Introduction of the items and current status of FUMAPEX and COST728

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Working Group discussions on urban meteorology: linkages between NWP - Air Quality models

FUMAPEX Workshop
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Integrated Systems for Forecasting Urban Meteorology, Air Pollution and Population Exposure

FUMAPEX

EVK4-CT-2002-00097

Project web-site: http://fumapex.dmi.dk

Shared-cost RTD,

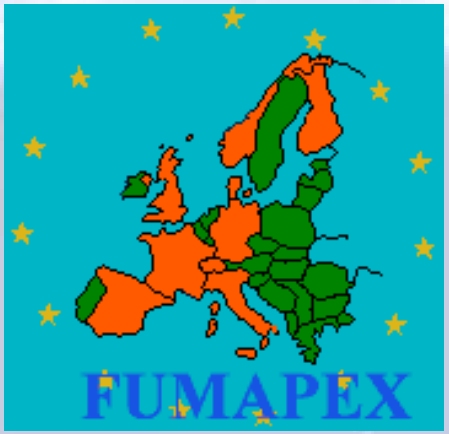
30 November 2002 – 31 October 2005

The Fifth Framework Programme (FP5)

Energy, Environment and Sustainable Development

Sub-programme: Environment and Sustainable Development

Key Action 4: City of Tomorrow and Cultural Heritage



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WHY to study it now ?

Meteorological fields constitute a main source of uncertainty in urban air quality (UAQ) forecasting models.

Historically, UAQ forecasting and NWP models were developed separately and there is no tradition for co-operation between the modelling groups.

This was plausible in the previous decades when the resolution of NWP models was too poor for city-scale air pollution forecasting, but the situation has now changed and it is obvious that **a revision of the conventional conception of urban air quality forecasting is required**.

FUMAPEX: *Integrated Systems for Forecasting Urban Meteorology, Air Pollution and Population Exposure*

Project objectives:

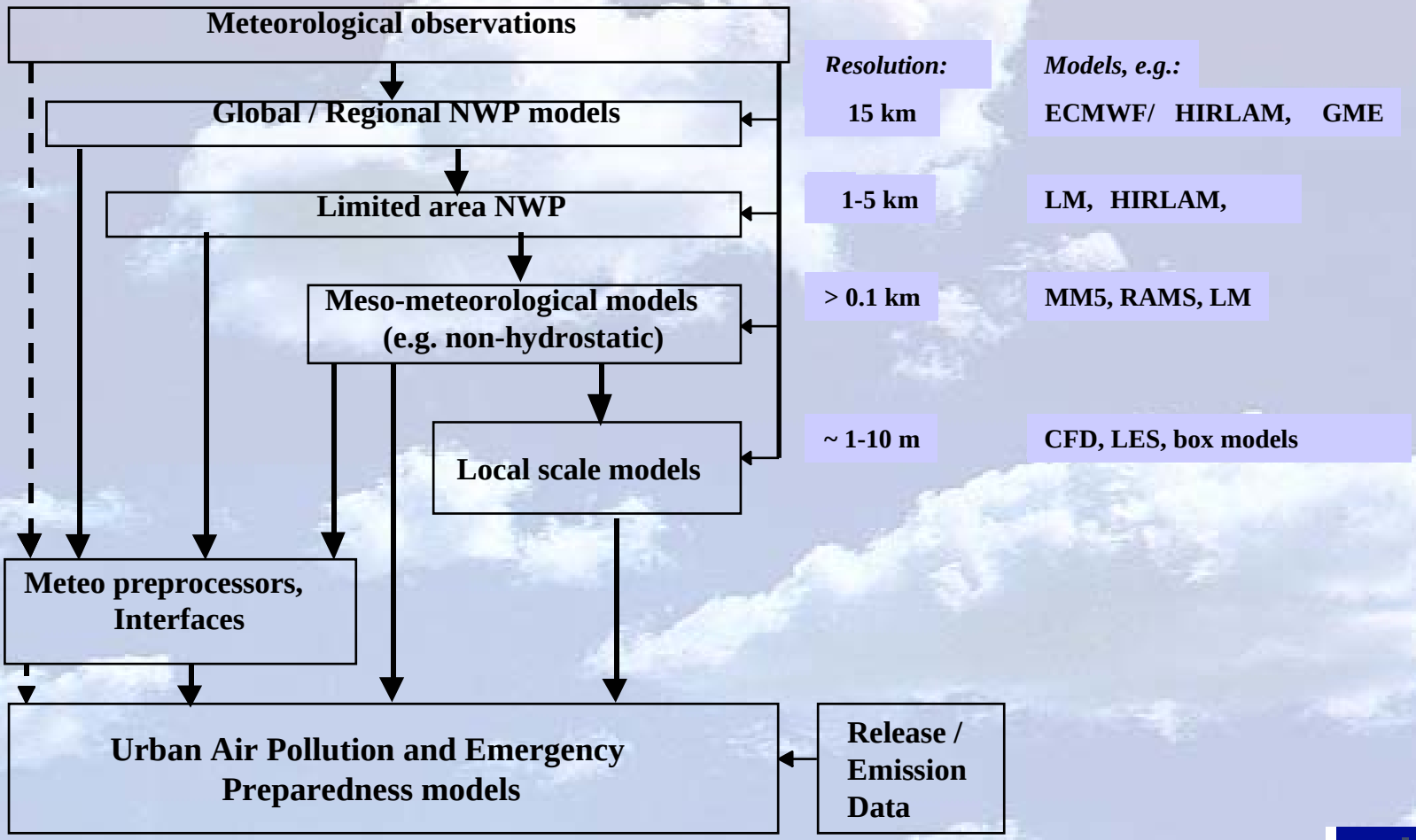
(i) the improvement of meteorological forecasts for urban areas,

(ii) the connection of NWP models to urban air quality (UAQ) and population exposure (PE) models,

(iii) the building of improved *Urban Air Quality Information and Forecasting Systems* (UAQIFS), and

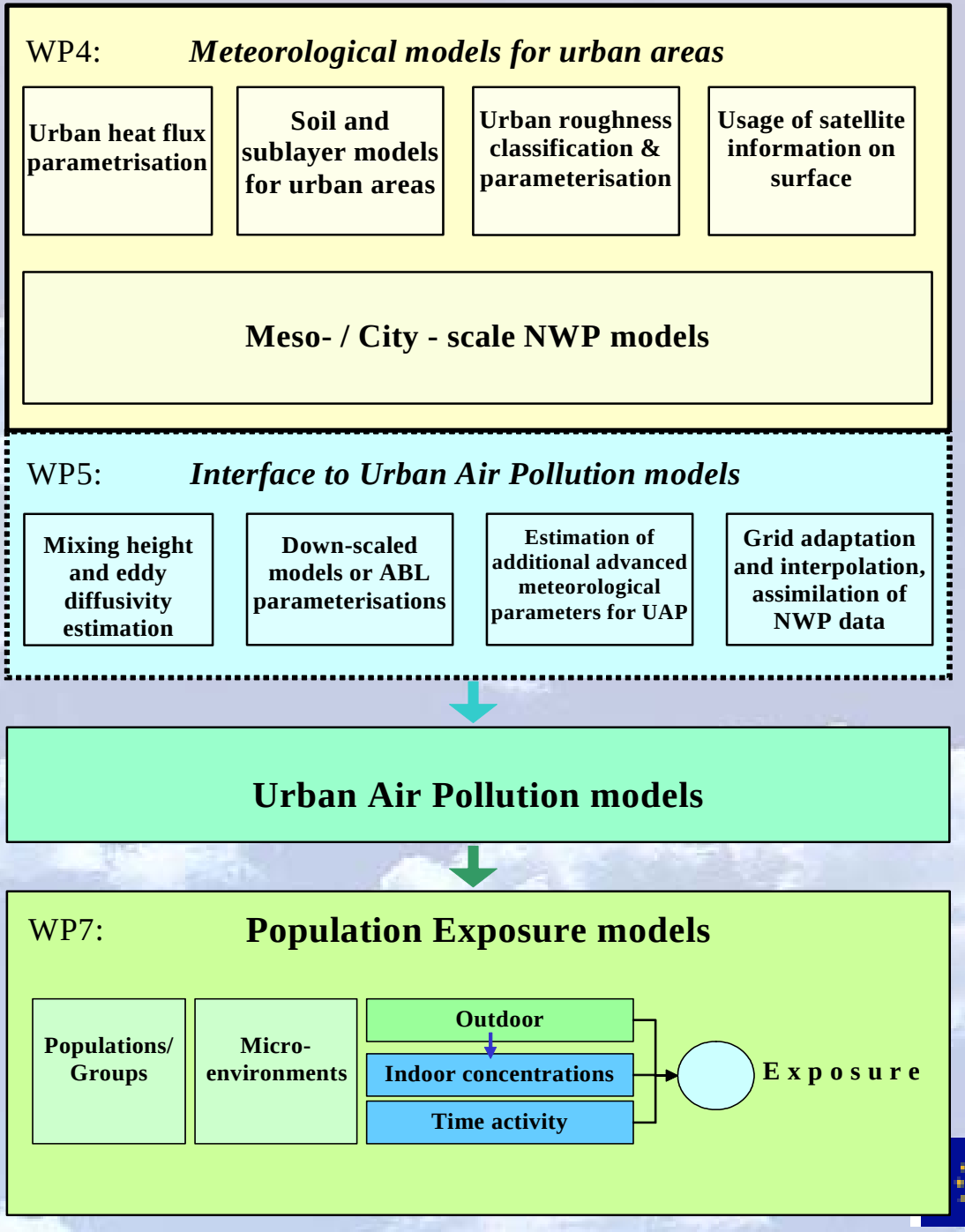
(iv) their application in cities in various European climates.

Current regulatory (dash line) and suggested (solid and dash lines) ways for systems of forecasting of urban meteorology for UAQIFS



UAQIFS:

Scheme of the suggested improvements of meteorological forecasts (NWP) in urban areas, interfaces to and integration with UAP and PE models

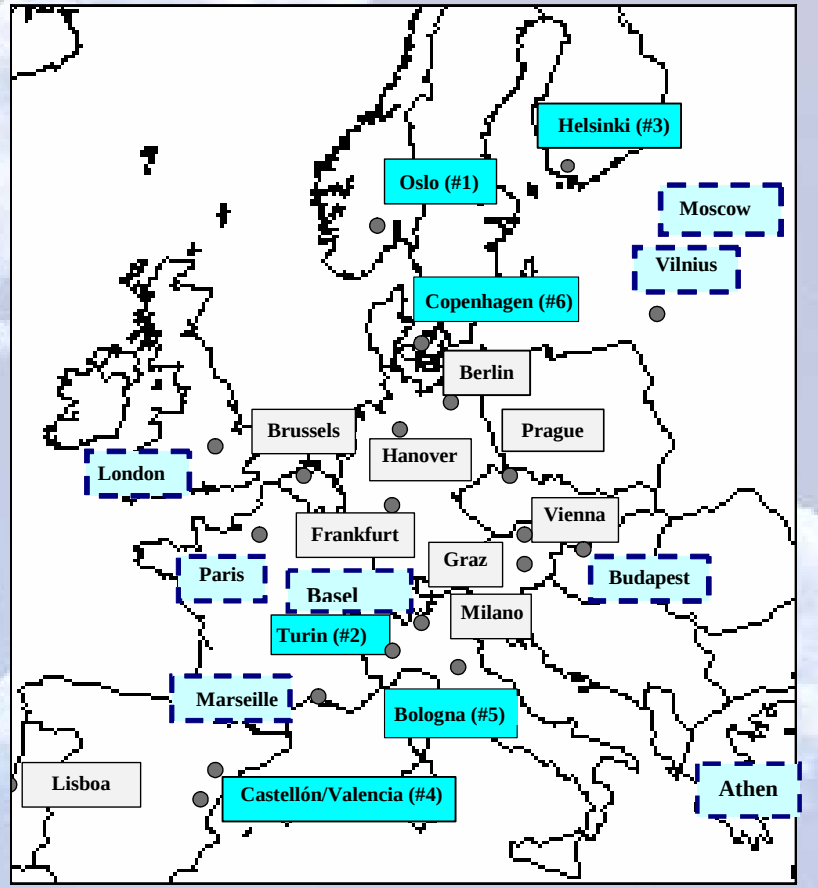


FUMAPEX target cities for improved UAQIFS implementation

#1 – Oslo, Norway
#2 – Turin, Italy
#3 – Helsinki, Finland
#4 – Valencia/Castellon, Spain
#5 – Bologna, Italy
#6 – Copenhagen, Denmark

Different ways of the UAQIFS implementation:

(i) urban air quality forecasting mode,
(ii) urban management and planning mode,
(iii) public health assessment and exposure prediction mode,
(iv) urban emergency preparedness system.



Map of the selected European cities for air pollution episode analysis. The target city candidates for UAQIFS implementation in FUMAPEX are marked by a # and blue background. Potential target cities for applying the FUMAPEX technique in future are marked with a dark-blue shaded border.

Met.no

FUMAPEX: Forecast procedure in Oslo

NWP model output (regional)

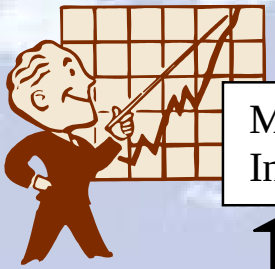
HIRLAM10 (~05:00)

MM5 1-3km (~05:30)

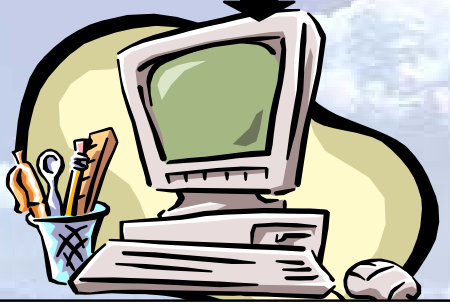
Met-preprocessor

AirQUIS (~06:30)

Global weather information



Meteorological Interpretation



MODEL OUTPUT PLOTS ON WEB FOR END-USERS (~06:30)

Remaining WP4 Tasks:

- To make the urban modules available for users
- Urban canopy wind tunnel experiment for model verification (MIHU, DMI)
- To finalize the model verification vs. measurements
- Intercomparizon of different schemes (test for episode/experiment by diff. models/partners)
- Presentation of all WP4 partner results
- Publications
- Initialisation of further studies, cooperation with other groups

Meteorology and Air Pollution:
as a joint problem

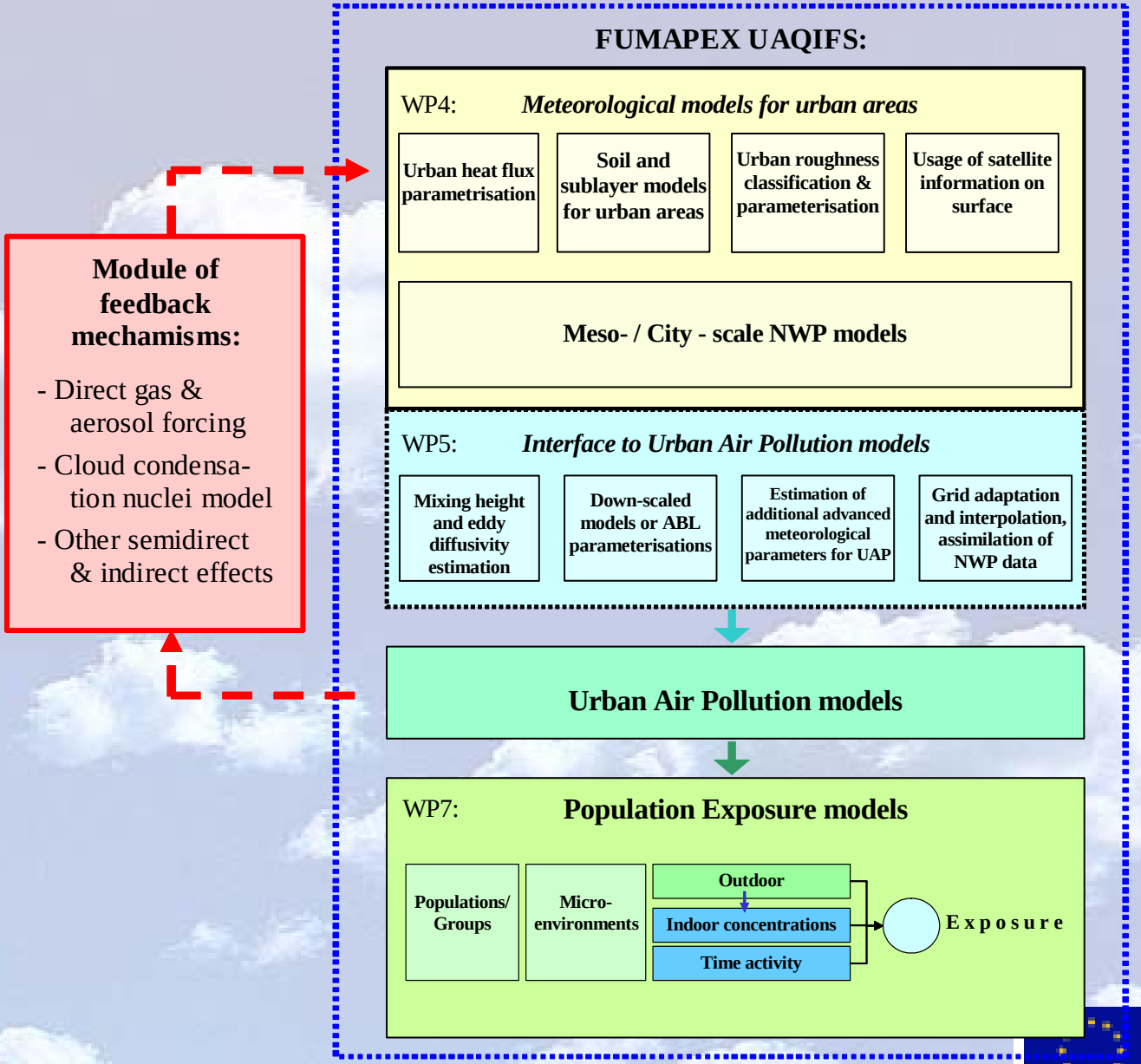
- Meteorology is a main source of uncertainty in APMs => needs for NWP model improvements
- Complex & combined effects of meteo- and pollution components (e.g., Paris, Summer 2003)
- Effects of pollutants/aerosols on meteo&climate (precipitation, thunderstorms, etc)

<u>Three main stones for Atmospheric Environment modelling:</u>

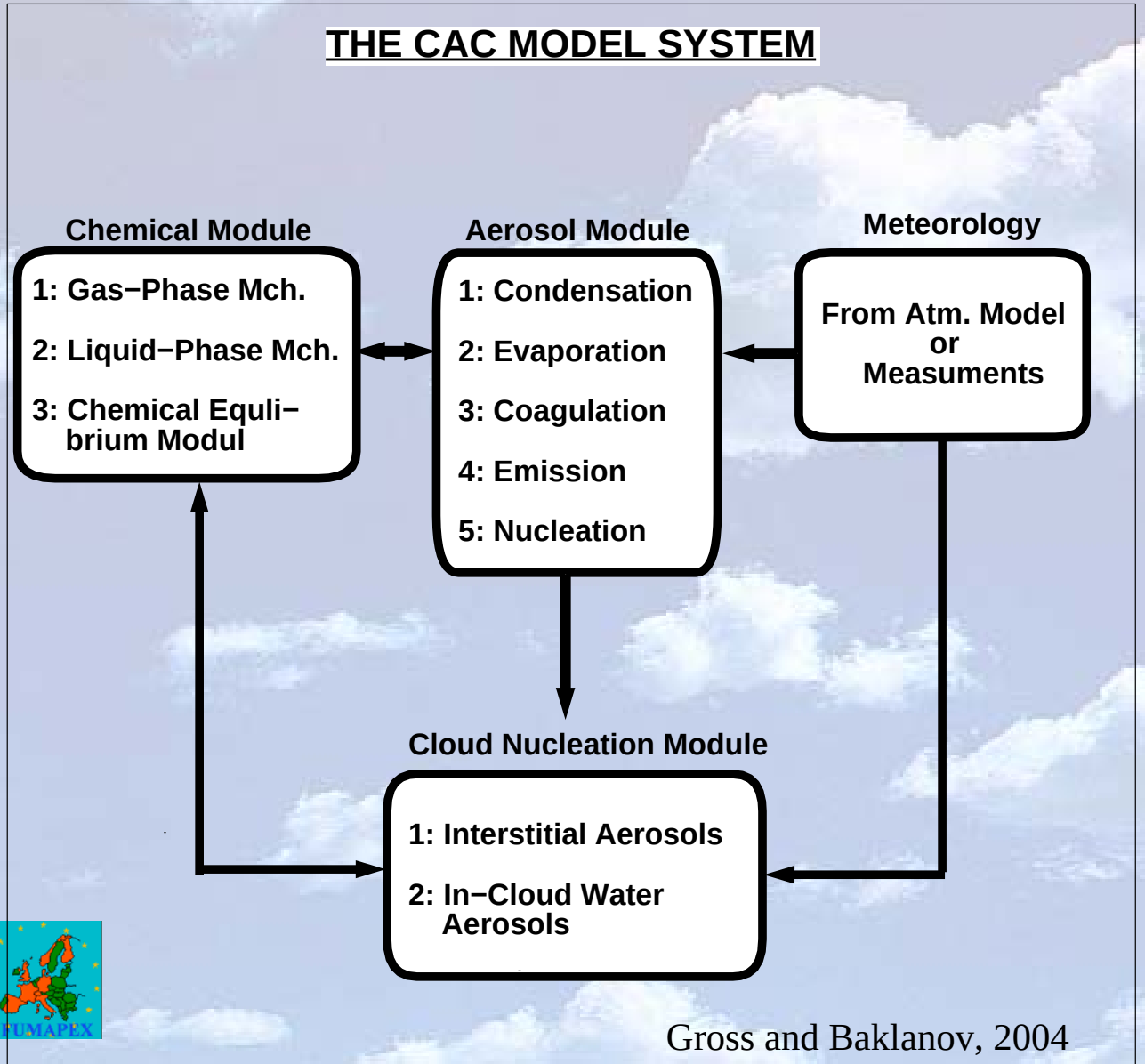
1. Meteorology / ABL,
2. Chemistry, => *Integrated Approach*
3. Aerosol/pollutant dynamics *("chemical weather forecasting")*
4. Effects and Feedbacks

Extended FUMAPEX scheme of the UAQIFS including feedbacks

Improvements of meteorological forecasts (NWP) in urban areas, interfaces and integration with UAP and population exposure models following the off-line or on-line integration



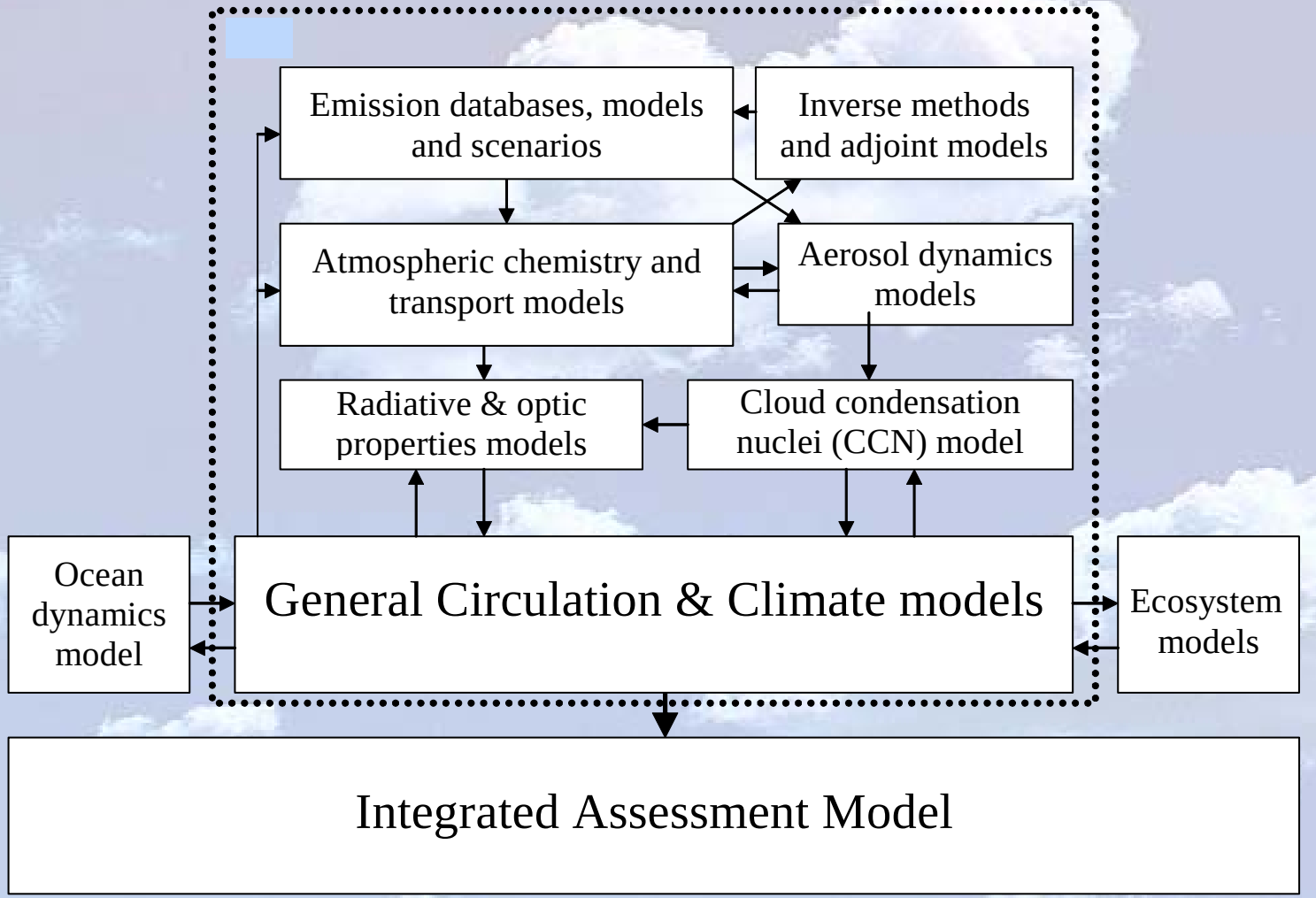
Schematic Illustration of the Chemistry-Aerosol-Cloud (CAC) System being developed at DMI



Gross and Baklanov, 2004

Recently DMI has developed a new version of the meteorological model HIRLAM with on-line integrated passive tracer (**DMI-HIRLAM-Tracer**) (Chenevez et al., 2004) and has implemented a versatile aerosol-cloud module and heterogeneous chemistry in their Atmospheric Chemical Transport Model (ACTM) (Gross and Baklanov, 2004).

Integrated (on-line coupled) modeling system structure for predicting climate change and atmospheric composition

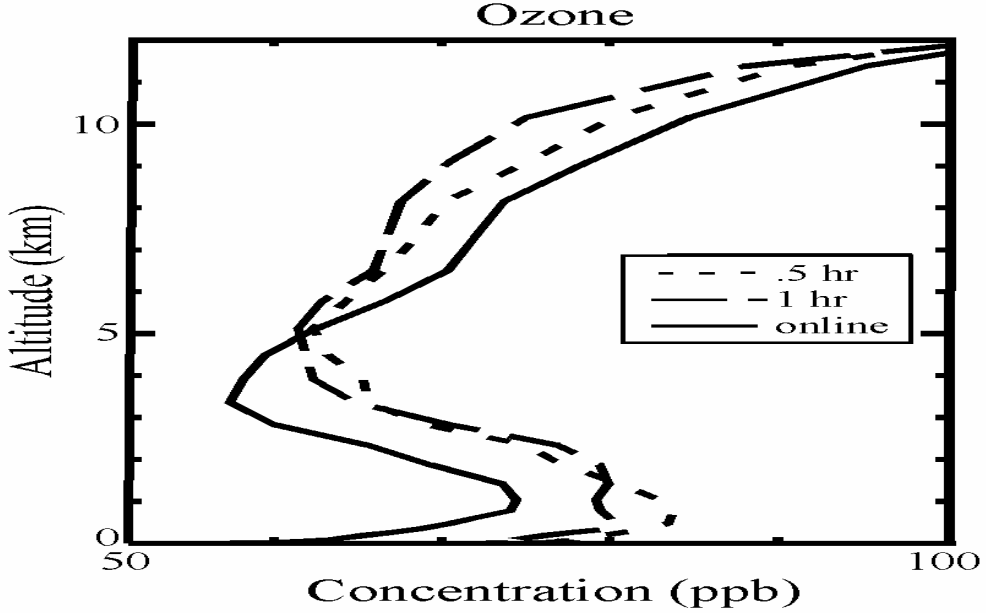


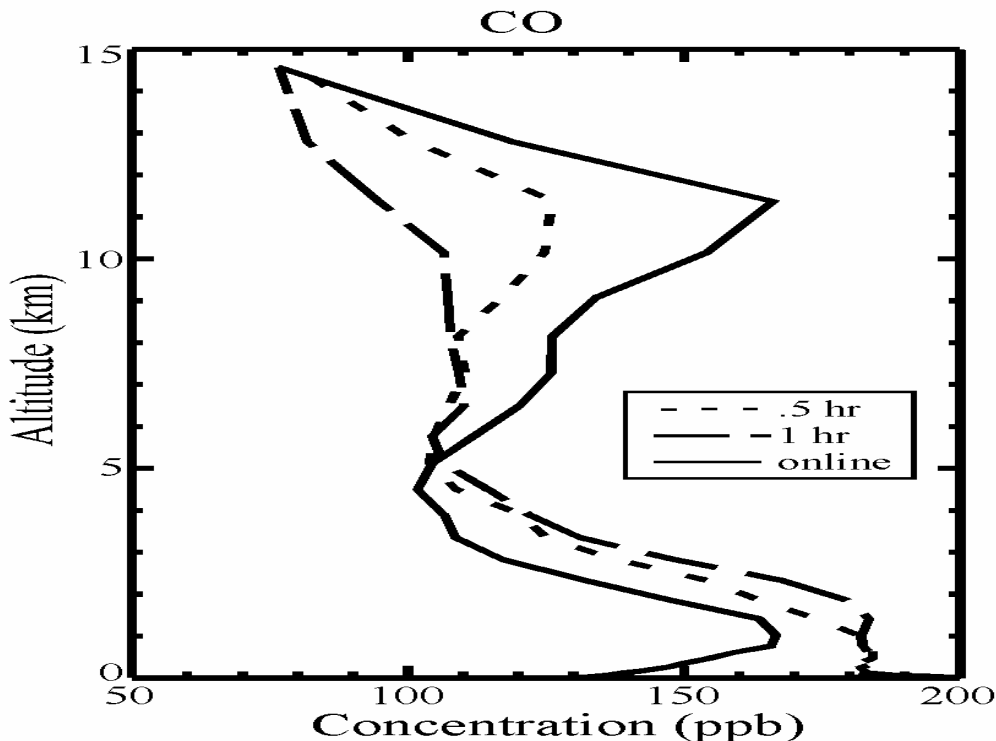
Baklanov et al., 2003

WRF-Chem:

Online versus offline averaged concentration over half of the domain,

At 21Z





COST 728: Enhancing meso-scale meteorological modelling capabilities for air pollution and dispersion applications

(2004-2009)

WG2: Integrated systems of MetM and CTM: strategy, interfaces and module unification

WG2 overall aim - to identify the requirements for the unification of MetM and CTM/ADM modules and to propose recommendations for a European strategy for integrated mesoscale modelling capability.

WG2 activities will include:

- **Forecasting models**
- **Assessment models**

Why we need to build the European integration strategy?

- **NWP models are not primarily developed for CTM/ADMs and there is no tradition for strong co-operation between the groups for meso/local-scale**
- **the conventional concepts of meso- and urban-scale AQ forecasting need revision along the lines of integration of MetM and CTM**
- **US example (The models 3, WRF-Chem)**
- **A number of European models …**
- **A universal modelling system (like ECMWF in EU or WRF-Chem in US) ???**
- **an open integrated system with fixed architecture (module interface structure)**

European meso-scale MetM/NWP communities:

- **ECMWF**
- **HIRLAM**
- **COSMO**
- **ALADIN/AROME**
- **UM**

- **WRF**
- **MM5**
- **RAMS**

European CTM/ADMs:

- **a big number**
- **problem oriented**
- **not harmonised (??)**
- **…..**