

The **GEOSS Health Societal Benefit Area:** Formation and Plans for a Health & Environment Community of Practice

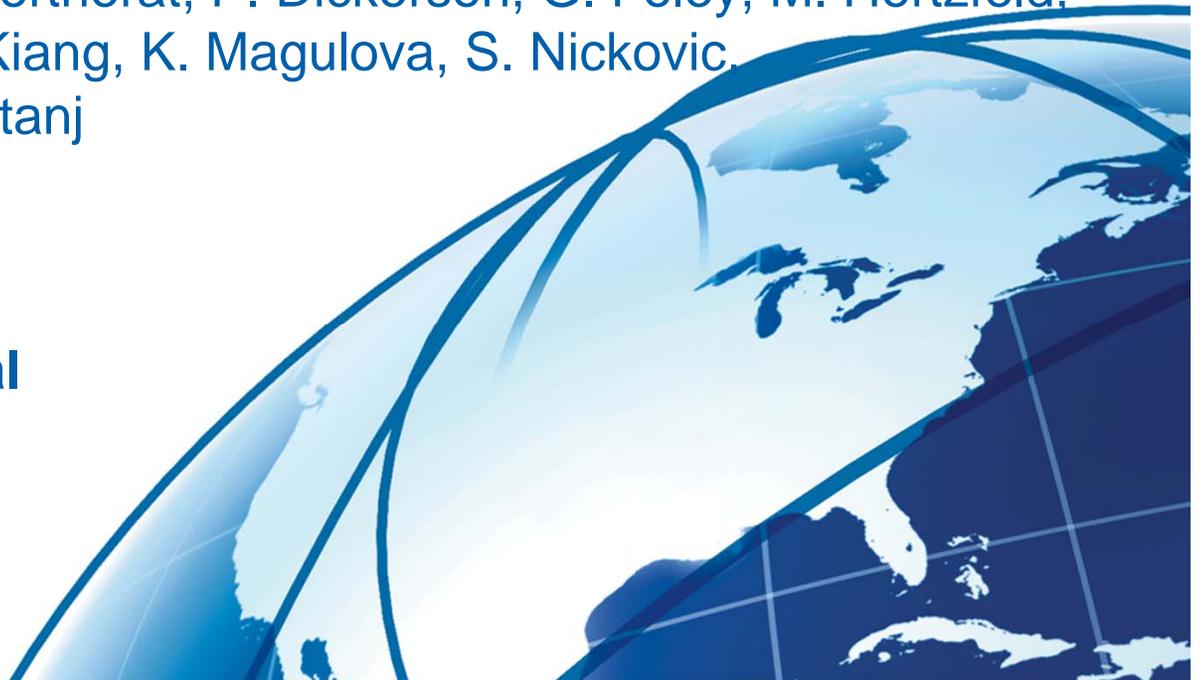
Masami Onoda, GEO Secretariat

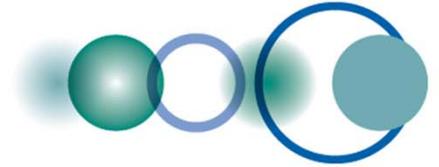
M. Lafaye, R. Dhiman, E. Bertherat, P. Dickerson, G. Foley, M. Hertzfeld,
R. Husar, M. Jancloes, R. Kiang, K. Magulova, S. Nickovic,
N. Pirrone, D. Rogers, J. Trtanj

ISPRS TC VIII/WG2

**“Advances for Geospatial
Technologies for Health”**

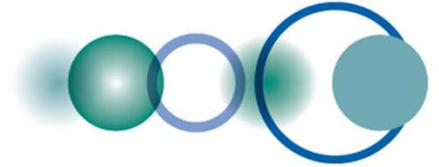
Santa Fe, 12-13 Sep. 2011





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- 1. Overview of GEO/GEOSS**
- 2. Current Activities: GEO Health Tasks**
- 3. The GEO Health & Environment
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- 4. Summary and Way Forward**



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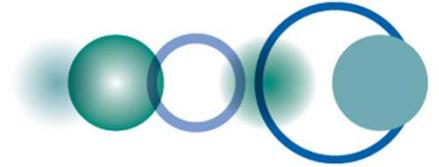
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GEO, the Group on Earth Observations

An Intergovernmental Body with 87 Members and 61
Participating Organizations



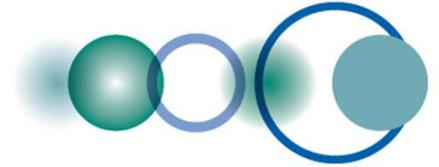


GEO

Group on Earth Observations

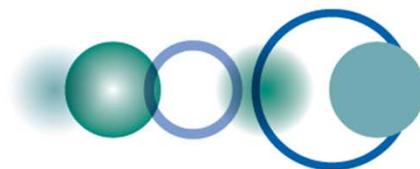
GEOSS

Global Earth Observation System of Systems

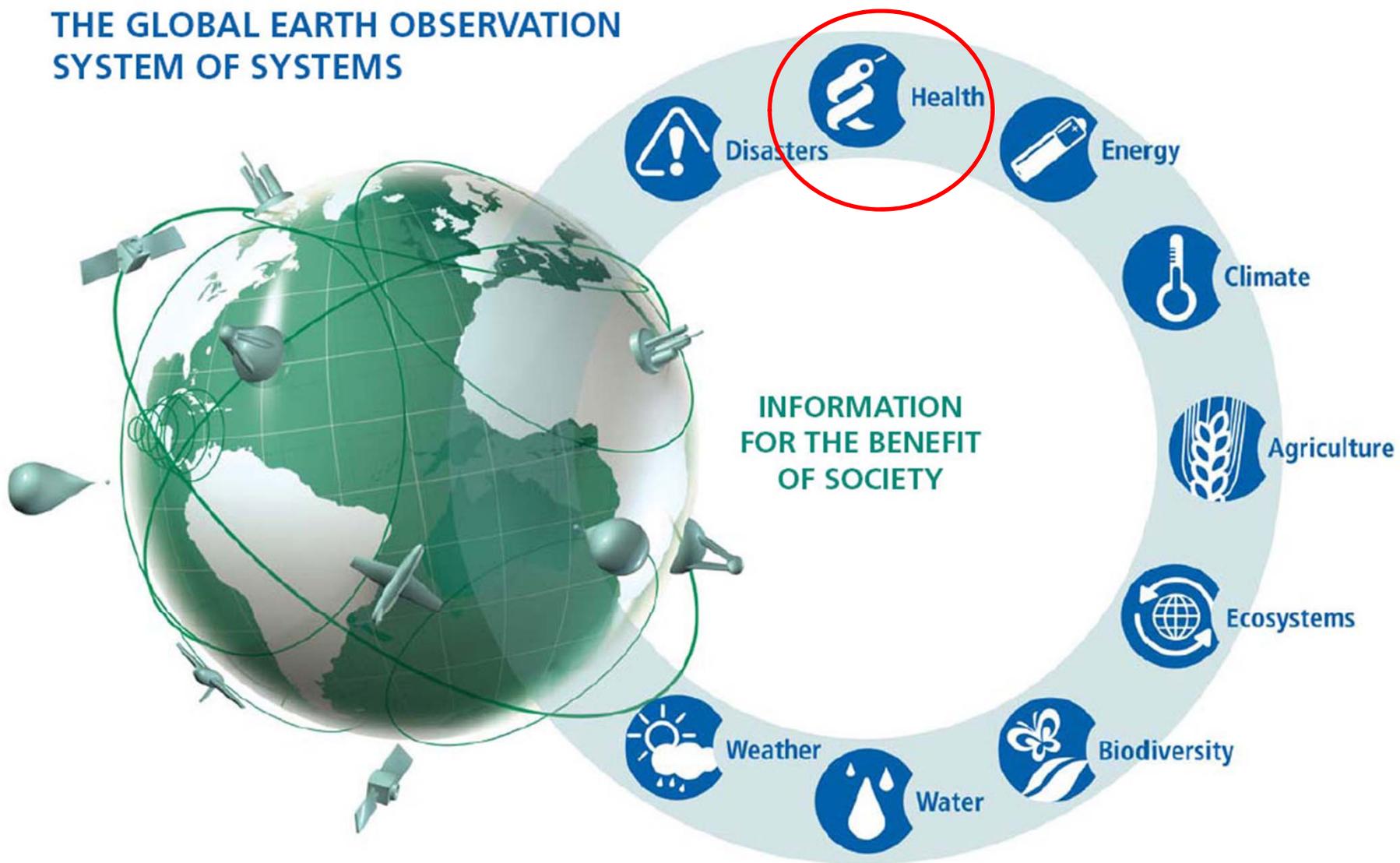


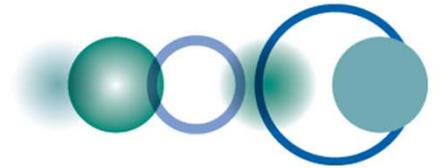
What can GEO offer ?

- **Networking and partnerships** – Tasks open doors to new contacts, collaborations, projects
- **Data Access** – Enhancing the use of existing data
- **Access to resources** – Although not a funding agency, GEO can open door to donors & resources
- **Visibility** (GEO Plenary and Ministerial Summits)
- **Influence on GEOSS development** – Shaping new global information system for decision-making



THE GLOBAL EARTH OBSERVATION SYSTEM OF SYSTEMS



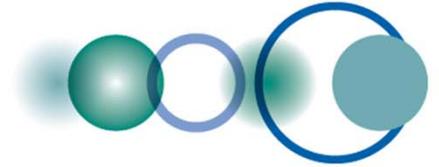


GEO Data Sharing Principles

- Full and Open Exchange of Data, recognizing Relevant International Instruments and National Policies
- Data and Products at Minimum Time delay and Minimum Cost
- Free of Charge or minimal Cost for Research and Education



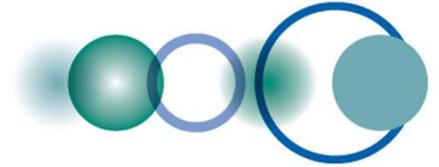
**→ GEOSS Common Infrastructure
& GEOSS Data-CORE**



Strategic Targets for Health

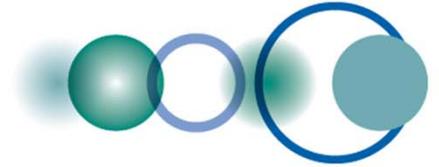
Before 2015, GEO aims to:

12. Substantially expand the availability, use and application of environmental information for public health decision-making in areas of health that include allergens, toxins, infectious diseases, food-borne diseases, and chronic diseases, particularly with regard to the impact of climate and ecosystem changes.



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GEO Health Tasks

(Overview based on proposed 2012-15 Work Plan)

1. Tools and Information for Health Decision-Making

- 1) Air-borne Diseases, Air Quality and Aeroallergens
- 2) Water-borne Diseases, Water Quality and Risk
- 3) Vector-borne Diseases
- 4) A Holistic Approach to Health: Transmission Dynamics, Urban Health Forecasting, Linkages and New Technologies

2. Tracking Pollutants

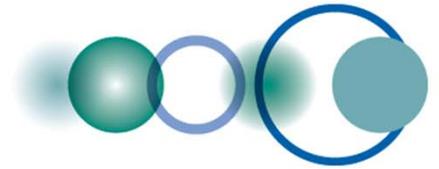
- 1) Global Mercury Observation System
- 2) Global Monitoring of Persistent Organic Pollutants



Tools and Information for Decision Making

Air-borne Diseases, Air Quality and Aeroallergens

Leads: EC (EO2HEAVEN), Spain (AEMET), USA (EPA,
HCF, NASA), WMO



The Meningitis Environmental Risk Information Technologies MERIT Project



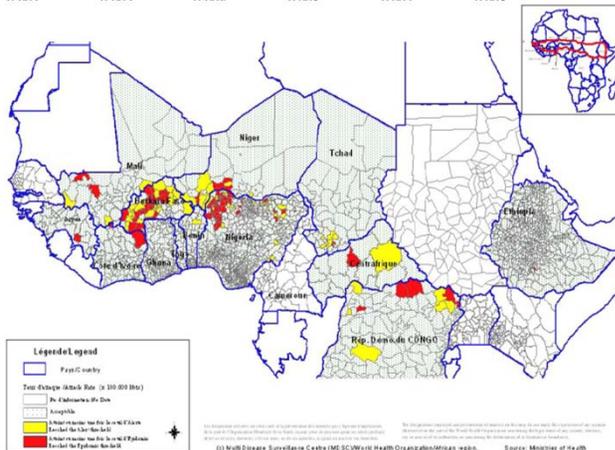
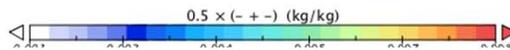
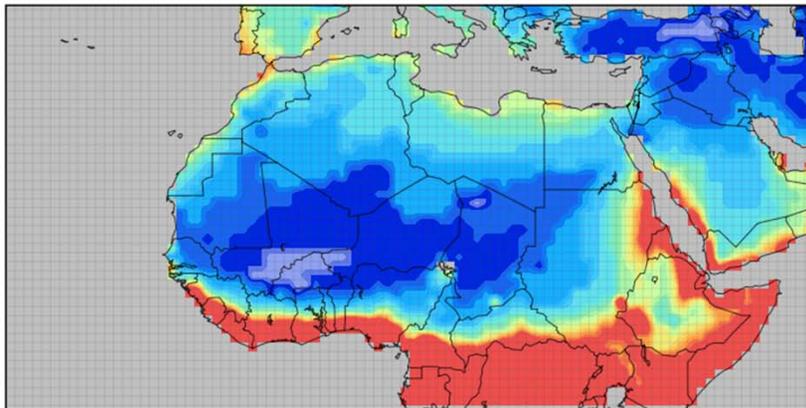
- Established in 2007
- Collaborative initiative of WHO and members of the environmental, public health and epidemiological communities to help reduce the burden of epidemic meningitis in Africa
- About 30 members, regional and international organizations, research institutes, climate and health working groups



Humidity and Meningitis Outbreaks

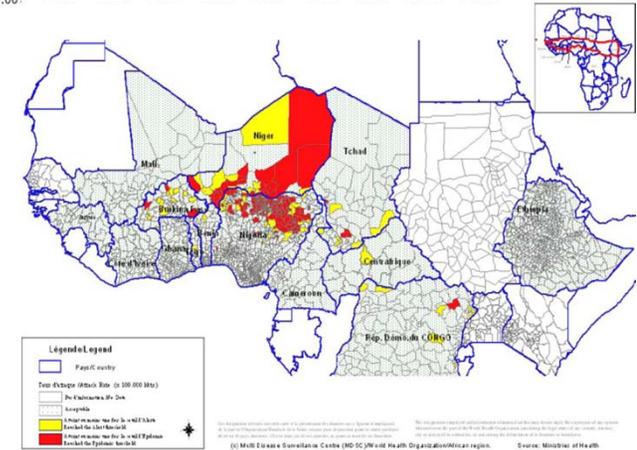
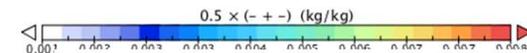
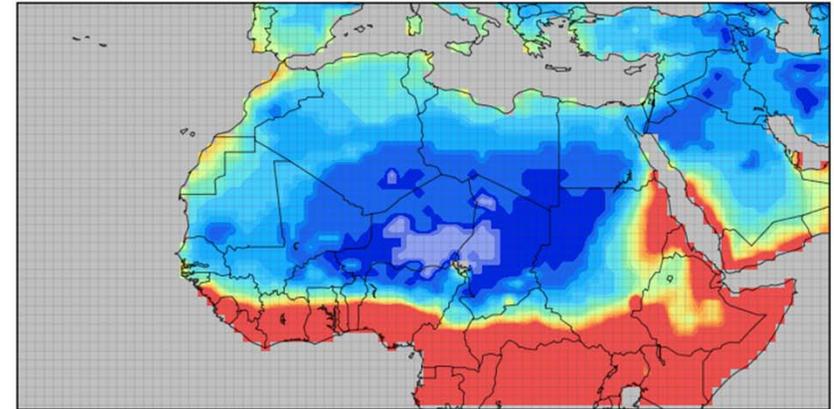
NASA GLDAS dataset (Noah land surface model)

JAN-FEB 2008 Specific humidity (kg/kg)



2008

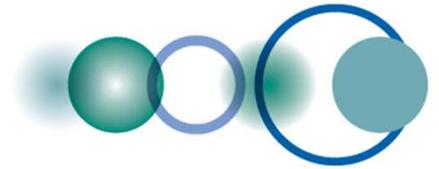
JAN-FEB 2009 Specific humidity (kg/kg)



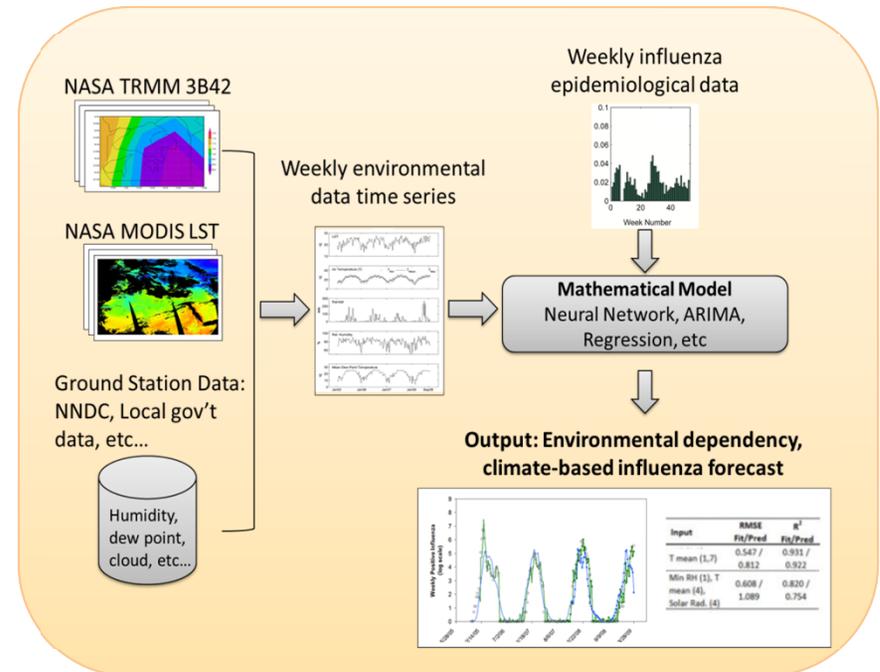
2009

Recapitulative maps of cumulative Meningitis attack rates at weeks 1 – 39 (Mapping based on weekly highest attack rates by district during the year) © Inter Country Support Team – West Africa/WHO African Region; Source: Ministries of Health

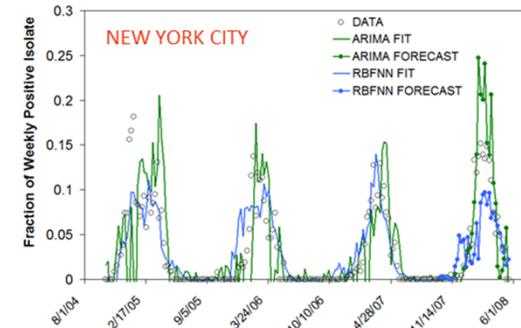
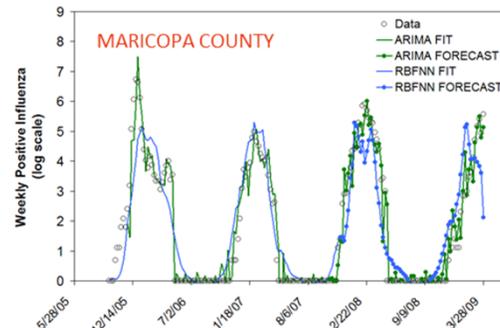
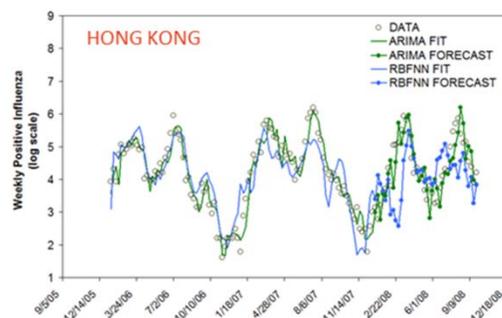
Influenza



- Assess the role of environmental factors on influenza transmission in populated cities
- Short-term environmental-based influenza forecast
- Collaborators include US CDC Influenza Division, US CDC-CAP, WHO EURO, and Health Ministries.

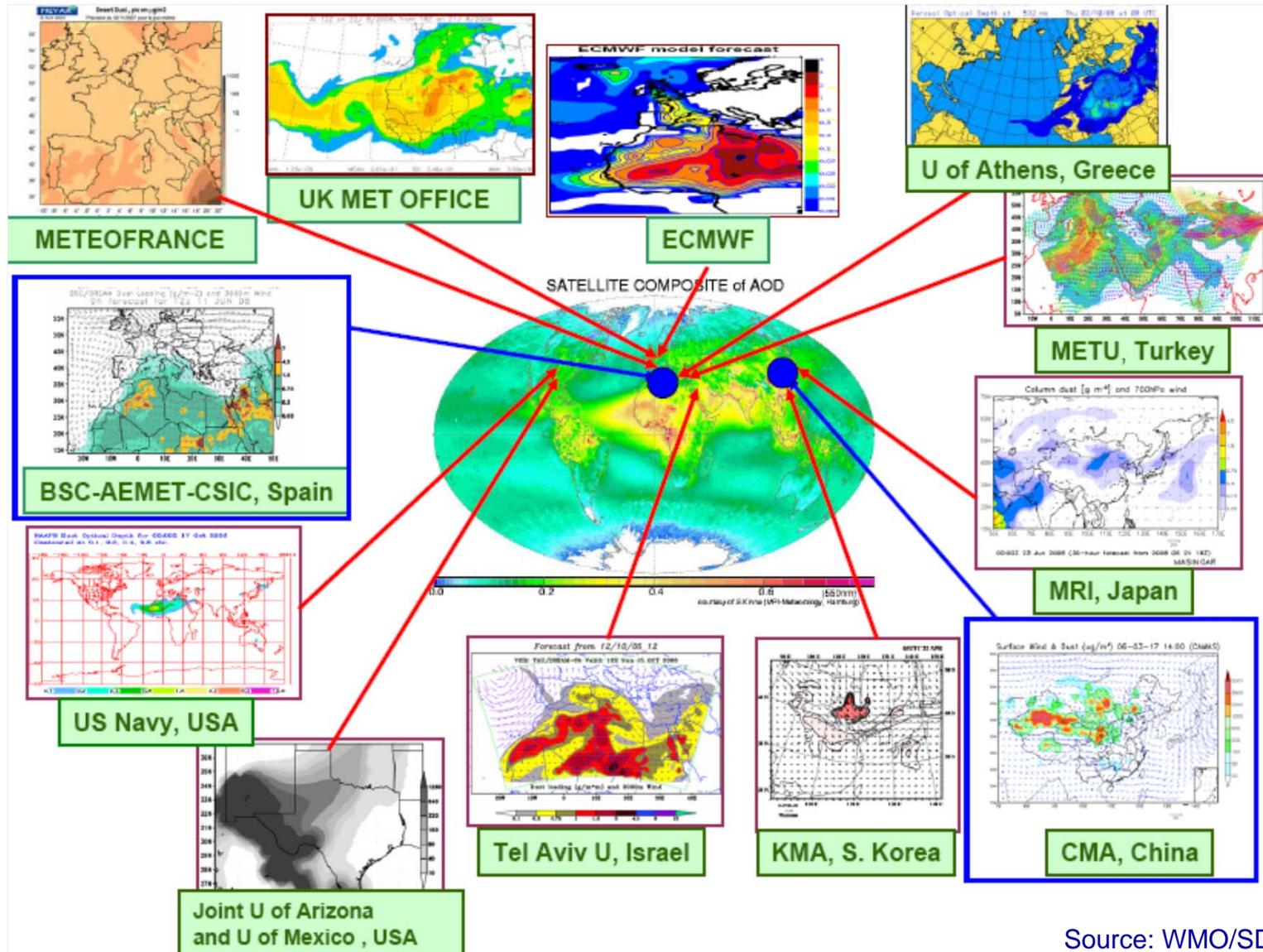


Test case:

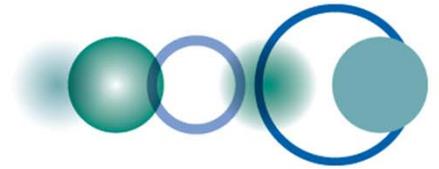




Research and Operational Forecasting



Air Quality



- Provide near-real-time AQ observations and forecasts for health management, research and public information
- Improve EO data assimilation schemes
- Implement a system that reduces adverse respiratory and cardiovascular outcomes among residents exposed to ambient pollution
- Build upon: EO2HEAVEN, AIRNow International, and Real Time Data Dissemination for Air Quality

AIRNow

AIRNow-Tech (web site)

AIRNow-Gateway (distribution service)

AIRNow-International

- New Software System

- Shanghai Pilot at World Expo

- GEO Air Quality CoP

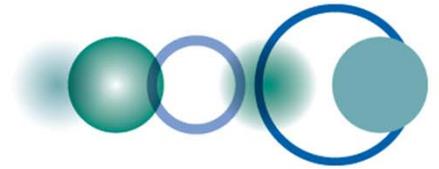




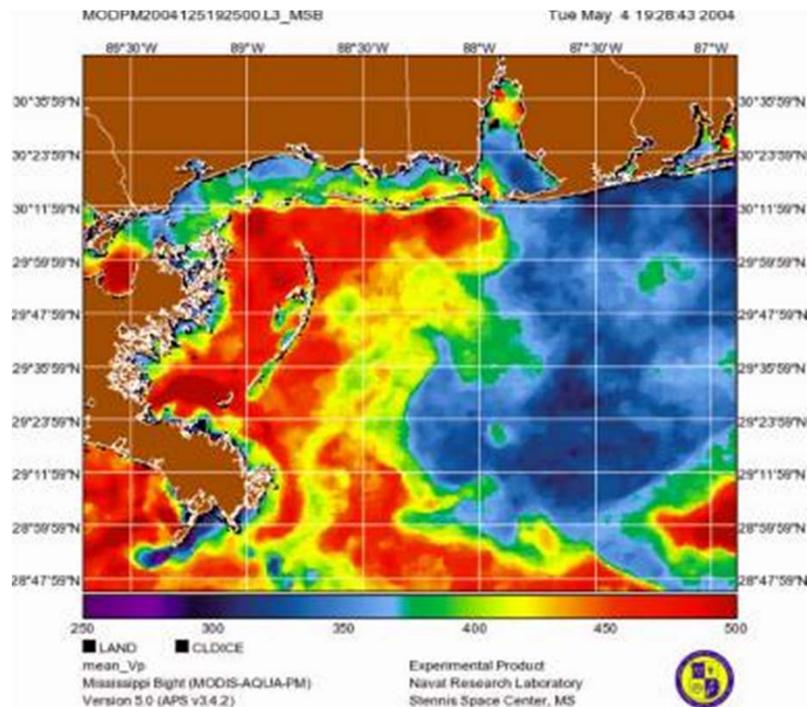
Tools and Information for Decision Making

Water-borne Diseases, Water Quality and Risk

Leads: EC (EO2HEAVEN), France (CNES),
USA (EPA, HCF, NASA, NOAA), WHO



Water-borne Diseases, Water Quality and Risk



The Use of Remote Sensing and Molecular Detection to Predict the Risk of Infection by *Vibrio Parahaemolyticus*: Prediction maps generated by RS SST

Dr. Jay Grimes, USM (Phillips, et al., 2007. *J. Food Prot.* 70:879-884, Figures 2 and 3.)

- Implement a global initiative for cholera early warning
- Identify and map environmental factors affecting the distribution and re-emergence of leptospirosis
- Build and sustain an international cross-disciplinary community that integrates environmental, health and social information to understand, predict and reduce freshwater and marine diseases risk
- Assess coastal and inland aquatic system health and human health impact from vibrios, contaminants, and harmful algal blooms. Improve real-time data dissemination for coastal beach water quality.



Water-borne Diseases, Water Quality and Risk Public Health Forecasting (vibriosis/cholera)



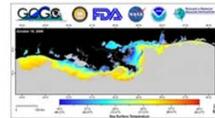
Vibrio parahaemolyticus (Vp) and Oysters
 Gulf Coast oysters (*Crassostrea virginica*), especially raw oysters on the half shell, top the list of favorites for many diners. Although these bivalves are safe for most people to eat, some consumers should avoid eating raw or undercooked seafood including oysters. These "at risk" consumers include diabetics, individuals that have liver disease and hemochromatosis (iron overload) and anyone with a weakened immune system. Oysters are filter-feeding animals and they sometimes accumulate large numbers of bacteria and viruses, including naturally occurring, disease-causing bacteria such as *Vibrio parahaemolyticus* (Vp), as they feed.

This potential bacterial content calls for simple safety steps such as keeping the oysters refrigerated or on ice after harvesting, and washing hands thoroughly with warm, soapy water after handling raw oysters and other raw seafood. If oysters containing naturally occurring bacteria such as Vp are harvested and not refrigerated or kept on ice, elevated temperatures (greater than 15C or 59F) may allow the Vp to grow to high levels. Vp in high enough densities can cause diarrhea and vomiting in consumers who eat raw oysters, especially in those individuals with pre-existing health problems.

The three maps to the right display sea surface temperature, salinity, and the predicted log of Vp per gram of oyster meat at the time of harvest, respectively. The Vp density map was created with the following algorithm:

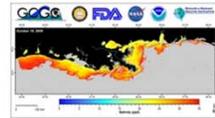
average $\log_{10}(p/g) = -2.05 + 0.097 * T_{surface} + 0.2 * SAL - 0.0055 * SAL^2$
 The logarithm (log) of a number y with respect to a base b is the exponent to which you have to raise b to obtain y. For example the base 10 log of 100 is 2.

Latest MODIS SST



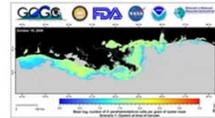
← SST

Latest MODIS Salinity



← Salinity

Latest Average log Vp/g at Harvest

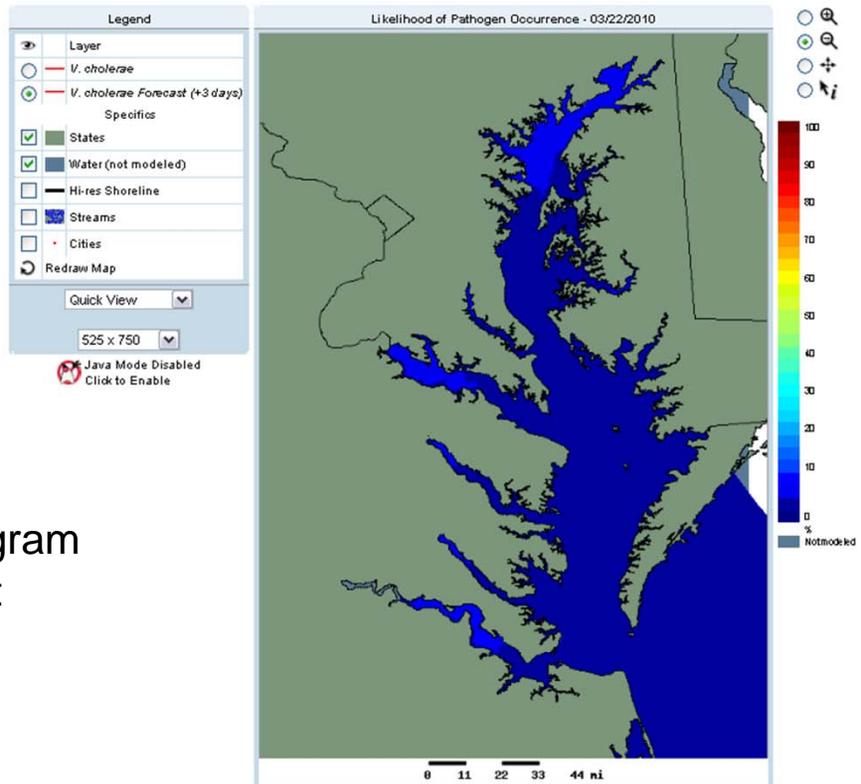


← Log₁₀ Vp per gram of oyster meat

← Vp algorithm

DISCLAIMER
 The densities of *Vibrio parahaemolyticus* shown on this abundance and distribution map are based on sea surface temperature and salinity measured by a NASA satellite. The predicted densities shown are not meant to be interpreted as absolute or actual values. The sole purpose of this map is to provide current information - a "nowcast" - that can be used to predict the abundance and distribution of *V. parahaemolyticus* in oysters collected from sites shown on the map. Furthermore, these maps are a research product and are designed to be educational and informative; they have no regulatory intent, purpose, or application. The methodologies that produce them and the maps themselves will improve over time, for example, if new satellite products become available.
 The participating agencies and institutions are not responsible for any disease or discomfort that might result from consuming raw or undercooked oysters from sites shown on this map.

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Likelihood of *V. cholerae* in the Chesapeake Bay G. Constantin de Magny and R.R. Colwell, Univ. of Maryland

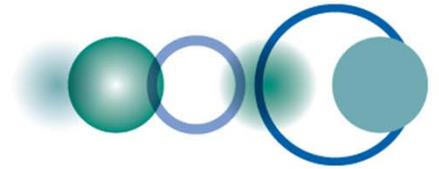
V. parahaemolyticus in the N. Gulf of Mexico



Tools and Information for Decision Making

Vector-borne Diseases

Leads: Brazil (FIOCRUS, UFPR), France (CNES),
India (ICMR), US (IRI, NASA)



Vector-borne Diseases

- Link Earth Observation and public-health communities to build user-driven tools for vector-disease monitoring.
- Foster the use of satellite and in-situ data for monitoring environmental conditions conducive to the spread of vector-borne and zoonotic diseases: dengue, malaria, RVF, Lyme disease
- Develop distribution maps, collect retrospective data, meteorological satellite data and examine the relationship, study feasibility of developing advanced systems for use by health authorities

STAR Center for Satellite Applications and Research
formerly ORA — Office of Research and Applications

NOAA Satellite and Information National Environmental Satellite, Data, and Information Service
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- [Team Members](#)

2009 Advanced Research Workshop
Using Satellite and In situ Data to Improve Sustainability
June 9-12, 2009 - Kyiv, Ukraine

Data and Images displayed on:

STAR - Global Vegetation Health Products

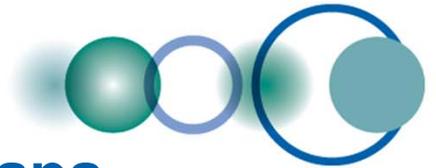
Current Week's Products: Please select Product and Region then click **Refresh** to see

Data type: Malaria Risk (Africa only) | Region: Africa | Refresh

Africa - Malaria Risk Map Derived from VHI
Oct. 28 2009 (week 43)

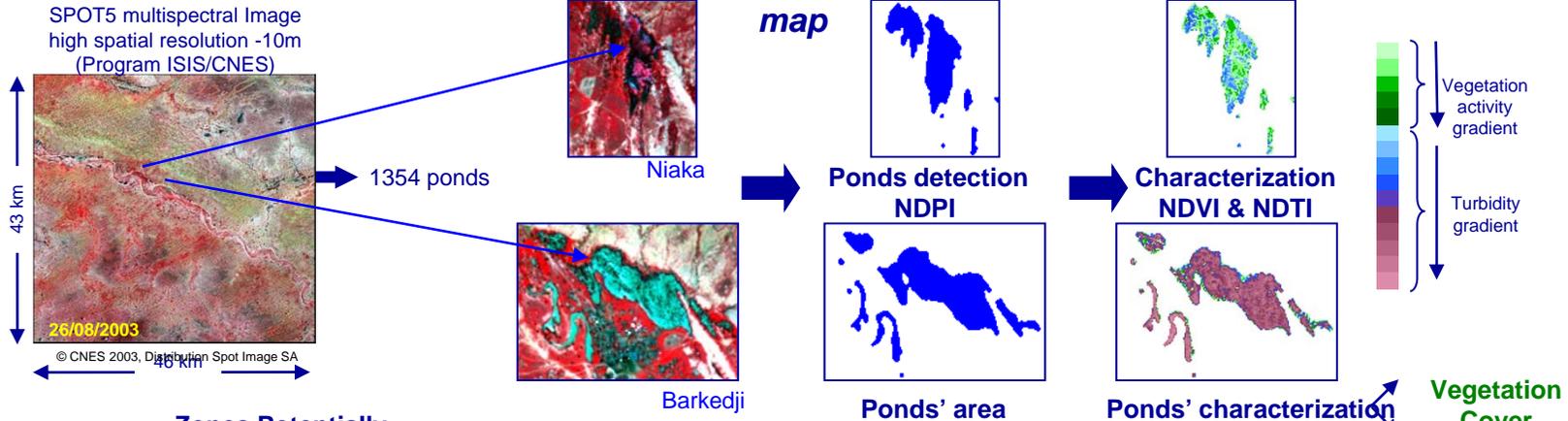
Malaria Risk Map Derived from VCI
Oct. 28 2009 (week 43)

http://www.star.nesdis.noaa.gov/smcd/emb/vci/VH/vh_currentImage.php

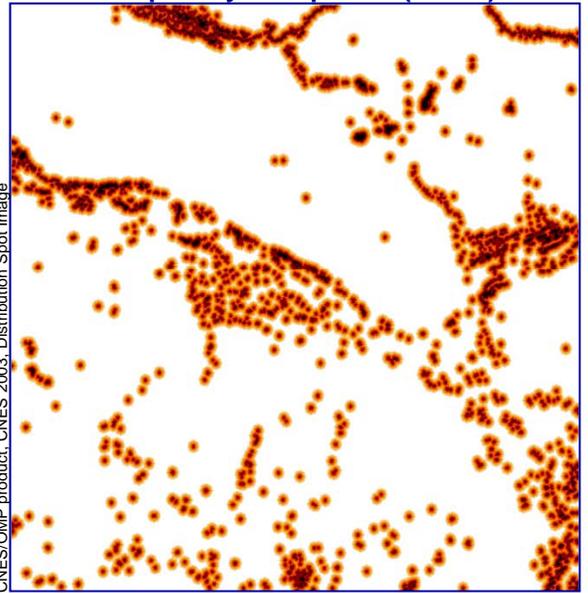


Space Tools for Innovative Risk Maps

Identify environmental factors of Aedes & Culex presence by remote sensing to obtain risk map



Zones Potentially Occupied by Mosquitoes (ZPOM)



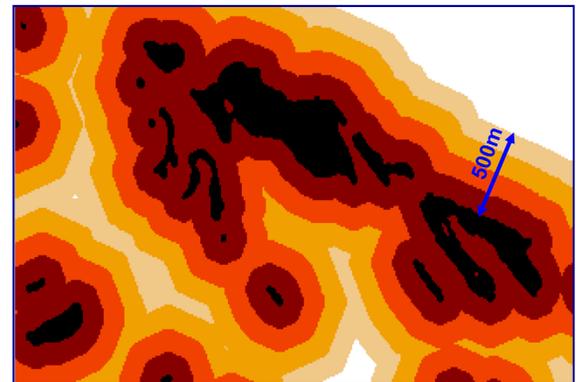
Mosquitoes flying range
~500m (Bâ et al., 2005)

26/08/2003

Ponds ~ 1%

ZPOM = 25%

Mapping the ZPOM

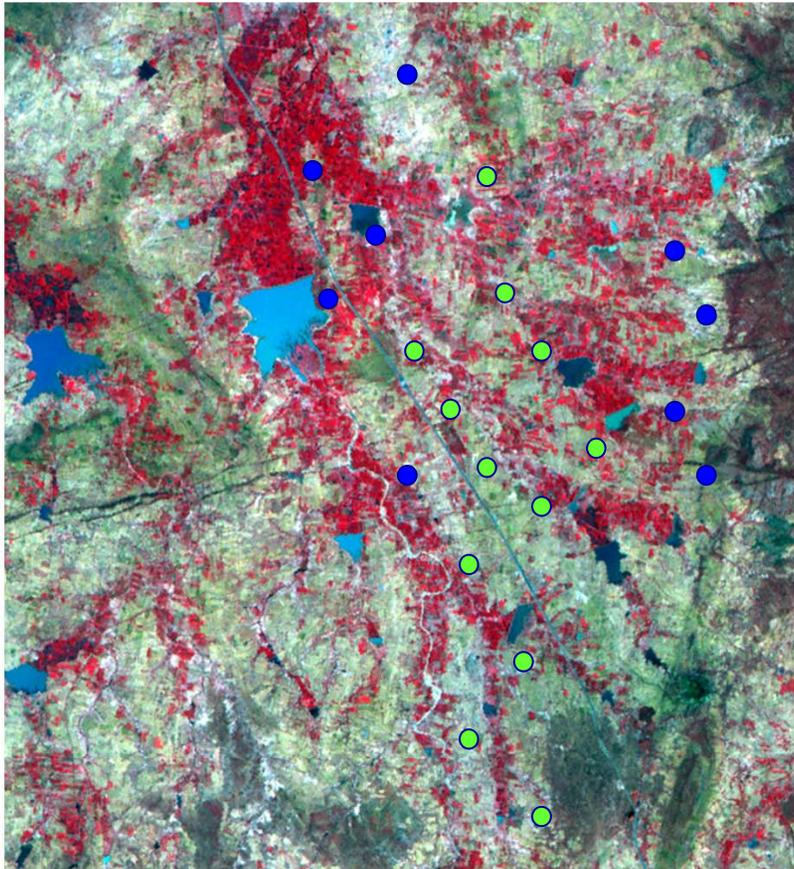


Source: CNES

Analyses and processing of high-spatial resolution images (SPOT 5, 10m) allows to detect ponds' area like their vegetation cover and turbidity and finally evaluate Zone Potentially Occupied by Mosquitoes (ZPOM)



IRS Image and Malaria (India)

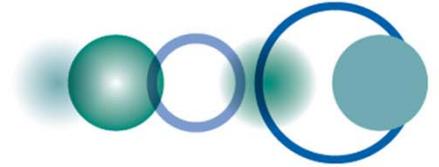


- High malarious villages
- Low malarious villages

Validation of relationship between Remote Sensing derived landscape features and malaria endemicity in Tumkur and Chitradurga districts of Southern Karnataka.

Presence of irrigation tanks(>5), vegetation cover (>20 %), low barren area (< 10%) were associated with high malaria endemicity. Ground truth validation in unknown areas confirmed the earlier findings.

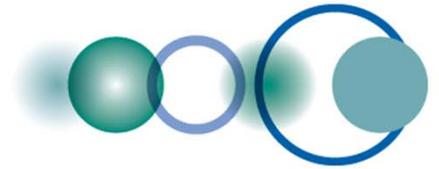
Satellite image (IRS P6 MX) showing high and low malarious villages in Kallembella (Sira Taluka , Tumkur)



Tools and Information for Decision Making

A Holistic Approach to Health: Transmission Dynamics, Urban Health Forecasting, Linkages and New Technologies

Leads: EC (JRC), USA (EPA, HCF)



Ecosystems, Biodiversity and Health



Ixodes scapularis is a tick that spreads Lyme disease from animals to people.



White-footed mouse. Very abundant in forests, a good host for ticks to feed on and become infected with the Lyme disease pathogen.

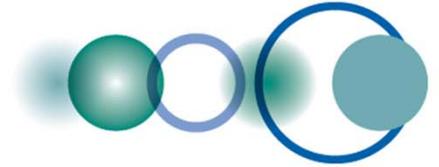


Forest fragmentation and destruction in the U.S. have been shown to reduce mammalian species diversity and to increase populations of the white-footed mouse.



Urban Public Health Advisory and Warning Services: “Fit City, Fit World”

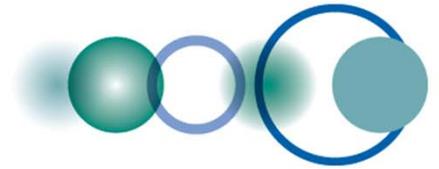
- Chronic diseases such as COPD, cardiovascular disease and children’s asthma
- Provide high-resolution environmental information
 - ***Multi-hazard early warning system***
- Annual meeting in Shiang Hai, conference in London in 2011.



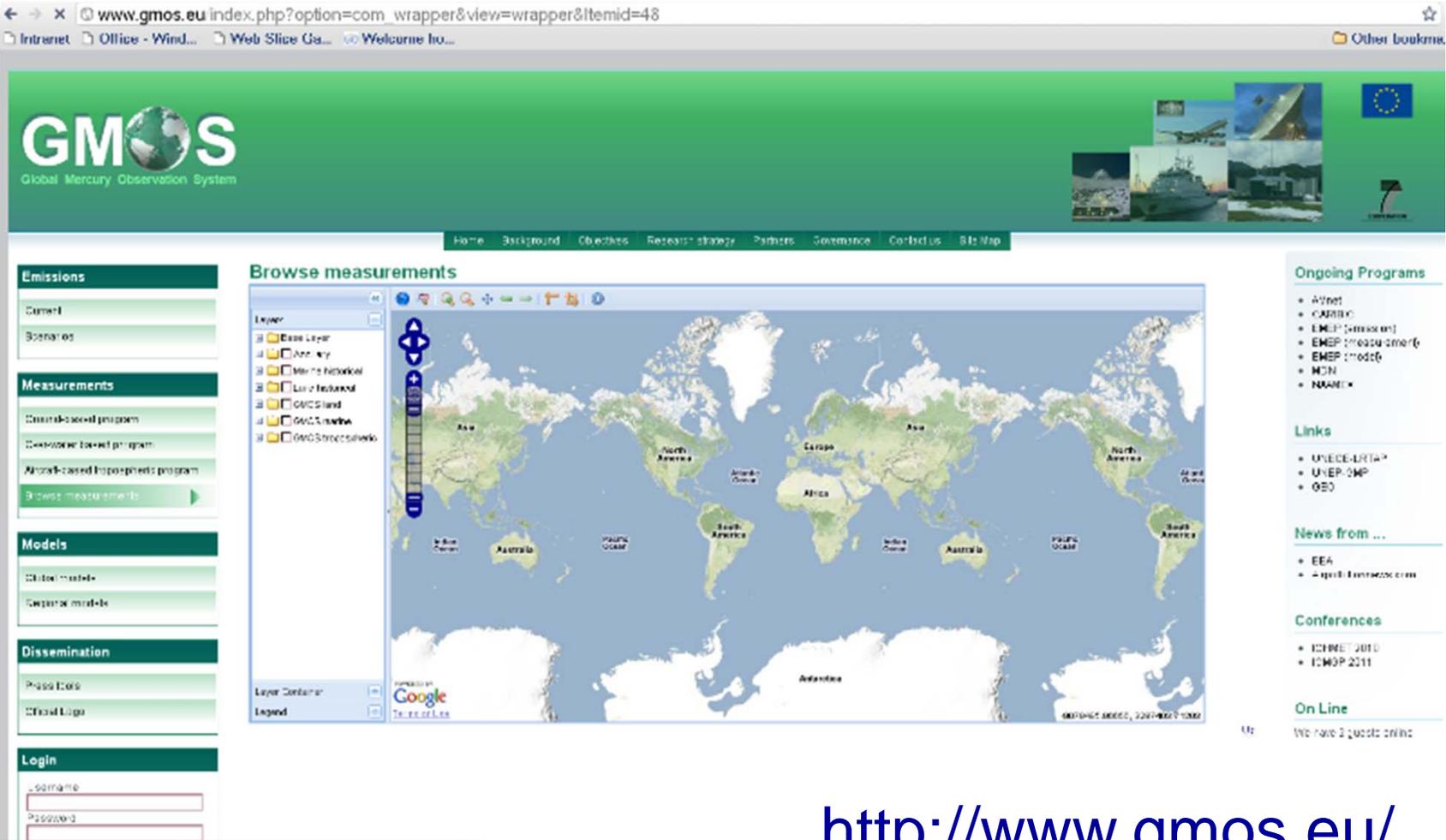
Tracking Pollutants

Global Mercury Observation System

Leads: EC (GMOS), Germany (HZG),
Italy (CNR), Japan (NIES), USA (EPA)



Global Mercury Observation System GMOS Image Browser



www.gmos.eu/index.php?option=com_wrapper&view=wrapper&Itemid=48

GMOS
Global Mercury Observation System

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- Central-based program
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Layer

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- AMT-Net
- Mercury Historical
- Land Use Historical
- GMOS Land
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- GMOS StreetsView

Layer Container Legend

Ongoing Programs

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- EMEP (model)
- MON
- NAEMEX

Links

- UNECE/EU/TA
- UNEP-GMP
- GEO

News from ...

- EEA
- April Earthweek.com

Conferences

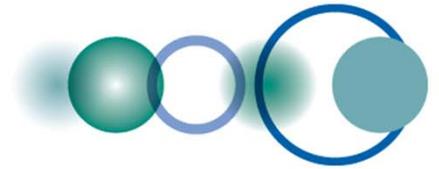
- ICMNET 2010
- ICMOP 2011

On Line

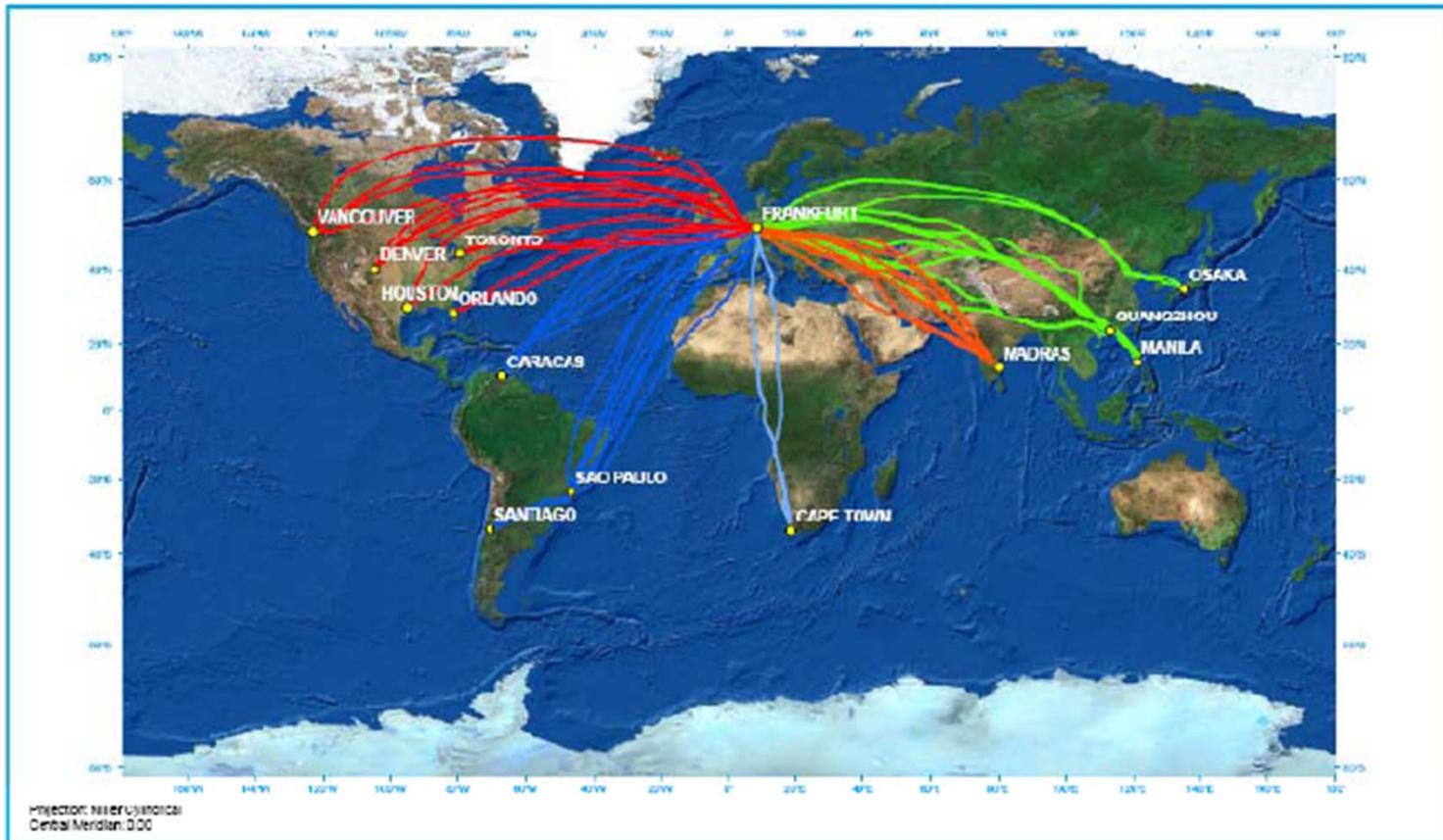
We have 2 guests online

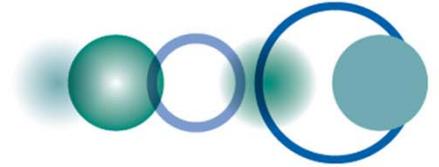
www.gmos.eu/index.php?option=com_wrapper&view=wrapper&Itemid=5

<http://www.gmos.eu/>



GMOS Aircraft-Based Program

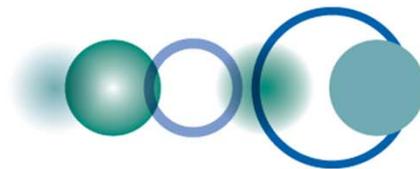




Tracking Pollutants

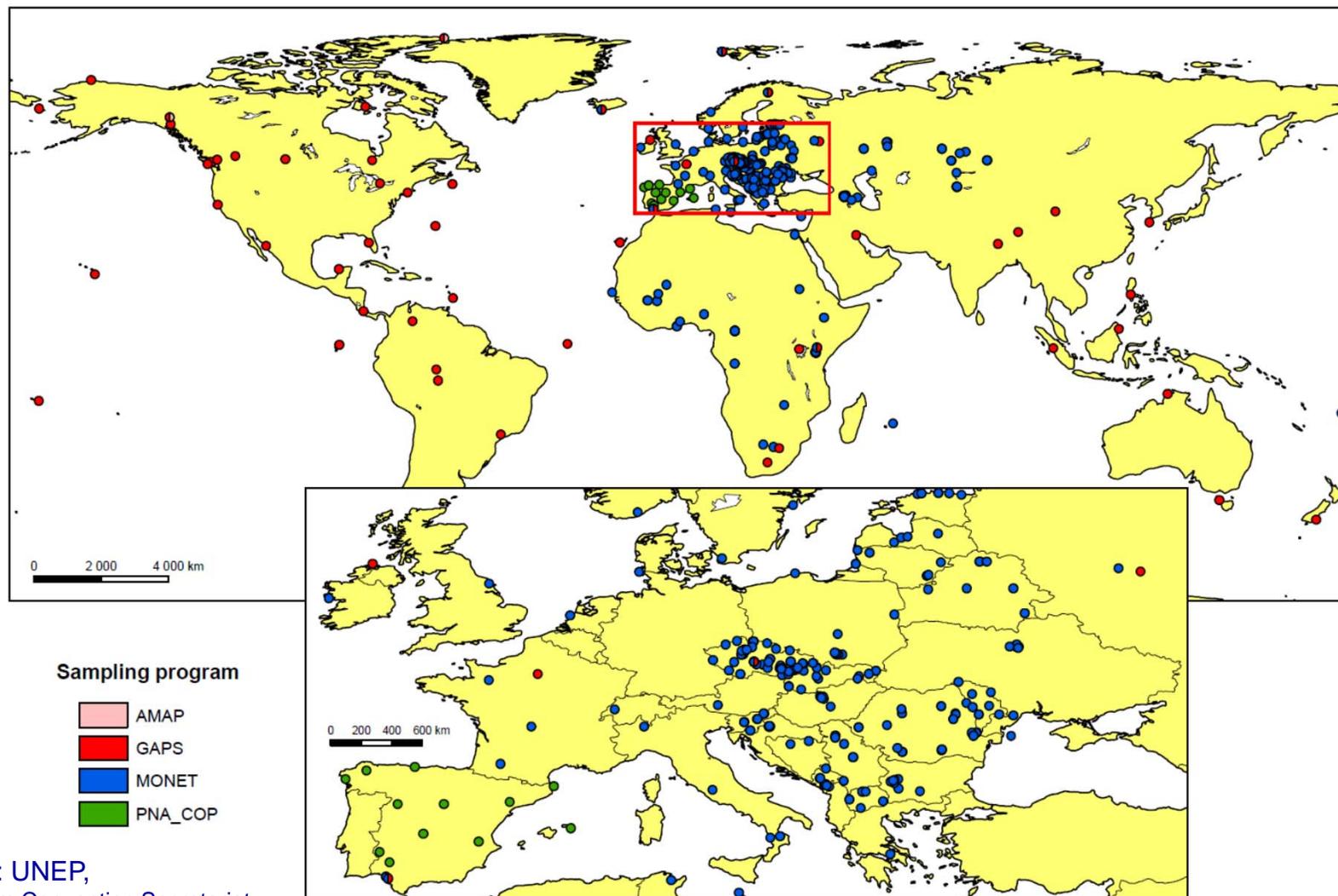
Global Monitoring of Persistent Organic Pollutants

Leads: UNEP (Stockholm Convention Secretariat), Czech Republic (RECETOX)

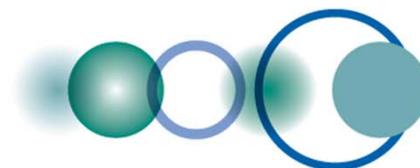


Global Monitoring Plan for Persistent Organic Pollutants (POPs)

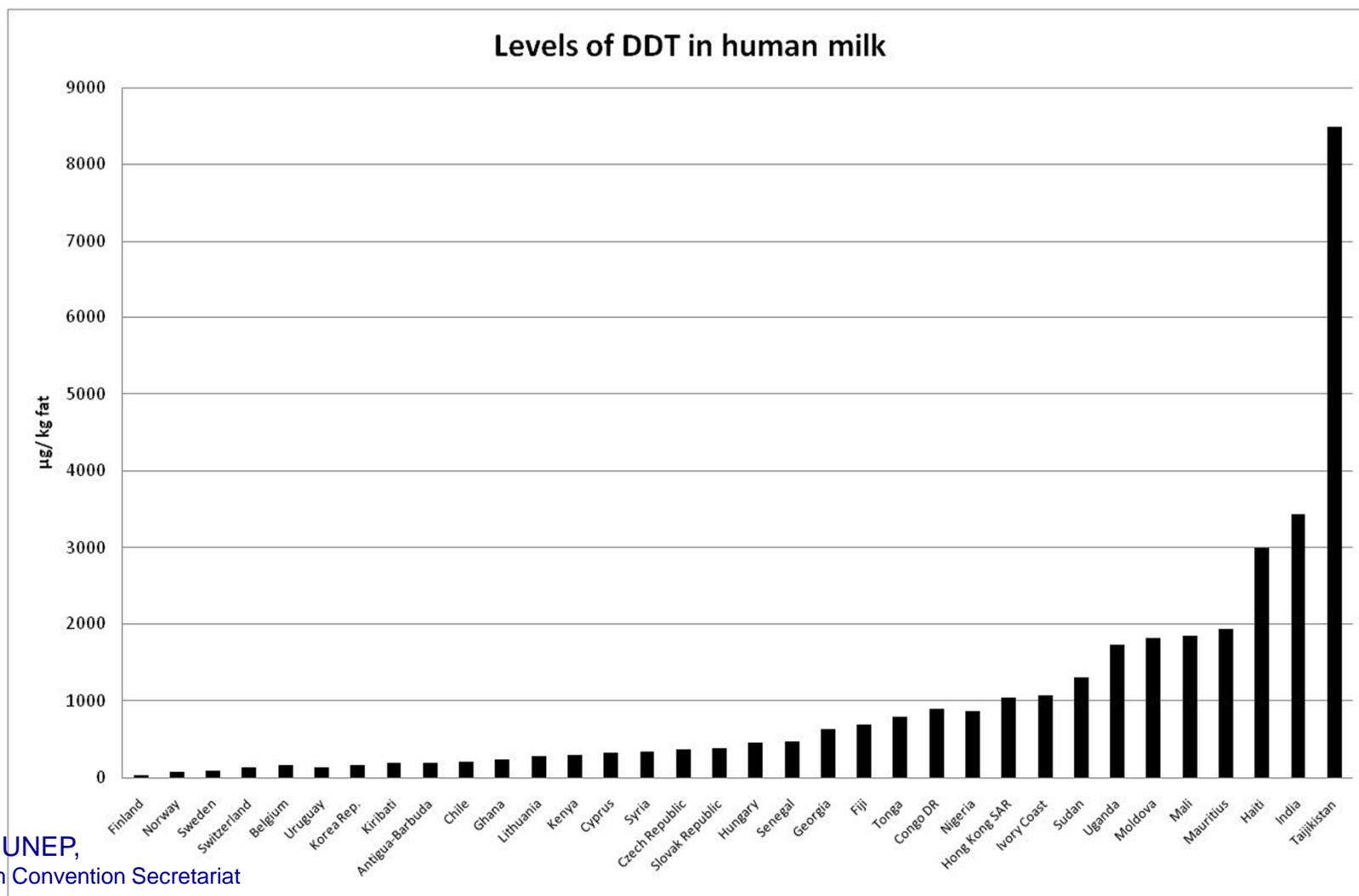
Air sampling: Passive samplers



Source: UNEP,
Stockholm Convention Secretariat



Global Monitoring Plan for Persistent Organic Pollutants (POPs) **Completion of the 5th round of the UNEP/WHO human milk survey**



Source: UNEP,
 Stockholm Convention Secretariat



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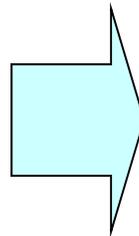


The Concept of “Community of Practice”

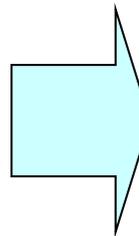
Groups of people who share a concern, a set of problems, or a passion about a topic and deepen their knowledge by interacting on an ongoing basis

Bring together...

- Users
- Providers
- Universities and research institutions
- Technology development actors
- Developed countries
- Developing countries



**Health & Environment
CoP formed in 2009**



**Air Quality CoP formed in 2010,
Focus on AQ Data Networking**



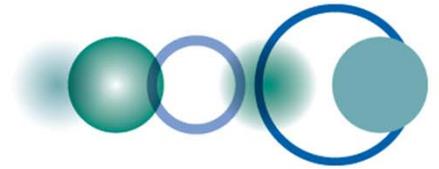
GEO Health and Environment Community of Practice Members

Set up in 2009 with currently 100 members, the CoP on Health & Environment aims to address the user perspective on issues involving environment and health, with emphasis on using environmental observations to improve health decision-making at the international, regional, country, and district levels.

Brazil	ACMAD
EC	HCF
France	ICSU
Germany	IEEE
India	OGC
Italy	UNEP
Japan	UNOOSA
Senegal	WHO
Switzerland	World Bank
UK	WMO
USA	and many others...



1st Health & Environment CoP Workshop, Washington DC, 2009



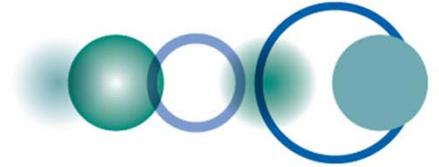
GEO Air Quality Community of Practice

- The GEO AQ CoP fosters the application of air quality observations to Health, Disasters, Weather and other SBAs.
- It aims to support, not compete with other integrating initiatives.
- A tangible goal of AQ CoP is to enable an air quality data network as a System of Systems by 2015.

Technical Workshop, August 2011:

Networking Air Quality Data Systems: From Virtual to Real





Contents

- 1. Overview of GEO/GEOSS**
- 2. Current Activities: GEO Health Tasks**
- 3. The GEO Health & Environment
Community of Practice**
- 4. Summary and Way Forward**



Summary & Way Forward

1. GEOSS Health SBA to develop a “user oriented” approach for Health and Environment, focusing on:

Tools and Information for Health Decision-Making:

- 1) Air-borne Diseases, Air Quality and Aeroallergens
- 2) Water-borne Diseases, Water Quality and Risk
- 3) Vector-borne Diseases
- 4) A Holistic Approach to Health: Transmission Dynamics, Urban Health Forecasting, Linkages and New Technologies; and

Tracking Pollutants:

- 1) Global Mercury Observation System
- 2) Global Monitoring of Persistent Organic Pollutants

2. Challenges and Opportunities: Establishing the concept/discipline of *Health and Environment*, Sustainability; Data sharing; Decision-making outcomes; Supporting international agreements.

Thank you!

<http://www.earthobservations.org>





Special Thanks to GEO Health Task and CoP Leads:

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Michel Jancloes, Health and Climate Foundation (HCF), USA

Richard Kiang, National Aeronautics and Space Administration (NASA), USA

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Nicola Pirrone, National Research Council (CNR), Italy

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Juli Trtanj, National Oceanographic and Atmospheric Administration (NOAA), USA