

New Technologies for emerging diseases

Andreas N. Skouloudis & David Rickerby

andreas.skouloudis@jrc.ec.europa.eu

Joint Research Centre (JRC)

The European Commission's Research-Based Organisation

JRC's Vision:

*“...to be a trusted provider of science-based policy options to EU policy makers to address key challenges facing our society,
underpinned by internationally-recognised research”*



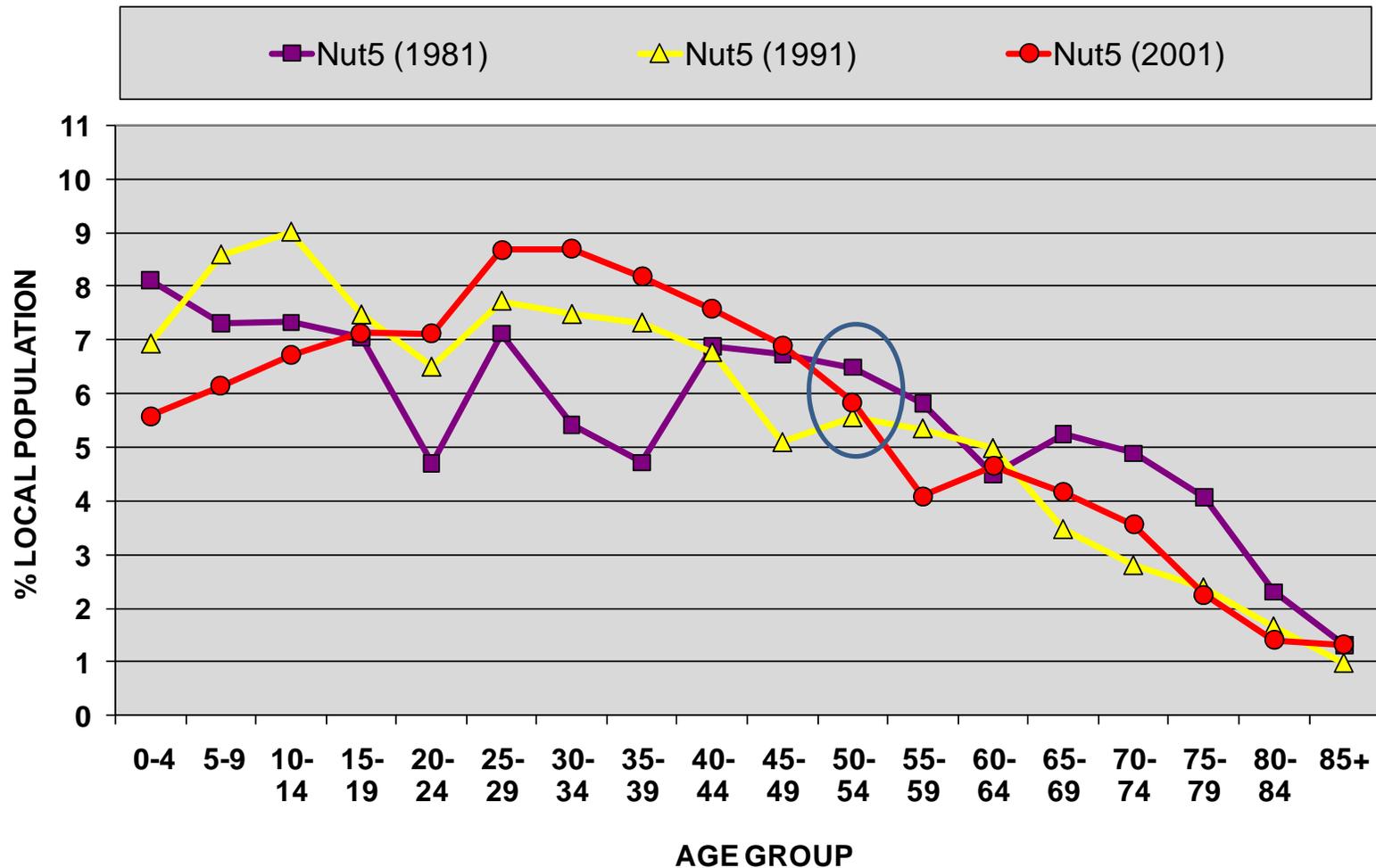
Aim to fulfil a set of strategic and organisational goals:

- Develop a range of policy options
 - Set out and provide analyses of science-based policy options
 - Make robust scientific contributions to solving EU and global 'grand challenges'
 - Provide more integrated scientific and technical support to our customers
 - Strengthen anticipation/forward-looking capacities
1. Towards an open and competitive economy by contributing to the goals of EU2020 Strategy
 2. Development of a low carbon society
 3. Sustainable management of natural resources
 4. Safety of food and consumer products (e.g. containing chemicals and nano-materials)
 5. Nuclear safety and security
 6. Security and crisis management by contributing to the development of new technological approaches
 7. Reference materials and measurements.

- Earth observations for health are usually treated as an input variable to models?
- **Model output on health is used as risk reported on maps?**
- There is a need to separate chronic or acute health effects.
- **We have usually a weak Environmental burden of disease examined and the causes of outbreaks is usually not properly described.**
- We also do not know what are the consequences of preventive measures and hope of an early detection.
- **We need to consider how technology can help for health impact assessments.**



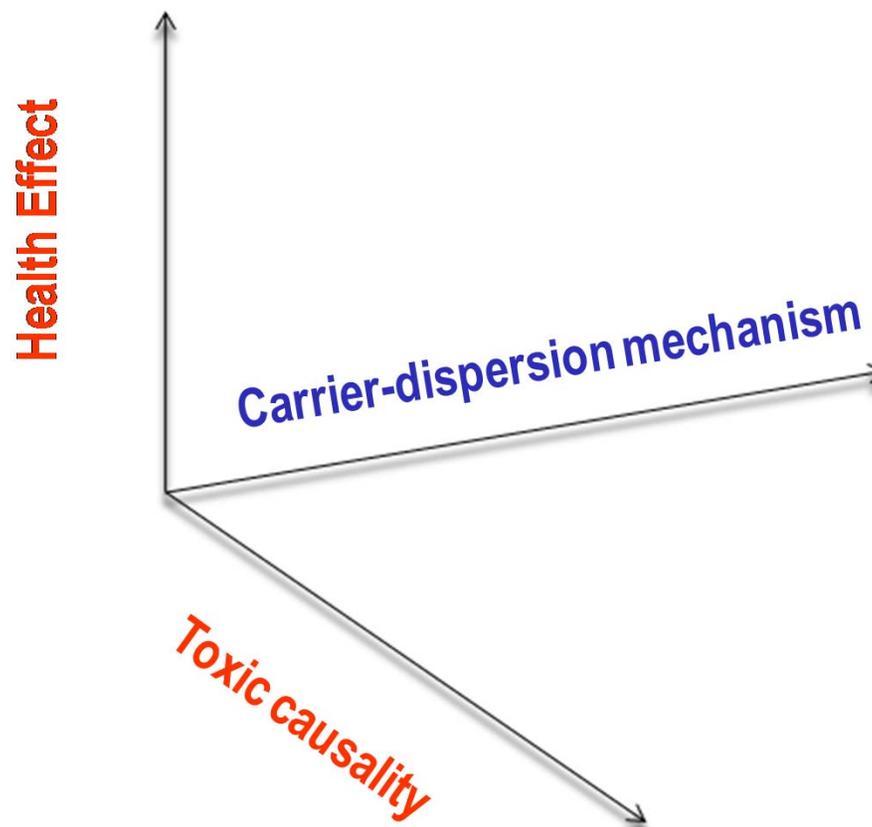
Areas of intensive agriculture have consequences on local demography.



Reducing local population older than 55 years.

Irrespective of the significant influx of population between 24-54 years old.

Similar trends in all regions with changes of land-use.



Earth observations “Not as predictive tools”, ...
but as regulatory compliance/verification process.

E1. Background concentration and local dispersion effects
E2. Local historical mean conditions
E3. Environmental limits affecting local biodiversity
E4. Conditions and alerts for local abatement strategies
E5. Targets for local annual mean concentrations
E6. Targets for regional/national concentrations
E7. Lower limits for acute health effects
E8. Upper limits for human health effects
E9. Permanent irreversible environmental damage

H1. Restrained minor health effects
H2. Impaired function of organs
H3. Appearance of health symptoms
H4. Utilisation of medicines
H5. Reduced performance / restricted activity
H6. Visit to local General Practitioners
H7. Emergency room visits
H8. Hospital admissions
H9. Premature mortality

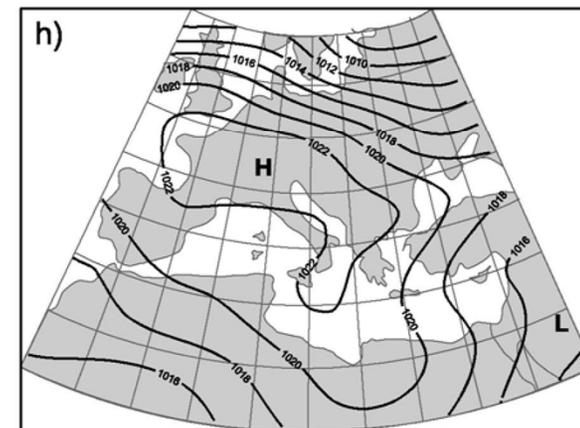
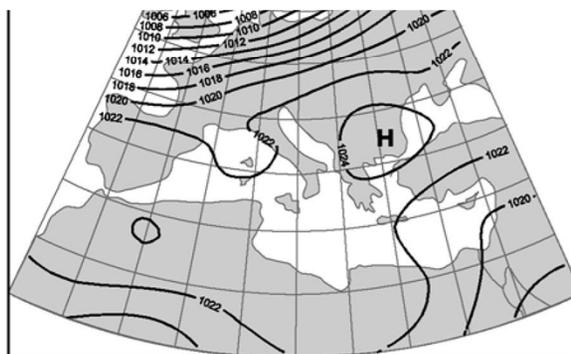
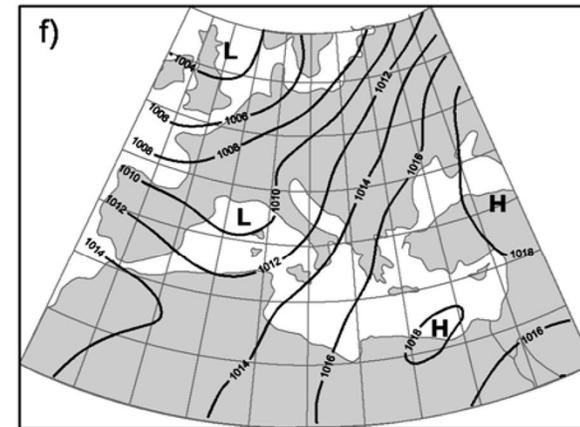
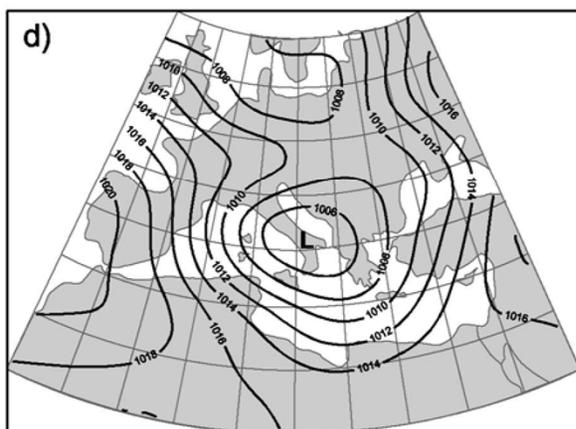
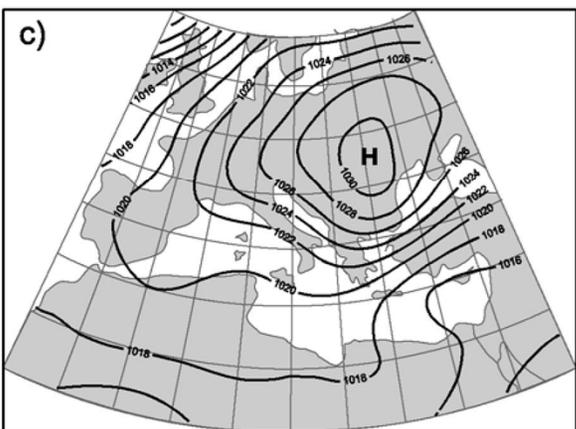
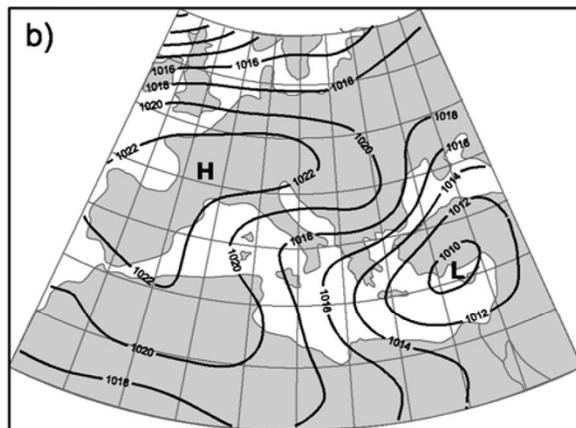
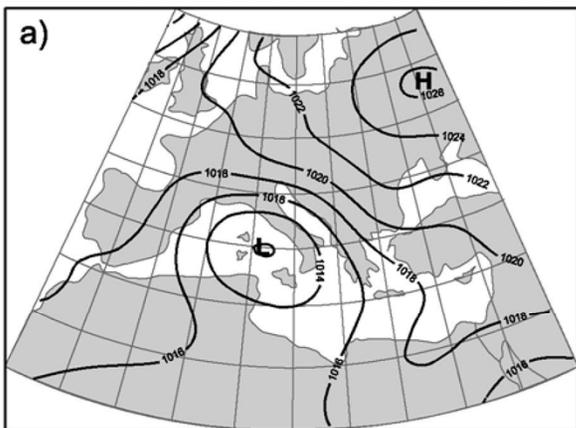
1. How big is the area of the environmental causes influencing the health effect?

2. What is the percentage of the local population effected?

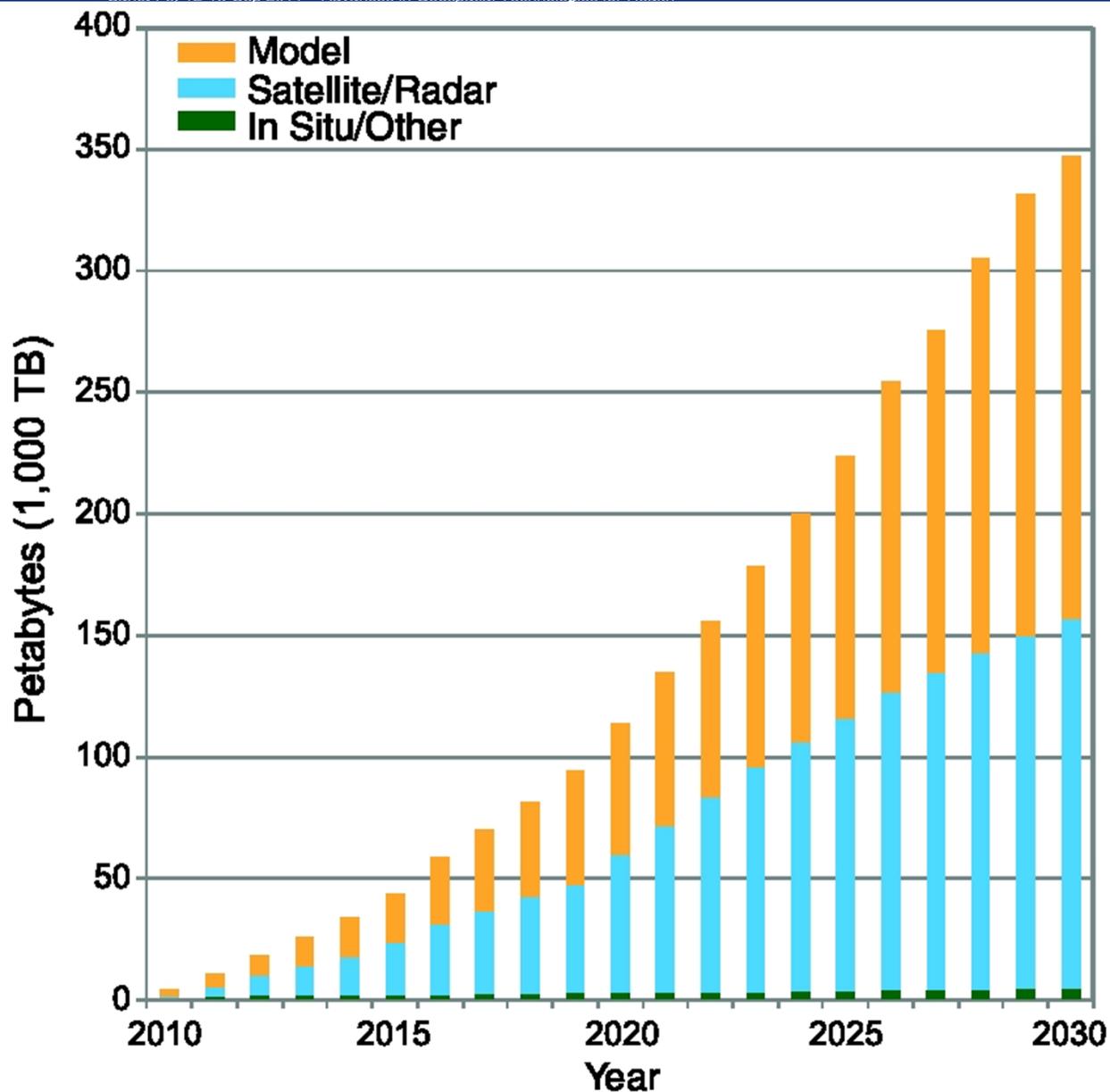
3. How frequently health consequences are happening due to adverse environmental condition.

	Cases	SR (MJ m ⁻²)	T_{mean} (°C)	T_{max} (°C)	T_{min} (°C)	T_{range} (°C)	RH (%)	P (mm Hg)	WS (m s ⁻¹)	v' (m s ⁻¹)	u' (m s ⁻¹)	e (mm Hg)
Cluster 1W	1090	6.7	12.2	15.3	9.7	5.6	79	753.3	2.0	-0.3	-0.4	11.5
Cluster 2W	933	8.1	7.5	10.4	5.3	5.1	69	751.2	3.3	-2.4	0.7	7.4
Cluster 3W	719	8.7	10.2	12.6	8.4	4.2	66	757.4	6.2	-5.8	-0.9	8.6
Cluster 4W	1024	7.6	12.9	15.9	10.2	5.7	75	745.7	3.4	2.0	-0.1	11.4
Cluster 5W	1048	17.1	14.1	18.7	10.4	8.3	62	749.6	2.3	0.8	0.6	10.3
Cluster 6W	1192	10.2	16.1	20.2	13.0	7.2	76	753.1	1.6	0.7	-0.2	14.2
Cluster 7W	1140	8.9	10.0	14.1	6.8	7.3	71	758.1	1.6	-0.6	0.0	9.0
Cluster 8W	944	13.7	12.5	17.5	8.7	8.8	62	756.5	1.8	-0.5	0.2	9.3

Kassomenos et. al: Seasonal variations of the circulation types ...,
Climate Research, Vol.24 (2003) pp 33-46



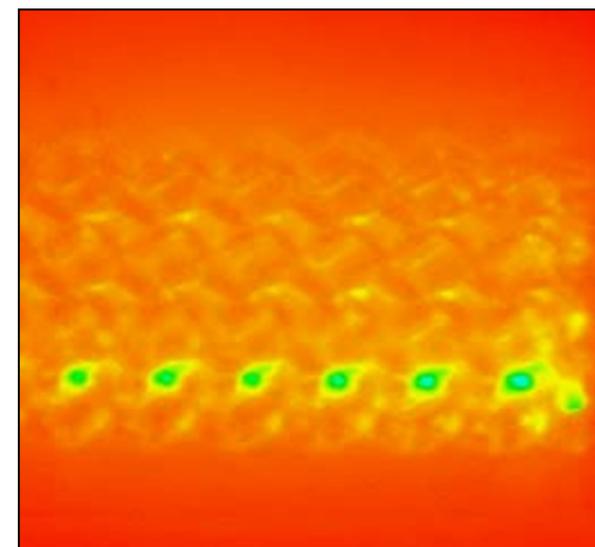
Clusters of dispersion patterns based on meteo-sat images.



Science 331, 700
(11 Feb 2011);
by Jonathan T. Overpeck, et al.

Existing Pathogen Concentrating Device

Automatically samples water or liquids for detection on the biosensor chip.

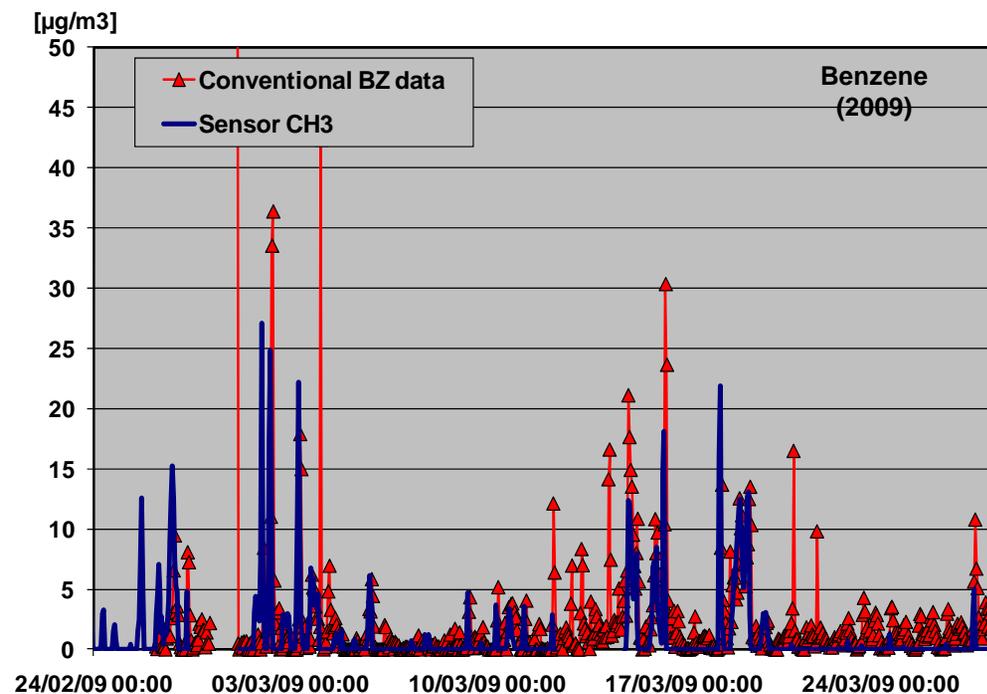
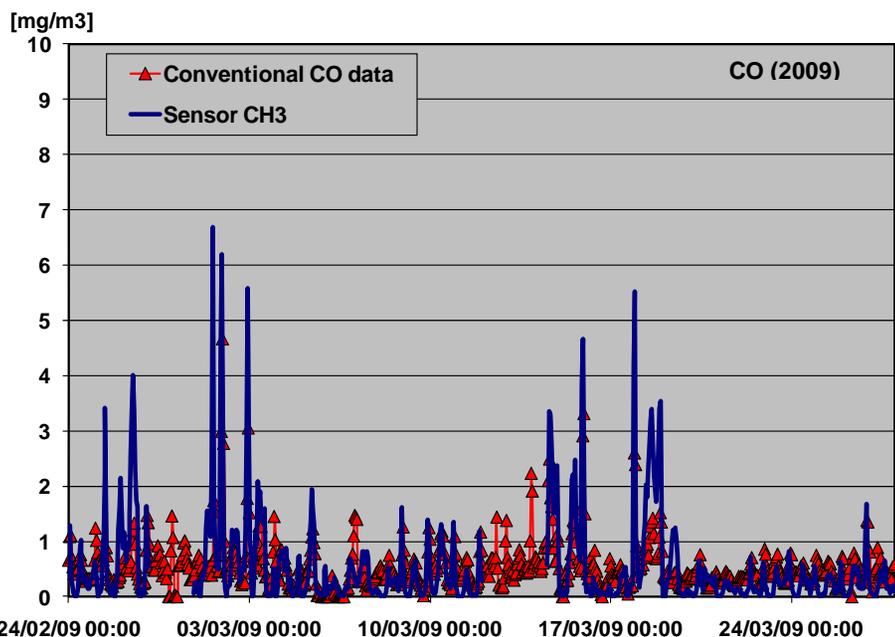


Bacteria captured on nm posts in an experimental Lab-on-a-chip (a 10 year approach)

Network of devices for real time warning and measurements



- ...the re-analysis of existing data sources can serve as a starting basis from where new health impact assessments can be carried out.
- ...with quantifiable parameters and harmonised satellite monitoring, identify dangers for specific population groups (intensive agri exposure).
- ...promote real-time monitoring and interventions coupled with a in-situ sensors (the use of which are rapidly propagating with current telematic networks).



- An ENVISOR **methodology** is established utilizing directly earth observations, for diagnosing health effects.
- But for acute health effects **in-situ** tools are introduced for **diagnostic purposes** and for the “assessment of regulatory effects”.
- By linking EO and in-situ sensors we can establish innovative reporting tools for characterizing different types of population exposure **without excluding the randomness of population activities**.
- Technology can be used **for changing** the perceptions about vulnerable population groups, the severity of specific locations (hot spots) and the significance of acute and chronic exposure to environmental stressors that have impact on human health.