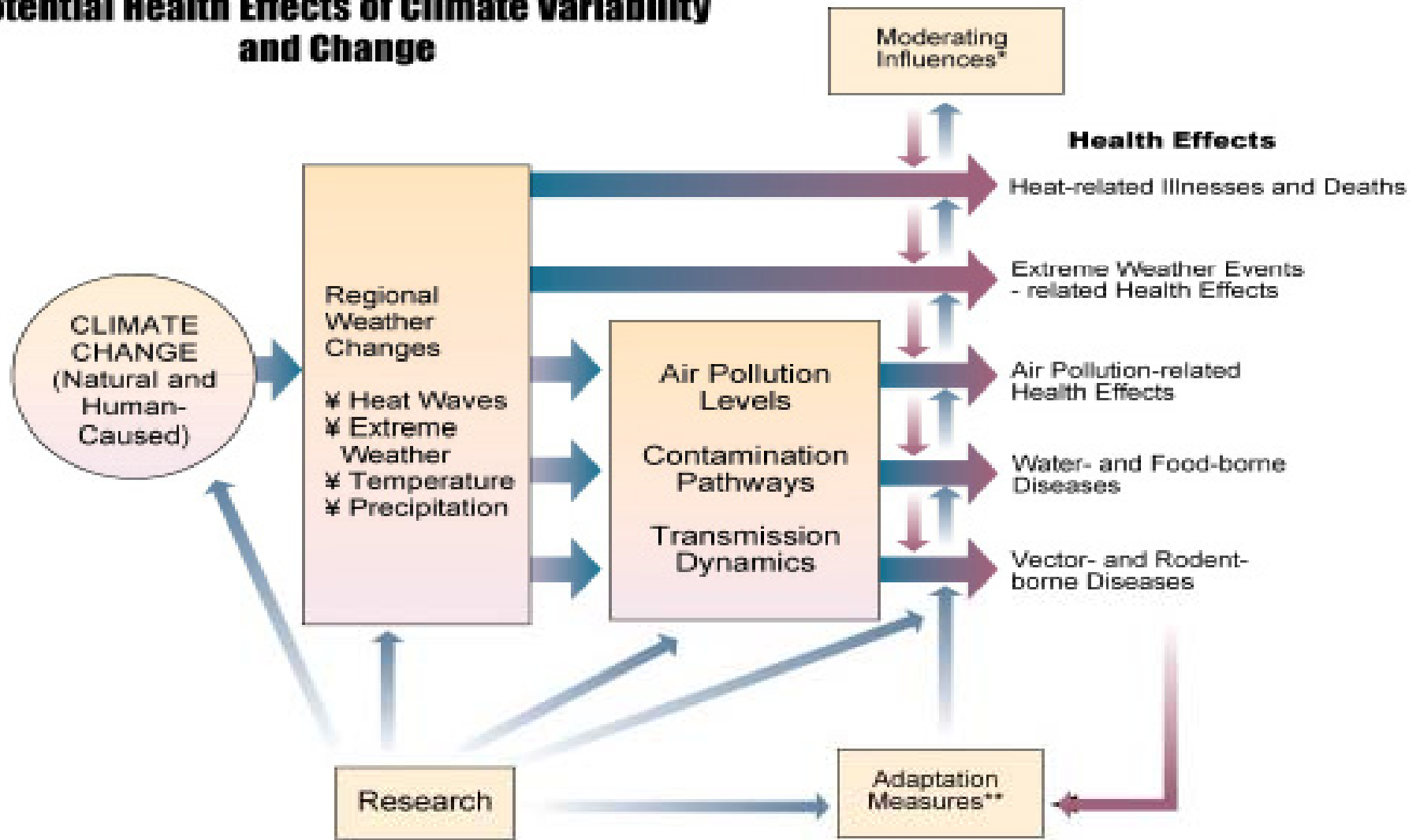
Current and **Future** NASA Earth Remote Sensing Observatories





Why public health?

Potential Health Effects of Climate Variability and Change






Focus Areas of Public Health

The Public Health application area focuses on Earth science applications to public health and safety, particularly regarding ***infectious disease, emergency preparedness and response, and environmental health*** issues. The application explores issues of toxic and pathogenic exposure, as well as natural and man-made hazards and their effects, for risk characterization/mitigation and improvements to health and safety.





Applied Sciences Program

Public Health

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Programmatic Themes

1. Environmental Health (including Oceans and Human Health) (9)
2. Infectious Disease (6)
3. Emergency Preparedness/Response (1)
4. Public Health Tracking/Information Networks (crosscuts)
5. Climate (crosscuts)

Goals

- Collaboration with other agencies to define the impact of climate change on public health
- Integration of NASA research into Public Health Information/Tracking Networks with the ability to track weather, climate, and environmental factors to improve disease outbreak and environmental health risk predictions to increase the public's warning time
- NASA research utilized to enhance our nation's emergency response and preparedness (e.g., DOD-GEIS, Coast Guard)
- Issue joint solicitations with other agencies
- Focus on upcoming missions (Decadal Survey)
- Through community, stay abreast and ahead of emerging diseases/issues (past – pandemic flu)

Federal Partners: CDC, EPA, DOD, USGS, USAID



NASA Public Health & Safety Research

- The Health and Environment Linked for Information Exchange (HELIX)-Atlanta.
- Regards – Reasons for Geographic and Racial Differences in Stroke Research
- Predicting and simulating pollen emission and downwind concentrations
- PHAiRS: Public Health Applications in Remote Sensing
- Mississippi Research Consortium Projects
- Malaria Modeling and Surveillance System/Global Situational Awareness Tool
- Avian Influenza Risk Prediction in Southeast Asia and Early Warning of Pandemic Influenza
- Using NASA Data and Models to Improve Heat Watch Warning Systems for Decision Support
- Influence of Land-Use and Precipitation on Regional Hydrology and Public Health
- Environmental Factors and Population Dynamics as Determinants of Meningococcal Meningitis Epidemics in the Sahel: An Investigation of NASA and NOAA Products
- ArboNET/Plague Surveillance System
- Predicting Zoonotic Hemorrhagic Fever Events in Sub-Saharan Africa using NASA Earth Science Data for DoD - Global Emerging Infections Surveillance and Response System
- Famine Early Warning System (FEWS)
- Malaria Early Warning System (MEWS)
- Integration of Remote Sensing into Encephalitis Virus Intervention Decision Support Systems
- Impact of NASA Satellite Data and Models on U.S. Coast Guard's Decision Support Tool for Search and Rescue in the Northeastern Pacific Ocean
- Monitoring and Forecasting Cyanobacterial Blooms for Public Health Protection and Response
- Application of NASA Data to Develop an Influenza Forecasting System
- Towards Predictive/Operational Assessment of Beach Closures Using Remotely Sensed Data



Avian Influenza Early Warning: Using NASA Data to Predict Pandemics



The 1918 flu was an influenza that spread to nearly every part of the world.



New Flu Strains Often Appear in SE Asia First Before Migrate to Other Regions. Migration Route of Seasonal Influenza A(H3N2) Virus. (Source: Russell et al., Vaccine 265 (2008))



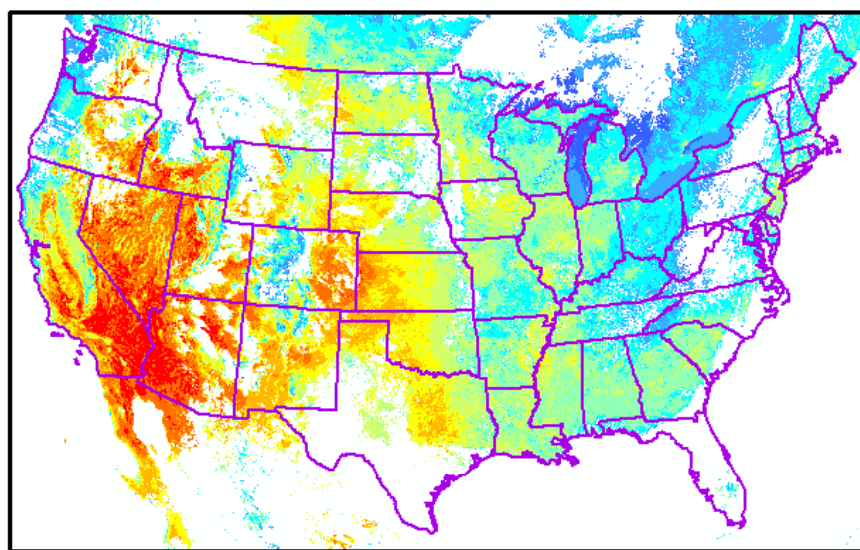
A conceptual image of flu virus invading cilia (courtesy National Geographic)

Most cases of avian influenza infection in humans have resulted from contact with infected poultry like domesticated chickens, ducks, and turkeys

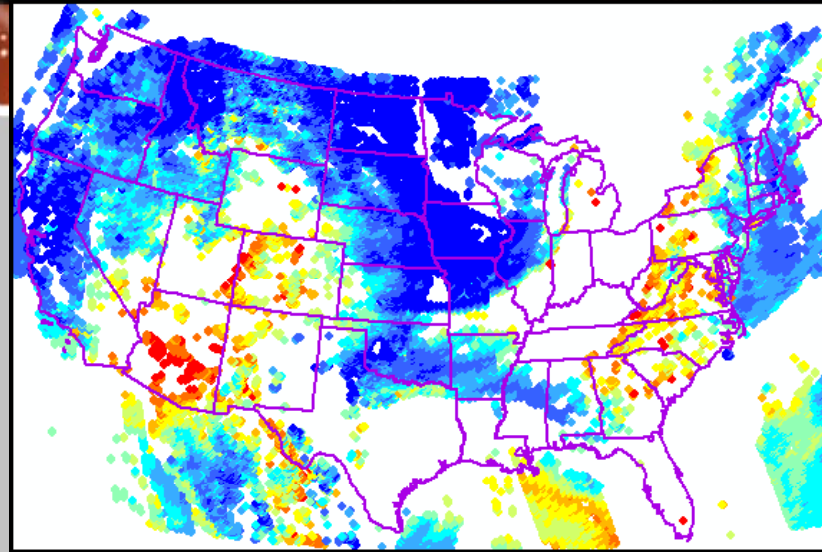
OBJECTIVES

- Perform empirical AI outbreak risk analyses based on outbreak history, environmental parameters, and socio-economic factors.
- Identify spatiotemporal risk for AI outbreaks based on wetland distributions, prevalence of bird species, flyways of migratory birds, surface characteristics, and socioeconomic factors.
- Model the spread of AI virus from large commercial poultry farms to small and backyard farms under typical environmental and socioeconomic conditions.
- Model weekly influenza-like illness cases based on observed and forecast meteorological parameters for regions in the US and some tropical countries.

REGARDS National Study



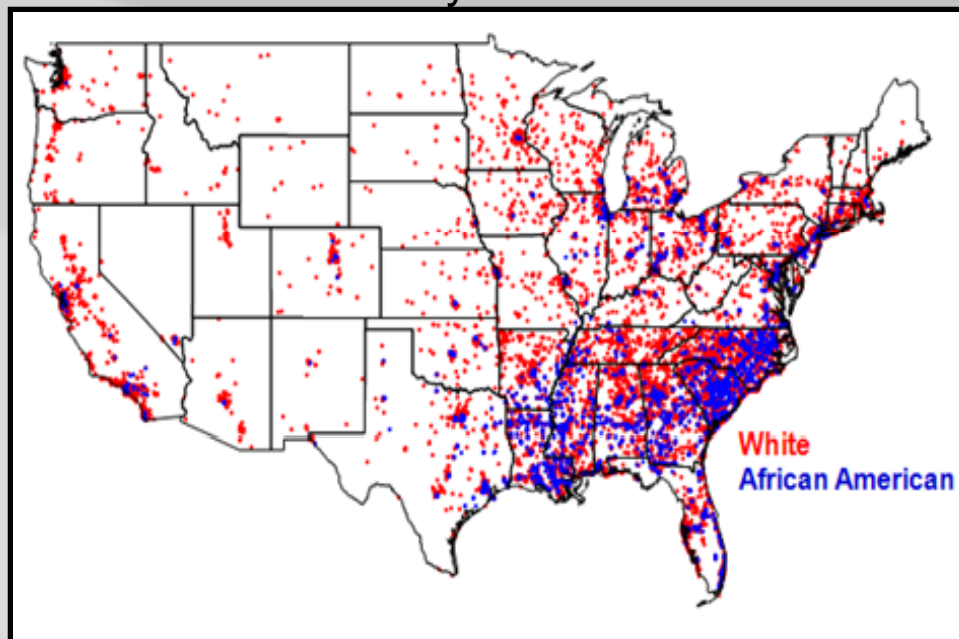
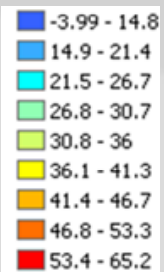
MODIS LST (July 1, 2008)



MODIS AOD (July 15, 2003)

REGARDS Study National Distribution

LST (°C)



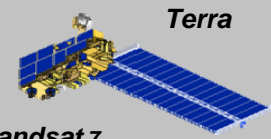
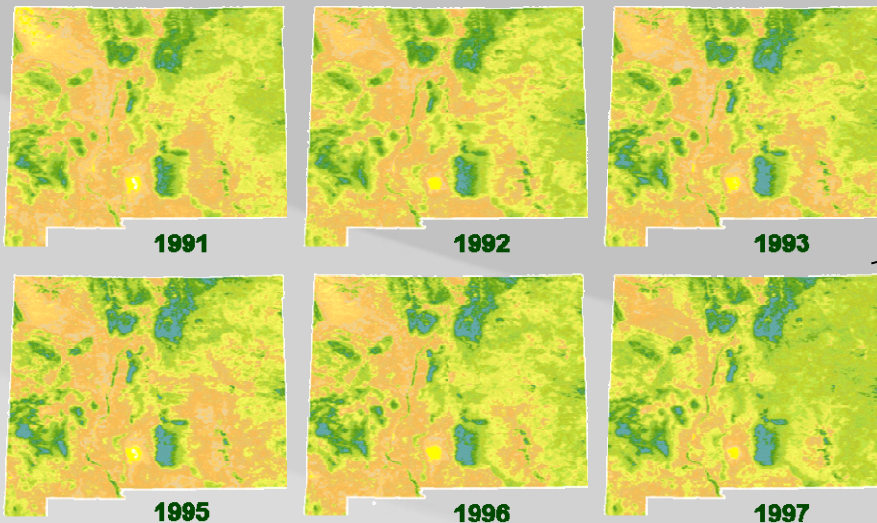
White
African American



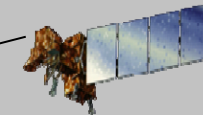
Surveillance Project: ArboNET/Plague



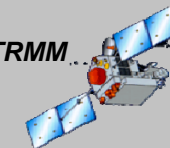
Vector habitats, seasonal lifecycle variations, migration pressure from rainfall, soil moisture, vegetative cover, surface temperature, elevation, and slope.



Landsat 7

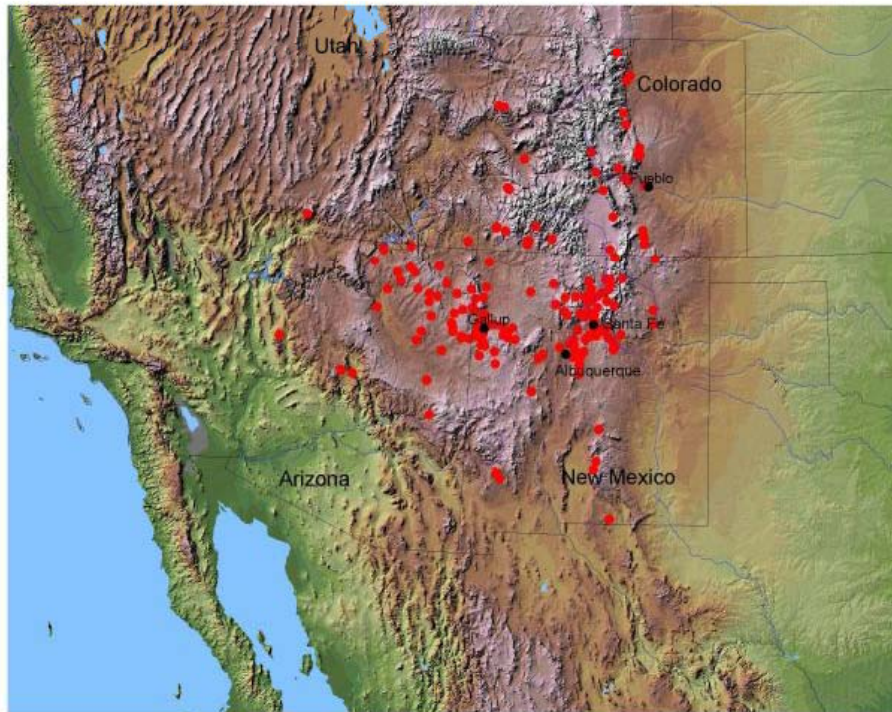


TRMM



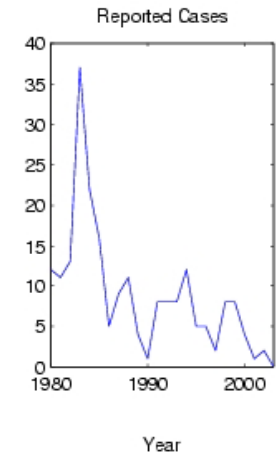
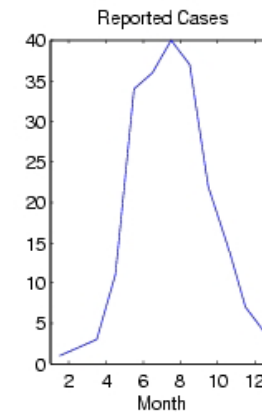
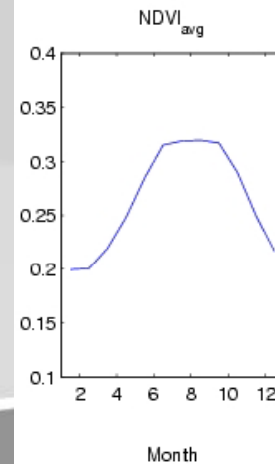
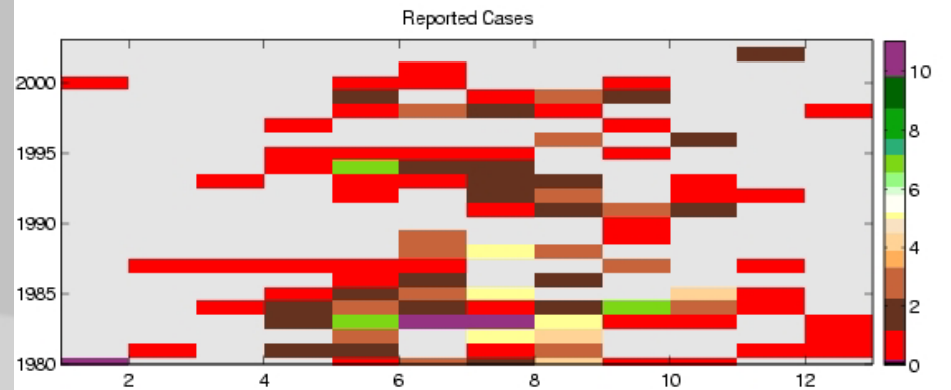
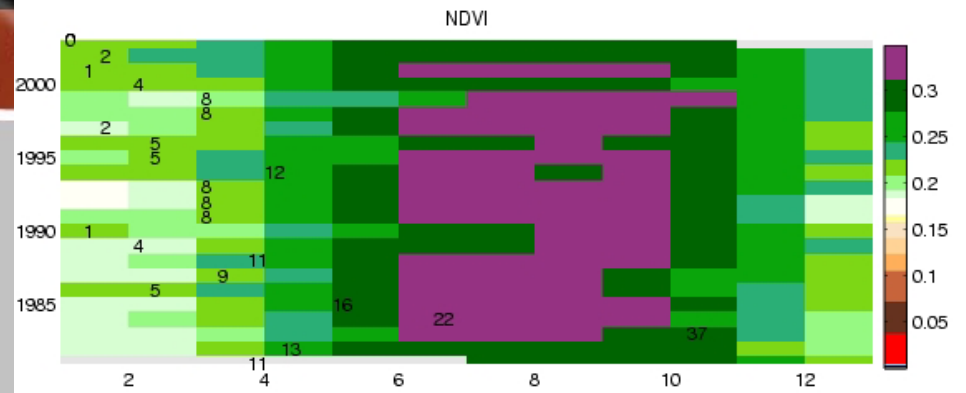
Surveillance Project: ArboNET/Plague

Shaded elevation and Plague cases, 1980-2002



• Locations with reported plague outbreak

100 0 100 200 Kilometers





Integration of Remote Sensing into Encephalitis Virus Intervention Decision Support Systems

This project establishes procedures to directly incorporate observations and model predictive capabilities into the CDC ArboNET and the California Mosquito-borne Virus Surveillance and Response Plan (CMVSRP) from NASA satellites and ecosystem models generated by the Terrestrial Observation and Prediction System (TOPS) at NASA Ames Research Center. At a minimum, the project will utilize observations from NASA MODIS and AMSR-E, Landsat, and NOAA AVHRR.

Preliminary data analysis suggest that variability in temperature and precipitation were two of the strongest drivers of the timing and spatial distribution of mosquito abundance.

Climate variables have strong influences on mosquito populations and will have predictive value months- to seasons-in-advance. These associations vary in space and time, particularly among the ecologically diverse zones of California.



Working with NASA Collaborators

- NASA employs scientists with diverse backgrounds and expertise
- NASA researchers bring to the table a strong desire to collaborate
- Where to find NASA researchers



NASA's Public Health Partners

.gov/ph



.gov/rs



.org



.edu



.int



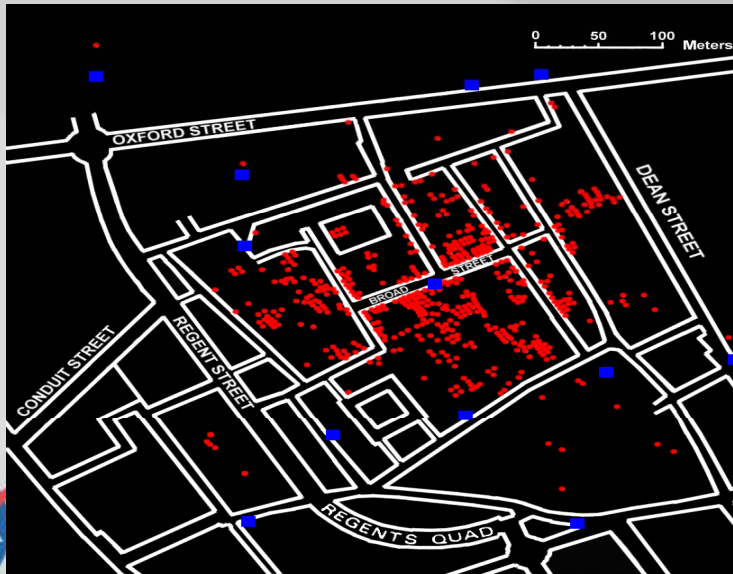
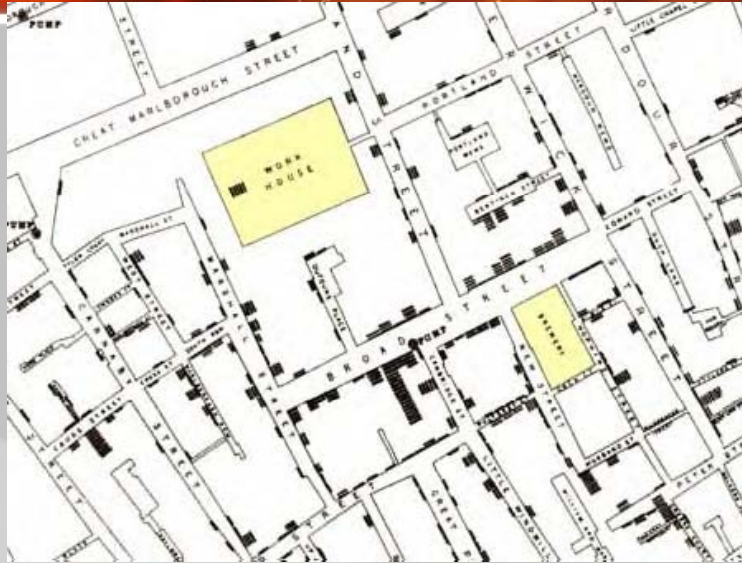


Funding

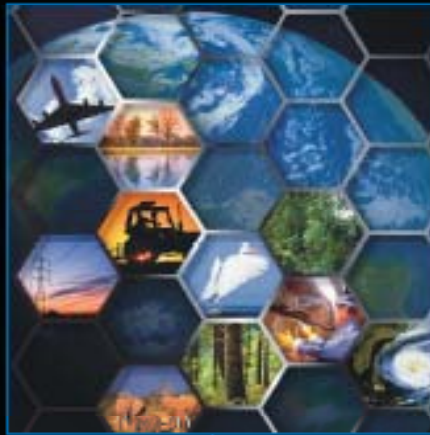
- NASA has several avenues of external funding available to non-NASA scientists
- Public Health Proposal Call in February, 2010
- Website for solicitation:
<http://nspires.nasaprs.com/external/>



Epidemiology in the 21st Century

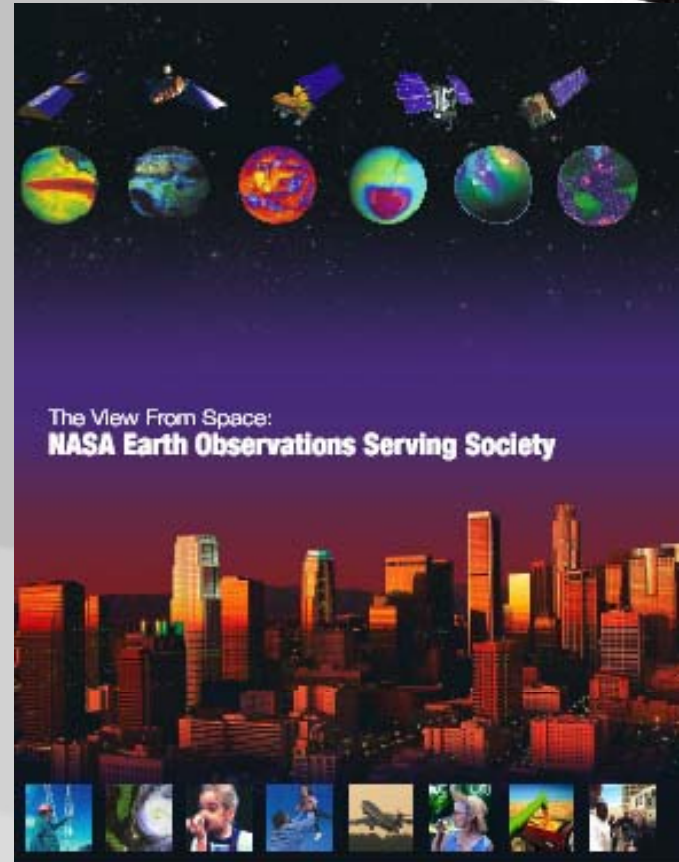


Applied Sciences Program



National Aeronautics and
Space Administration

Earth Science Enterprise
Applications Plan



The View From Space:
NASA Earth Observations Serving Society

<http://nasascience.nasa.gov/earth-science/applied-sciences>

<http://aiwg.gsfc.nasa.gov/>

