AirMonTech

Options and Strategies:

Urban Air Quality Monitoring Technologies in Context

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Barcelona Workshop

25 – 26 April 2012

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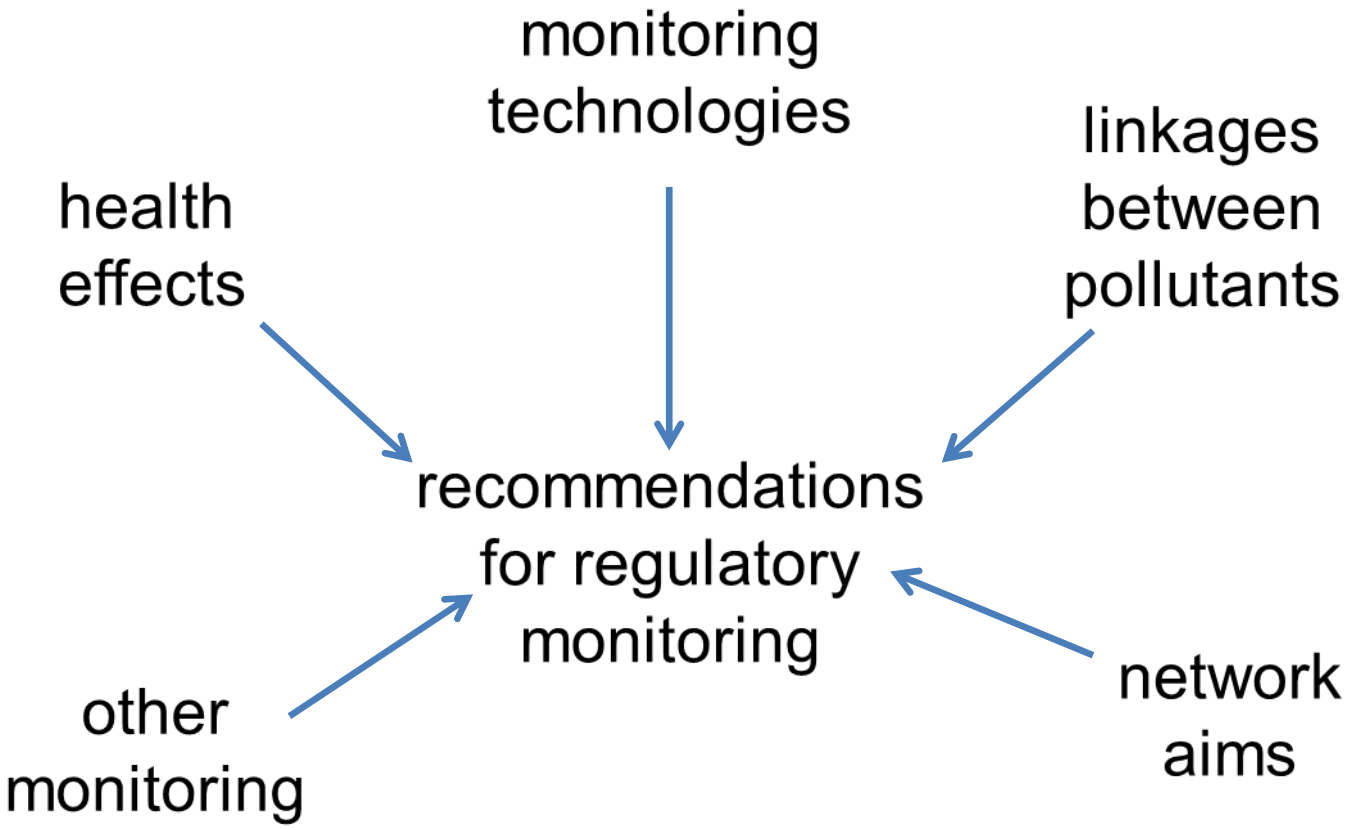
Introduction

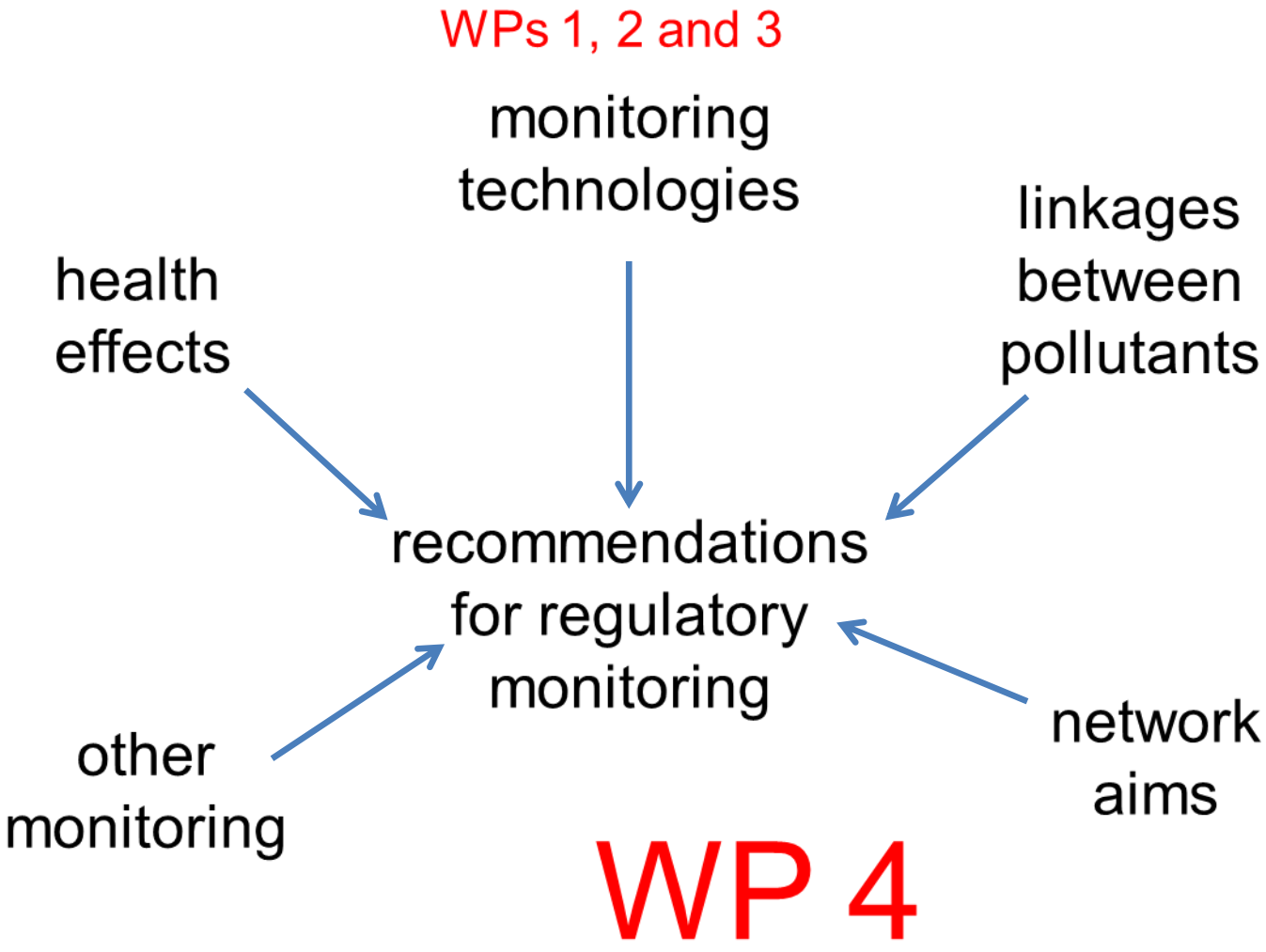
monitoring technologies

recommendations for regulatory monitoring

Introduction



Introduction



Air Pollution Monitoring Technologies for Urban Areas

Outline of talk

NPL National Physical Laboratory

Issues bridging “technology” and “policy”

1. Health effects – covered previously in the meeting
2. Network aims – the importance of having network objectives before setting a strategy and requirements
3. European monitoring networks other than those used for the Air Quality Directive
4. Linkages between pollutants – are some combinations more useful than others?

Network aims

Focus:

Urban monitoring networks for compliance with Air Quality legislation

Superficial purpose:

to monitor compliance with legislation, with prescribed requirements for spatial coverage, types of site, time resolution etc.

Main underlying purpose:

Protection of human health

Network aims

Protection of human health

Is the focus on the most polluted areas (with a consequent blanket “limit value” approach) ? or

Is the focus on maximum relevance to the population (where an “average exposure indicator” may be more appropriate) ?

The emphasis varies between having a few high accuracy sites and having a broader, more representative sample.

Network aims

Other purposes:

- to evaluate the health effects of the regulated pollutants,
- to enable and evaluate source apportionment for the pollutants,
- to allow the evaluation of the effects of specific pollution control measures,
- to validate and improve emissions inventories and air quality models,
- to assess non-regulated pollutants that may become regulated in future.

These may be seen as secondary purposes, but they need to be explicitly included or excluded, with consequences for siting criteria and monitoring technologies

USA example

2008 Ambient Air Monitoring Strategy

- Implement a multi-pollutant monitoring approach that will broaden the understanding of air quality conditions and pollutant interactions, furthering the capability to evaluate air quality models, develop emission control strategies, and support long-term health studies.

- Pursue opportunities for integrating monitoring networks and programs.

- Reconfigure the existing compliance networks to place emphasis on pollutants for which problems with attainment are more widespread and persistent, such as ozone and $PM_{2.5}$.

- Ensure the quality system and other technical requirements for monitors are appropriate for the intended use of the data.

- Encourage the use of continuous and high-sensitivity methods and the adoption of the latest digital data acquisition technology.

Keep several aims in mind; build in the capacity to change

Broad strategies

- "Reference" fixed site monitoring (high accuracy, limited representativity)
- "Sensor" fixed or mobile monitoring (lower accuracy, higher representativity)

- in these cases the associated questions are the number and location of sites, and the pollutants to be monitored

- remote monitoring (ie satellite / GMES (Global Monitoring for Environment and Security) type – very high spatial coverage)
- support from modelling (linked to emission inventories)
- support from monitoring data from other networks

Some combination of these will be desirable

Satellite monitoring of NO_2

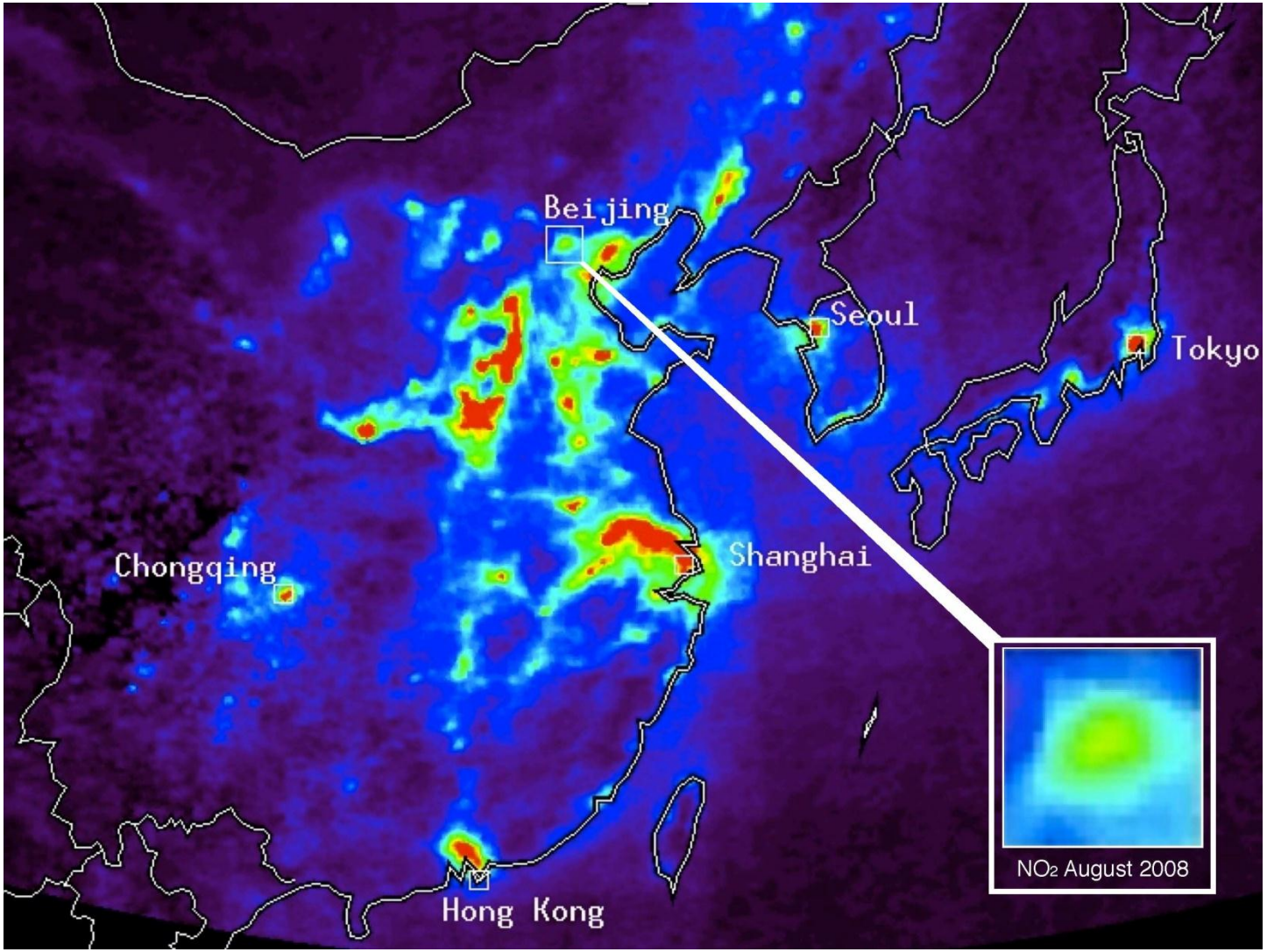


Image courtesy of NASA

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AQ Networks in context

Monitoring required by Air Quality Directives –

regulated pollutants; siting, methods and QA/QC covered by Directives, clarified by CEN standards, and coordinated by AQUILA; mainly urban sites

Monitoring required by the Convention on Long Range Transboundary Air Pollution (EMEP) –

many more parameters monitored; siting, methods and QA/QC coordinated by EMEP; rural and background sites

some EMEP sites are included within the WMO Global Atmospheric Watch programme

Air Pollution Monitoring Technologies for Urban Areas

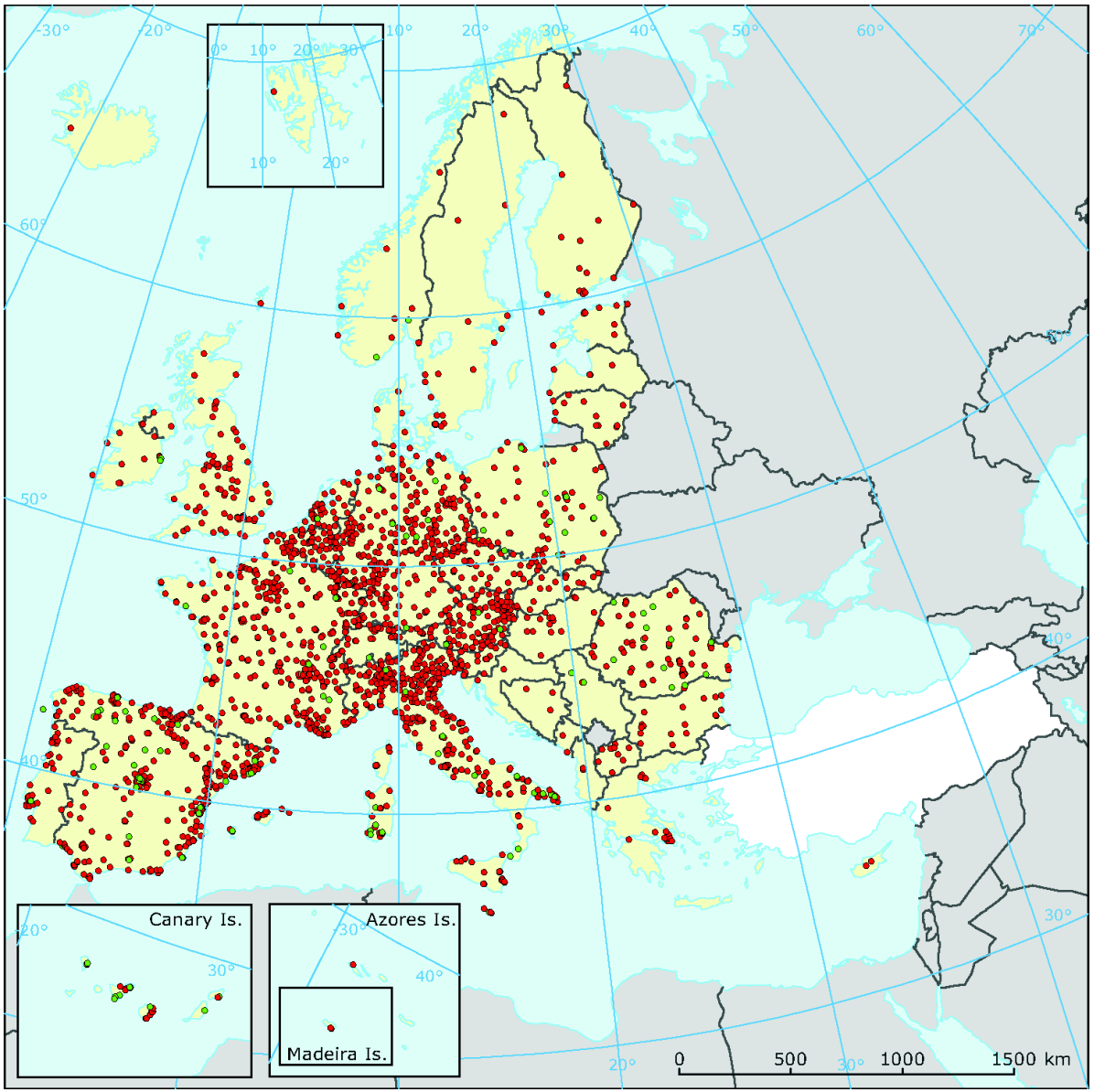
EMEP sites reporting ozone to AirBase

National Physical Laboratory

Air Pollution Monitoring Technologies for Urban Areas

All sites reporting ozone to AirBase in 2010

NPL National Physical Laboratory



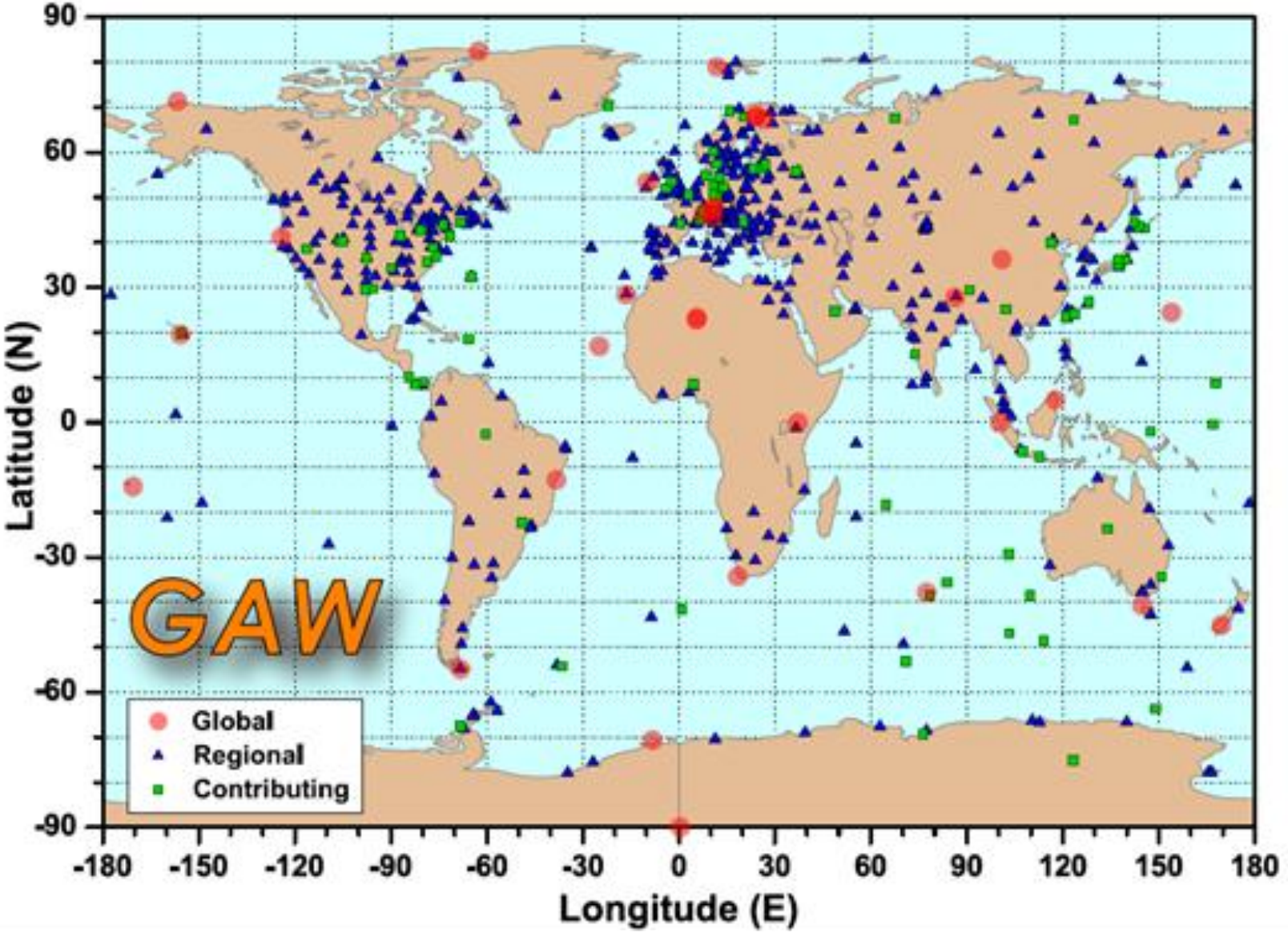
Location of stations for which 2010 air quality data for Ozone have been reported

- Stations reporting O_3 in 2010
- Stations with existing time series
- Stations reporting for the first time in 2010
- No data
- Outside data coverage

Air Pollution Monitoring Technologies for Urban Areas

Global Atmospheric Watch sites

National Physical Laboratory



Networks in context

- Although the aims of Air Quality sites and EMEP sites are different, there is clear overlap in some areas.
- Siting criteria, methods and QA/QC need to be brought closer together.
- This has already started through

  - EMEP participation in AQUILA
  - CEN standardisation
  - common intercomparisons

  and needs to continue.

Linkages between pollutants

1) Are there types of instrument that do not measure specific chemical or physical pollutants, but which measure something relevant to Air Quality, at low cost and high reliability?

2) Do some pollutants correlate so closely in real situations that it is not worth measuring both of them?

3) Are there pollutants which, measured in parallel, provide more information than simply the sum of the individual outputs?

Proxy pollutants

Black Carbon / Black Smoke

Although a measure of optical absorption, it is a good indicator for the impact of traffic emissions, can be measured with high time resolution, and is strongly implicated with health effects.

It can distinguish between products from fossil fuel combustion and biomass burning.

It needs to be supported by standardisation, possibly explicitly linked to Elemental Carbon.

Since a large proportion of exceedances are attributed to traffic or biomass burning emissions, monitoring of ”soot-like” PM would greatly assist the assessment of abatement strategies for air quality in exceedance areas.

Linkages between pollutants

Black Carbon, CO and NOx correlate rather well in urban environments given that they have a common major emission source (vehicular traffic).

However, there are reasons which justify monitoring each of them separately, as they provide additional and relevant information. Their ratios are important for assessing sources and differences between sites.

Collocated measurements of PM_{10} and “soot-like” PM are useful as their combination provides additional information beyond the individual datasets, relating to traffic emissions (exhaust particles) and coarse particle emissions.

Ref: Reche et al (2011), Variability of levels of PM, black carbon and particle number concentration in selected European cities, Atmospheric Chemistry and Physics 11(13) 6207-6227

Summary (1)

The objectives of the current and future regulatory networks need to be explicit, setting out the balance between regulatory and scientific purposes.

The focus of networks required by the Air Quality Directive should be broad enough at least to include the assessment of compliance with EU standards in background and hotspot sites, and the assessment of population-based exposure.

There should be explicit supplementary aims of addressing scientific questions about sources and pollution control measures.

There should be explicit coordination of objectives with regional-scale networks, notably EMEP.

There should be explicit harmonisation of measurement methods and QA/QC procedures with EMEP and other relevant networks.

Summary (2)

There needs to be some flexibility in requirements to encourage the uptake of new technologies, to respond to changing priorities, and to reduce “monitoring inertia”.

Connsideration should be given to moving away from a strategy of comprehensive monitoring networks for each pollutant, to one of having a combination of permanent “supersites” measuring a large range of pollutants in carefully-chosen sites, supplemented by other monitoring techniques and modelling.

The other monitoring techniques could take the form of low-cost instruments, and they could be used in short term campaigns rather than for permanent monitoring.

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SEVENTH FRAMEWORK PROGRAMME

Thank you for your attention

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