Proposal for a New Task: Aeroallergens and Allergic Diseases

GEO Health and Environment Community of Practice
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**Why Aeroallergens?**

- **Pollen**
  - 17% of the general population is sensitized to pollen
  - *Tree* - birch, cedar, oak, mulberry
  - Grass
  - Ragweed

- **Fungi**
  - 10% of the general population
  - 40% of the asthmatic population
  - Basidiomycetes (mushrooms)
  - Alternaria

- **Associated Allergenic Illnesses**
  - Asthma
  - Allergic Rhinitis
  - Atopic dermatitis/eczema
**Anthropogenic**

- Gaseous pollutants
  - SO₂, NOx, O₃, CO, VOCs (PAH, benzene, aldehydes etc)
- Particulates pollutants
  - coarse PM 10
  - fine PM 2.5
  - ultrafine (<0.1μm)

**Primary Biological Aerosol Particles (PBAPS)**

- fur fibres, dandruff, skin fragments
- **pollen**, plant fragments, spores
- bacteriae, algae, fungi, viruses
- protein ‘crystals’

25 %

of atmospheric aerosol

Jaenicke (2005) Science 308,73
BY THE NUMBERS: ALLERGIES IN THE UNITED STATES

- 18.0 million adults suffer from hay fever allergies\textsuperscript{20}
- 7.1 million children suffer from hay fever allergies\textsuperscript{20}
- 13.1 million doctor’s visits for hay fever each year\textsuperscript{20}
- $11.2 billion in medical costs to treat allergic rhinitis each year\textsuperscript{21}
- 4 million missed or low productivity workdays each year due to hay fever allergies\textsuperscript{22}
- $700 million in lost productivity due to hay fever allergies each year\textsuperscript{22}
Projected Number of Persons with Asthma 1980-2020
Atopy: Genetic predisposition to the formation of increased levels of IgE antibody

Sensitization

Pollution

Antigen-specific IgE antibody production

Target Organ Response
GEOSS Common Infrastructure

Nine Societal Benefit Areas

- Climate
- Disasters
- Weather
- Water
- Energy
- Health
- Agriculture
- Biodiversity
- Ecosystems

Registries:
- Services
- Standards
- Best Practices
- Requirements

Web Portal
Clearing-house

GEOSS Common Infrastructure

Applications
Models
Metadata
Data
Services
Products

Earth Observations

3 Sub Health SBA areas:
- Air Quality
- Aeroallergens
- Infectious Diseases
Aeroallergen SBA Sub-Area

GEO Task US- 09-01a

Diseases:
- Allergic asthma and allergic rhinitis

Major themes:
- Aeroallergens, production, and release
- Aeroallergens and air pollution interaction
- Meteorology: Humidity, rain, thunderstorms

H. Koren - Aerobiolgy analyst
Hirst Type Volumetric Sampler

*Hirst, 1952
Using phenological monitoring/research to:

- Educate
  - Inform the public, media, school children
  - Establish inventories
  - Enlist participation in climate change initiatives
- Integrate existing observation systems to better inform public health
  - Analyzing/quantifying impacts
  - Standardizing international monitoring programs


http://www.euro.who.int/globalchange/Assessment/20021114_2
GLOBAL PHENOLOGY DATA

GEO 2009-2001 Working Plan Sub-task Number: US-09-03d

Elisabeth Koch, Mark D. Schwartz, Jake Weltzin

Zentralanstalt für Meteorologie und Geodynamik

EUMETNET

USA

NPN

National Phenology Network
Predicting Pollinating Seasons

Methodology: Numerical simulation of large-scale atmospheric transport of allergenic pollen
- Identified source areas (forest inventories; satellite images of broadleaf forests)
- Applied existing dispersion models and birch flowering model (climatalogical dates)

Potential Use: Forecasting tool; predicting modified pollinating seasons

Needs: Parameter refinements; European-wide flowering model

Online Alerts/Forecasts

National Allergy Forecast
<pollen.com>

European pollen tracking
<polleninfo.org>
GEO Task US-09-01a
Critical Earth Observation Priorities
Final Report • October 2010

Recent Contributions to GEO Efforts

User Requirements Registry

Research Needs
Create a New Research Need or Edit an Existing Research Need

Information for users and implementers

For information on individual fields, click on the information icon.

Research Need Definition

Short name:
aeroallergen remote sensing

Long title:
Development and validation of remote sensing (RS) technologies for use in aeroallergen earth observations.
Agencies’ Efforts in Aeroallergens/Allergic Diseases
Allergic Diseases and Climate Change
Predicting Regional Allergy Hotspots in Future Climate Scenarios – Putting the Where & When on Wheezing

EPA Grant Number: R834359
Title: Predicting Regional Allergy Hotspots in Future Climate Scenarios – Putting the Where & When on Wheezing
Investigators: Foster, David R., Rogers, Christine A., Stinson, Kristina
Institution: Harvard University, University of Massachusetts
EPA Project Officer: Bloomer, Bryan
Project Period: September 1, 2009 through August 31, 2013
Project Amount: $898,634
RFA: Climate Change and Allergic Airway Disease (2008)
Research Category: Global Climate Change
Climate Change Influences on Aeroallergens

AEROBIOLOGICAL PATHWAY

Range shifts & increased production

Changes in timing & aerosolization

Changes in wind speed & direction, humidity

Dispersal

Changes in human behavior

Exposure

Change in size, shape & charge of bioaerosol particles

Deposition

Change in human vulnerabilities

Release

Source

Allergen concentration is a sensitive measure of global warming
* Field studies at high CO2 concentrations show plant-dependent enhanced growth and sporulation of fungi (Staddon 2002)
Seasonality in Symptom Severity Influenced by Temperature or Grass Pollen: Results of a Panel Study in Children with Eczema

Ursula Krämer,*† Stephan Weidinger,‡ Ulf Darsow,‡ Matthias Möhrenschlager,‡ Johannes Ring,‡ and Heidrun Behrendt‡

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Betula Peak Date, Denmark

Viborg: \( Y_m = 122.1 \), \( \beta = -0.67 \), \( r = -0.81 \), p<0.001 (***)

Copenhagen: \( Y_m = 123.3 \), \( \beta = -0.74 \), \( r = -0.92 \), p<0.001 (***)

15 day advancement in 20 yrs

Rasmussen 2002
• Trends for birch pollen annual totals and sensitization rates (1976–2002 n.s.)

• Proportion of respiratory allergies 1984–2002 in %; p < .001 in Vienna

Jaeger and Berger
2000
(Source: WHO 2003)
Data Needs/Gaps for Decision Making & Benefiting Public Health

- Gap – Insufficient data to conduct trend analysis & long-term forecasting
- Action – Establish networks to cover more land and develop models combining RS and ground-based technologies to achieve real-time forecasting
- Gap – Pollen grain counts are useful but are labor intensive
- Action - Develop more automated systems to assess aeroallergen conc. and provide long-term trends of allergens
- Gap – Phenology (flowering data) and aerobiology data seem to correlate but lack coordinated strategic planning
- Action – Phenological programs need to be adapted to meet the needs of pollen/allergen forecasting; improve communication
Experts* Supporting the New Task and Its Goals

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Bless You!!!
Thank you

H. Behrendt, ZAUM