



EO2HEAVEN

Earth Observation and ENVironmental modelling for the mitigation of HEAlth risks

European Research Projects for GEOSS

INSPIRE Conference 2010

23-25 June 2010. Krakow, Poland

Jose Lorenzo

ATOS ORIGIN





Concept

EO2HEAVEN will develop a better understanding of the complex relationships between environmental factors, population exposure, and health impacts

Expected outcomes:

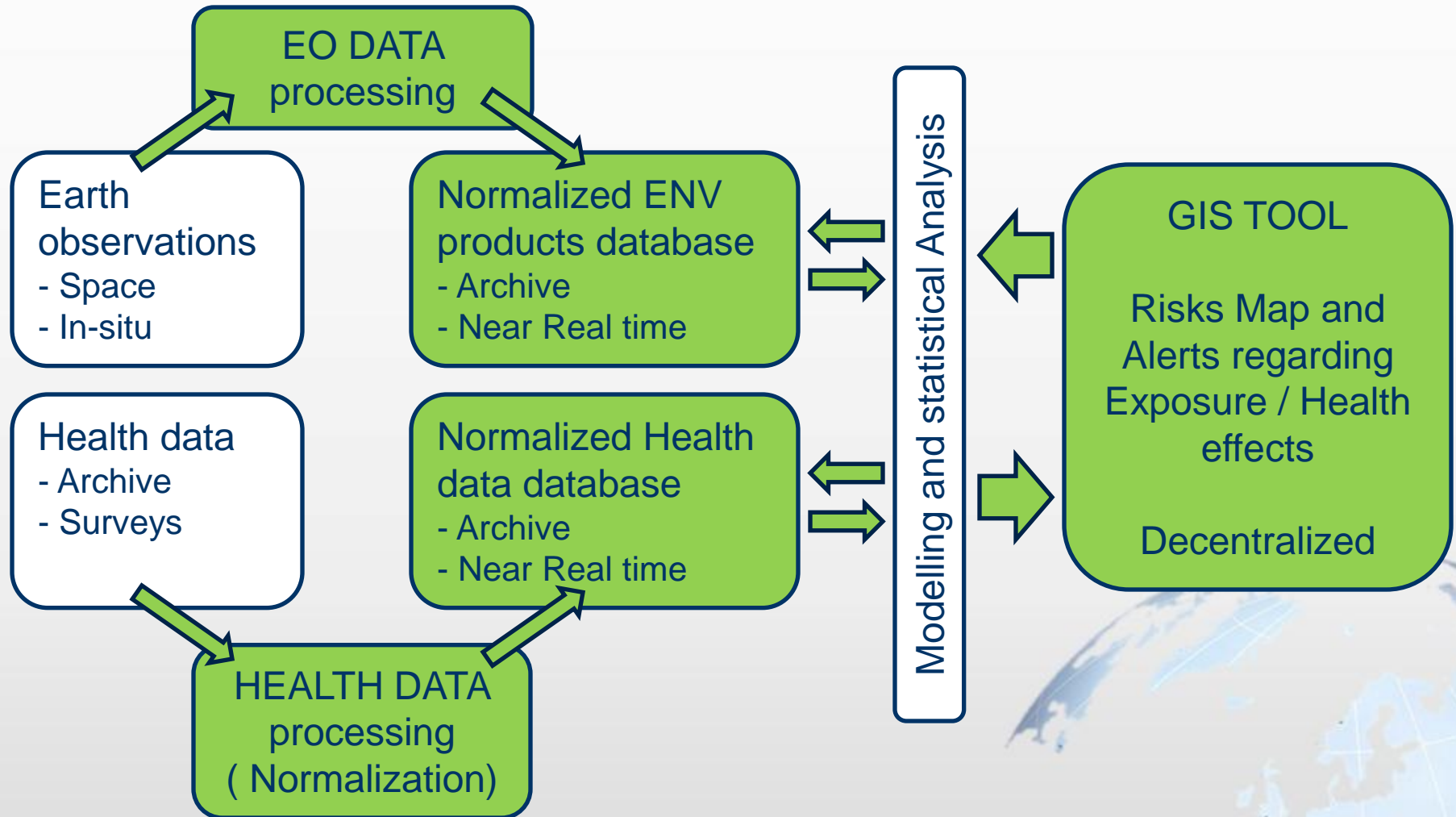
- Development of models relating environmental changes to health exposure
- Development of GIS, risk mapping and alerts
- Ability to predict environmental conditions that is likely to increase the risk of adverse health outcomes within the affected communities



Consortium



Process for building-up new health risk information services through use of innovative SDI



Case studies

3 x case studies to validate the results on different areas, scales and thematics:

1. Environmental effects on allergies and cardiovascular diseases in Dresden
 - respiratory, asthma, allergic and cardio-vascular diseases
2. Environmental Challenges to Health in south Durban, South Africa
 - respiratory and cardio-vascular diseases
3. Investigating the impact of climatic variables on the outbreak of cholera in Beira, Mozambique
 - infectious disease (cholera)

1. Environmental effects on allergies and cardiovascular diseases in Dresden

- **Characteristics (at a glance; 1)**

- Dresden has currently around 516.000 inhabitants (this equals 1.542 inhabitants/square km) and is population wise the one of the few growing eastern German city
- Economically and politically stable
- Environmental situation (examples):
 - SO₂ reduced in the last decade; today mostly below thresholds
 - Particulate matter and NO₂ also slightly reduced; but today still close or above thresholds
 - **Locally traffic produces most of the critical emissions**



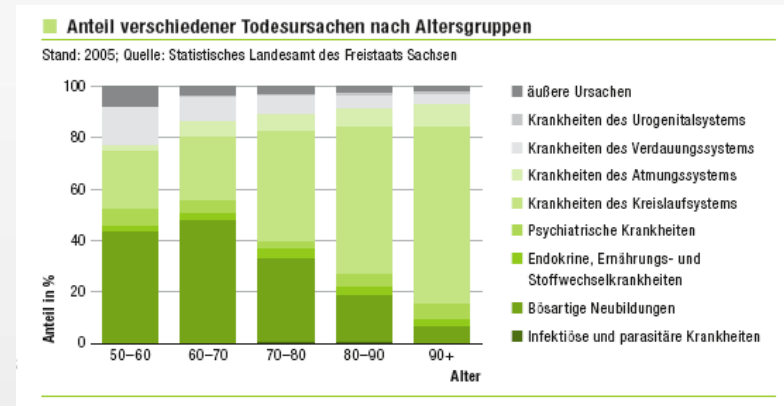
1. Environmental effects on allergies and cardiovascular diseases in Dresden

- Characteristics (at a glance; 2)

- Health Situation

- Cardiovascular & respiratory diseases are (most) common causes of death
 - Allergic asthma is the most common chronic disease (~10 % of German children & ~ 5 % adults suffer from asthma)
 - These diseases are driven to some* extent by environmental exposition

* However, environmental data is still too coarse grained for detailed analysis



EO²Heaven Case Studies

1. Environmental effects on allergies and cardiovascular diseases in Dresden

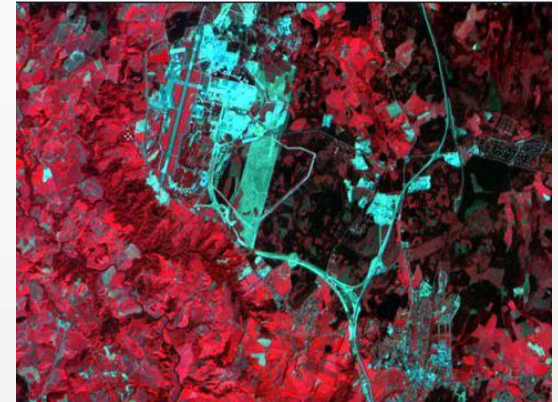
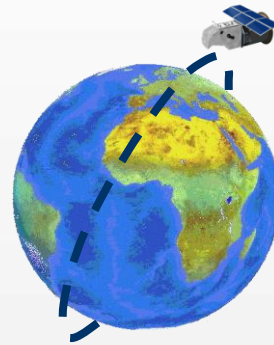
- Objectives

- Interconnecting Health data to Environmental causes
 - (better) explore relations between cardiovascular & allergic effects caused by environmental exposition
 - based on existing medical & environmental data (2003-2006)
 - derive robust spatio-temporal models to forecast stress situations based on environmental sensors & simulations (link to WP3)
- Design an alerting system for health authorities
 - to inform about current environmental exposition risks of patients
 - to support planning prophylactic medication, preparing for an increase need of therapies, to monitor medication success
 - feed findings into guidelines & recommendations on how to transfer the developed methodologies & tools

1. Environmental effects on allergies and cardiovascular diseases in Dresden

- Satellite imagery for pollen flight prediction

- Monitoring of the seasonal development of vegetation by analysing multi-temporal satellite imagery
- Analysis of multi-spectral imagery to derive vegetation indices



- Critical temporal gaps in the satellite imagery series

- Development and verification of concepts for configurable microdrone based sensor networks for the local and temporal densification of satellite image based pollen risk prediction



1. Environmental effects on allergies and cardiovascular diseases in Dresden

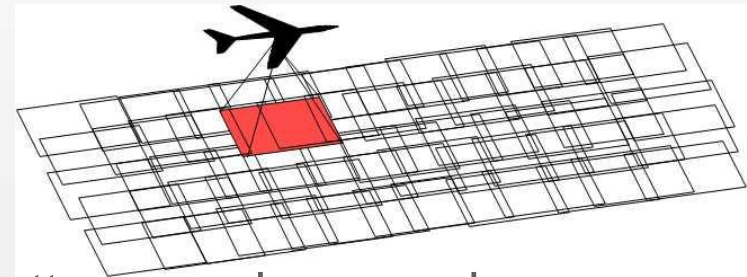
- Acquisition of aerial imagery

- Micro-drones with multi-spectral cameras
- Very high temporal resolution over smaller areas (spatial and temporal densification of satellite data)
- GPS waypoint navigation



- Tasks

- Development of spatio-temporal flight patterns and processing schemes
- Georeferencing (images block adjustment + micro-drone to satellite referencing)
- Vegetation index matching
- Develop plant-specific regression models for pollen risk prediction
- Generate plant-specific spatio-temporal pollen early warning maps



2. Environmental Challenges to Health in south Durban, South Africa

- Background

- The south Durban Industrial Basin (DSIB) consists of approximately 200.000 people living in 25 designated "suburbs"
- The basin is at particularly high risk for exposure to significant levels of ambient air pollution because of its geographic relationship with certain stationary sources of air pollutants
- Two major petroleum refineries are within the community, together with a pulp and paper manufacturer
- Up to a few years ago, each of these refineries has emitted, on average, in the range of 35.000 to 40.000 kg of SO₂ per day



2. Environmental Challenges to Health in south Durban, South Africa

- Data needed

- Meteorological parameters that could be used to predict periods of pollution trapping within the basin, particularly as a result of atmospheric inversion layers
- In-situ environmental measures will be provided by the local government Department of Health's Air Quality Monitoring System (AQMS)
- Health data, particularly presentation of acute cardiac and respiratory diseases among adults and children respectively, will be available from local community clinics
- The epidemiological data from the various studies conducted by the research team at UKZN is also available

2. Environmental Challenges to Health in south Durban, South Africa

- Expected benefits

- The benefits are expected from combining available environmental pollutant data from the AQMS, together with meteorological and other earth observation data, GIS and geographical information and models that can predict elevated levels of pollution
- Providing this early warning system to the communities affected by ambient pollution will allow for children with asthma, adults with cardiac and respiratory disease to take appropriate action such as staying indoors, or leaving the affected areas during the times of elevated pollution
- The success of the prediction of the model will be by showing a defined drop in clinic attendances during times of elevated pollution

3. Investigating the impact of climatic variables on the outbreak of cholera in Beira, Mozambique

- Background

- Mozambican study area-Beira: second largest city as well as an important harbour city in Mozambique with an estimated population of about 550.000 inhabitants
- The city is built on a coastal swamp at the confluence of two major rivers namely the Pungwe and Buzi rivers
- It has poor natural drainage and large areas are inundated during the warm rainy season (October to Marc/April)
- Currently only about 43% of the city's residents have access to piped water and of this number only 60% have access to water that meets the World Health Organization minimum standards for safe drinking
- Beira has been affected by cholera outbreaks on an annual basis since the early 1990's

3. Investigating the impact of climatic variables on the outbreak of cholera in Beira, Mozambique

- Objectives

- This use case will research and develop an early warning system for cholera outbreaks in southern Africa
- Specific coastal and inland areas in Mozambique (Maputo, Beira- including Pungwe and Buzi rivers and Inhambane with Zambezi river) and South Africa (KwaZulu Natal and Limpopo province, including Limpopo river) will serve as test cases
- Remote sensing imagery, health data, data from in-situ sensors and data about environmental and demographic conditions will be combined in models to study the forming conditions conducive for cholera outbreak and spread

Links to GEO Work Plan 2009-2011

GEO Work Plan 2009-2011 Task				EO2HEAVEN		
GEOSS Societal Benefits Areas	OVERARCHING TASKS	SUB-TASKS	LEAD	WP's or subtasks highly linked	LEAD	
HEALTH	HE-09-01: Information Systems for Health		WHO CNES, IEEE	HIGH PRIORITY	WP2, WP3 WP6 Task 6.4 GEOSS Pilot Activity	OGCE
	HE-09-02: Monitoring and Prediction Systems for Health	HE-09-02b: Air Quality Observations, Forecasting and Public Information	USA (EPA)			
Building an Integrated GEOSS	OVERARCHING TASKS	SUB-TASKS	LEAD	Subtasks that could offer additional links	LEAD	
ARCHITECTURE	AR-09-01: GEOSS Common Infrastructure (GC)	AR-09-01a: Enabling Deployment of a GEOSS Architecture	EuroGEOSS USA (FGDC)	WP4	BRGM, Fraunhofer	
		AR-09-01b: GEOSS Architecture Implementation Pilot	OGC	WP4	OGCE	
		AR-09-01c: GEOSS Best Practices Registry	IEEE	WP4	Fraunhofer	
		AR-09-01d: Ontology and Taxonomy Development	Japan (Tokio Univ.)	WP4	Fraunhofer	
	AR-09-02: Interoperable Systems for GEOSS	AR-09-02c: Sensor Web Enablement for In-Situ Observing Network Facilitation	South Africa (CSIR, Meraka)	WP4 Task 4.4 Advance Sensor Web Enablement Concepts	CSIR, 52N	
AR-09-02d: Model Web Development		USA (NASA) IEEE	WP4	WP4		
DATA MANAGEMENT	DA-09-01: Data Management	DA-09-01a: GEOSS Quality Assurance Strategy	CEOS (ESA)	WP3, WP4	WP3	
		DA-09-01b: Data, Metadata and Products Harmonisation	CEOS (NOAA)	WP3, WP4	WP3	
CAPACITY BUILDING	CB-09-03: Building Institutional Capacity to Use EO	CB-09-03b: Establishing Regional Capacity Building Networks	Netherlands (ITC)	WP6 Task 6.3 Training	ITC, CSIR	
	CB-09-04: Capacity Building Needs and Gap Assessment	CB-09-04c: User Oriented Workshops for GEOSS Outreach and Feedback	Netherlands (ITC)	WP6 Task 6.3 Training	ITC	

Contribution to GEOSS (Health)

- **HE-07-01 – Information Systems for Health**
 - Improve in-situ environmental and health data collection for the utilization and validation of remotely-sensed data
 - Explore how GEOSS will support the collection & distribution of information and meet the diverse needs of the health community
 - Develop a global public health information network database to improve health decision-making at the international, regional, country and district levels
- **HE-07-02: Monitoring and Prediction Systems for Health**
 - Support the development of operational health-related applications
 - Connect established and emerging cross-cutting observing systems to monitoring and prediction systems for health
 - Include and gradually consolidate contributions from different, not yet coordinated systems

EO2HEAVEN AIP-3 contribution

- Provision of detailed scenarios
 - Air Quality Health Group:
 - Air Quality Dresden
 - Air Quality Durban
 - Cholera Mozambique
 - Water Quality and Drought Group:
 - Coastal water quality (Cholera Mozambique)
- Action: identification of potential GEOSS contributors to our scenarios
 - Data / products

EO2HEAVEN AIP-3 contribution

Agenda

- **June:** provision of scenarios templates
- **September:** evaluation of GEOSS contribution to the scenarios (feedback on products)
- **October:** provision of feedback
- **AIP-4 (2011):** Foreseen contribution with new products and processes by registering them into the GCI

Thank you for your attention

José Lorenzo

Jose.lorenzo@atosorigin.com

Atos Research & Innovation

Madrid

ph: +34 91 214 86 13

www.eo2heaven.org

The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 244100