What are models? Are they useful for assessing the air quality in Europe? The role of the FAIRMODE community

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What is a model?

Model:

\[ X = V \cdot T \quad T = \frac{X}{V} \quad V = \frac{X}{T} \]

With a model one can:
- Verify conditions → Assessment
- Anticipate facts → Forecast
- Speculate on scenarios → Plan
Air Quality Conceptual Model

Transport (advection by wind)
- Vertical shear
- Low-level jets
- Orographic effects
- Lake/sea breeze

Physical Transformation
- Phase change (gas-particle partition)
- Breakup/agglomeration

Chemical Transformation
- Photolysis
- Oxidation (OH, O3, NO3)
- Neutralization

Chemical Production
- New radicals
- Odd oxygen (Ox)

Deposition/Removal
- Radical termination
- Surface reaction/absorption
- Rainout/Washout/Cloud venting

Primary & secondary ambient concentrations

Ecosystem

Geogenic emissions

Biogenic emissions

Anthropogenic emissions

Mixing volume

Location

Activities

Actions

Policies

Attainment tests

NAAQS, Goals

Society

Costs

Exposure

Effects
Applications of Air quality models for regulatory purposes

**Assessment**: of air quality levels to establish the extent of exceedances and establish the population exposure

**Forecast**: air quality levels for short term mitigation and public information and warnings

**Plan**: measures to control AQ exceedances

In addition to these applications modeling can also be used for:

- Designing and rationalizing monitoring networks
- Source allocation and identification
EU directive 2008/50/EC prescriptions in essence

The EU directive prescribes the use of models as:

- **optional complement** to monitoring data for the assessment of AQ in case of exceedances to get the spatial representation (art 6 and 14)
  - In such case provided specific conditions, monitors can be reduced up to 50% (art 7)

- only-assessment method under low pollution conditions

- planning tool (not mentioned explicitly though) in case of exceedance of target/limit value plans of countermeasures have to be prepared or put in place
Quality of model results

- There is no single model
- There is no perfect model
- AQ models depend on a chain of other models

- AQ model results are input for exposure and economic impact assessment models

- EU agreed QA/QC procedures for models have to be devised, fit-for-purpose evaluation
Promote positive examples on model use

Competence building in countries with no experience

Harmonize practices and upgrade QA/QC standards for models

Connect with monitoring community to mutually benefit from the two practices

Connect to the policy needs at EU and MS level