The AQMEII Two-Continent Regional Air-Quality Model Evaluation and Inter-comparison

Phase 1 and 2

An overview and the collaboration with

EuMetChem – Action ES1004

S. Galmarini

Joint Research Center, IT

AQMEII

European Commission

Environment Canada

Environnement Canada

AQMEII's foci:

Evaluation of regional scale air quality models
Development of a common evaluation framework
Bridging North American and European modeling communities

- JRC-IES
- US-EPA
- Environment Canada

- DG-RTD and DG-ENV

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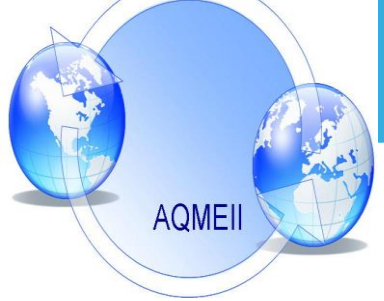

European Commission

Environment Canada

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AQMEII P1: The two continent model evaluation exercise

- Collection of model results for EU and North America continent over a period of 1 year (2006)
- Collection of model and monitoring data for the case study
- Organization the information of a central database with the high level of harmonization
- Exchanging experience on the use of emission inventories produced in NA and EU
- 4D Analysis of model behavior and evaluation at monitoring stations against measurements

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Number of groups per country and mode char

AUSTRIA 1
CANADA 1
SWITZERLAND 1
GERMANY 3
SPAIN 1
FINLAND 1
FRANCE 3
GREECE 1
ITALY 1
NORWAY 1
POLAND 2
UK 2
US 4

	Model			Res (km)	n.Vertical layers	Emission	Chemical BC
	Code	Met	AQ				
European Domain	Mod1	COSMO	Muscat	24	40	Standard	Standard
	Mod2	MM5	DEHM	50	29	Global emission databases, EMEP	Satellite measurements
	Mod3	MM5	Polyphemus	24	9	Standard	Standard
	Mod4	EMEP	Hirlam	50	20	EMEP model	From ECMWF and forecasts
	Mod5	WRF	CMAQ	24	52	Standard	Standard
	Mod6	WRF	WRF-Chem	22.5	36		
	Mod7	WRF	WRF-Chem	22.5	36		Standard
	Mod8	ECMWF	SILAM	24		Standard	Standard
	Mod9	MM5	Chimere	25	9	Standard	MEGAN, Standard
	Mod10	LOTOS	EUROS			Standard	Standard
	Mod11	WRF	CAMx	12	23	Standard	Standard
North American Domain	Mod12	GEM	AURAMS	15	58	Standard	Climatology
	Mod13	WRF	Chimere	36	9	Standard	LMDZ-INCA
	Mod14	MM5	CAMx	24	23	Standard	LMDZ-INCA
	Mod15	WRF	CMAQ	12	34	Standard	Standard
	Mod16	WRF	CAMx	12	23	Standard	Standard
	Mod17	WRF	Chimere	36	9	Standard	standard
	Mod18	MM5	DEHM	50	29	global emission databases, EMEP	Satellite measurements

Across Atlantic AQMEII model input and monitoring data organization

WEST ATLANTIC data organization

Data provider: **US-EPA**
Data: NA-Emissions
NA Meteorology

AQMEII Data Depots:
NA Emissions: US-EPA; delivery: FTP
NA meteo: **US-EPA**; delivery: hard disk
EU meteo (copy from IPSL); delivery: hard disk

Through MACC

Emission Inventory for Europe
Boundary Conditions
MOZAIC/IAGOS

EAST ATLANTIC data organization

Data provider: **TNO**
Data: EU-Emissions

Data provider: **IPSL**
Data: EU Meteorology

AQMEII Data Depots:
EU Emissions: TNO; delivery: FTP
EU meteo: **IPSL**; delivery: hard disk
NA meteo (copy from US-EPA); delivery: hard disk

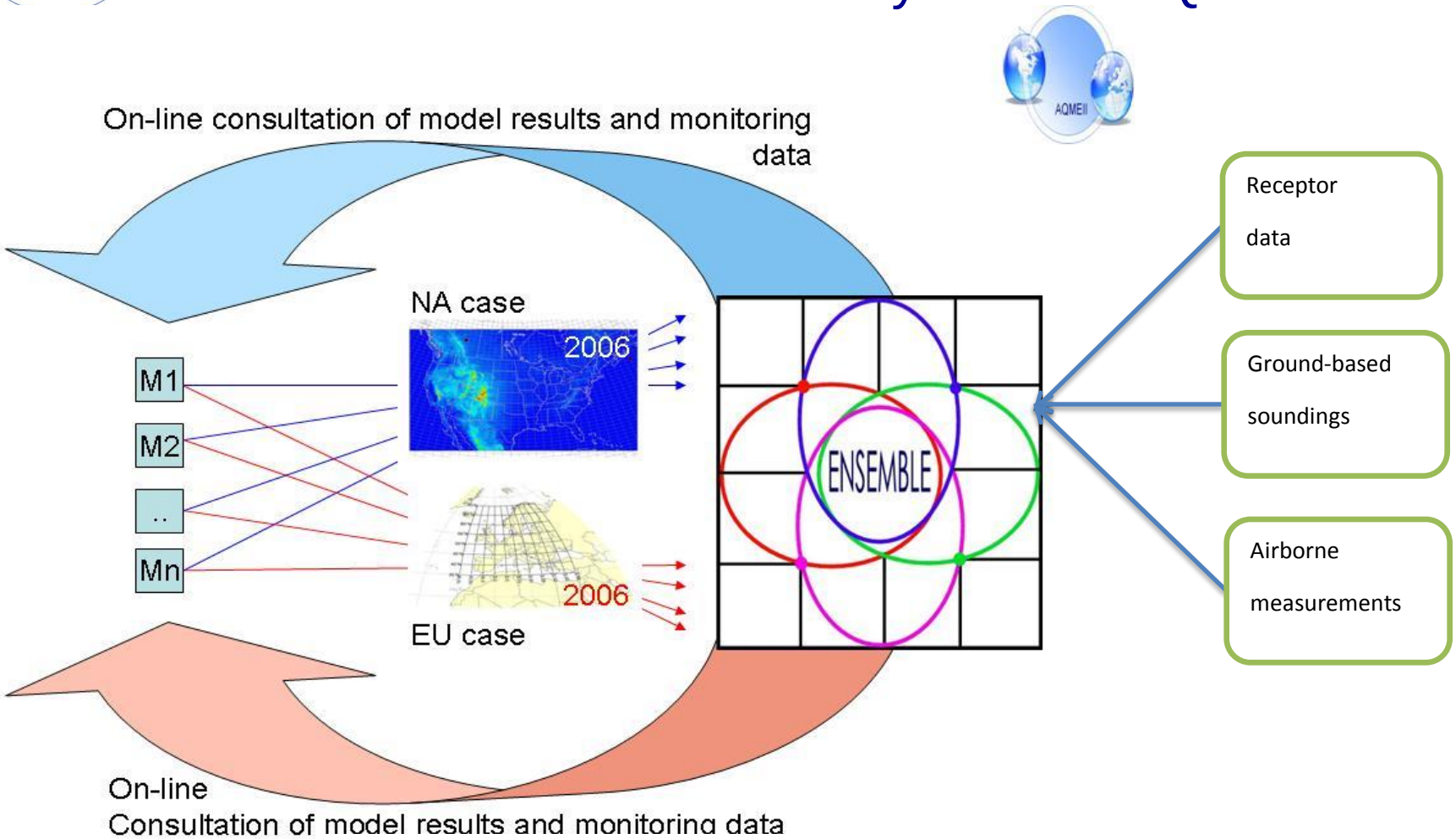
Data provider: **ECMWF-MACC**

Data: NA Boundary conditions
EU Boundary conditions

AQMEII Data Depot: **METEO France**; delivery: FTP

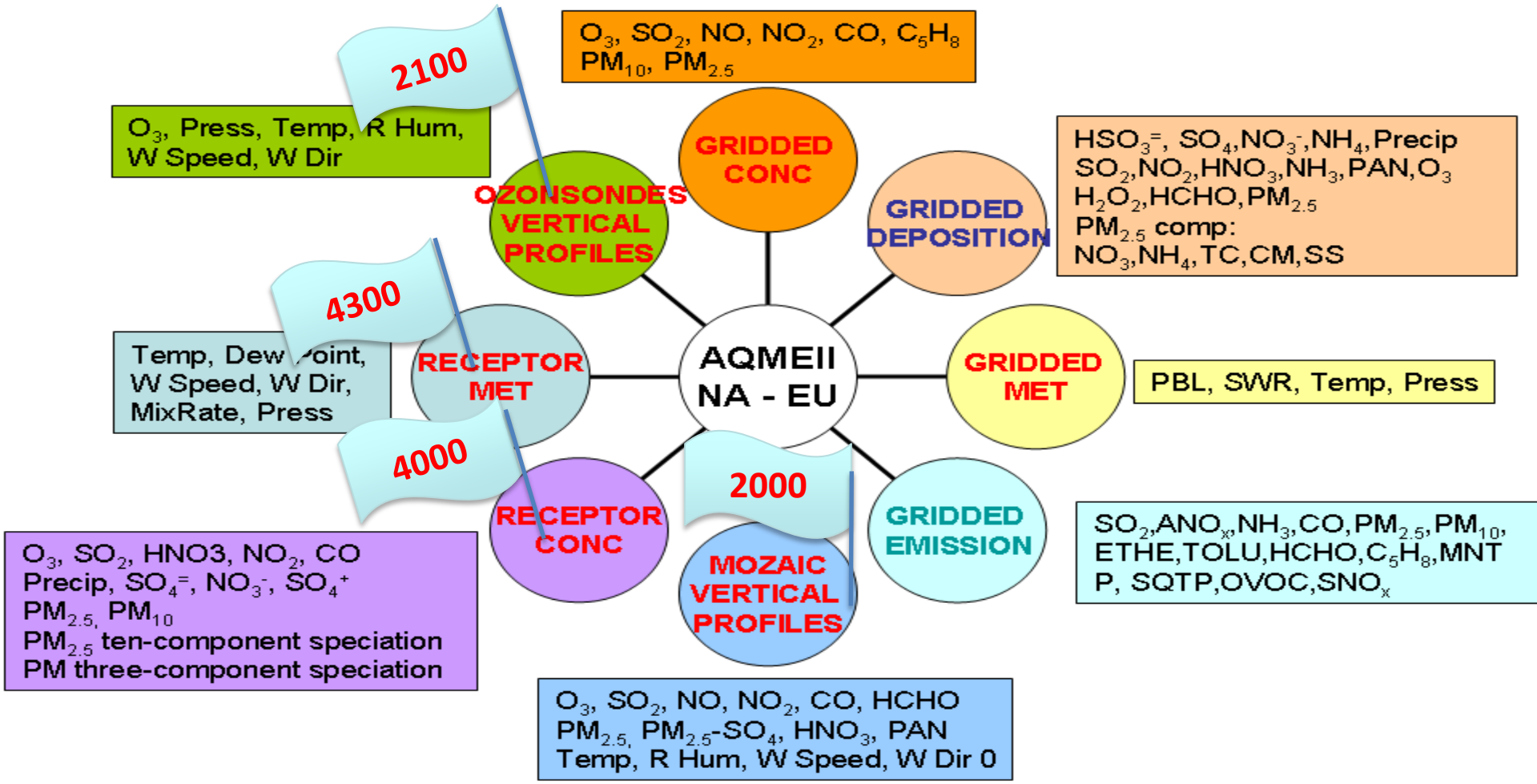
Data providers: **various sources (see CoC)**
Monitoring data NA and EU:
Ground stations (AQ and meteo)
Ozone soundings
MOZAIC profile

Use of the ENSEMBLE system for AQMEII



(Galmarini et al. 2001, JER, 2004 JEM&S, 2004 AE)

Model output and measured variables

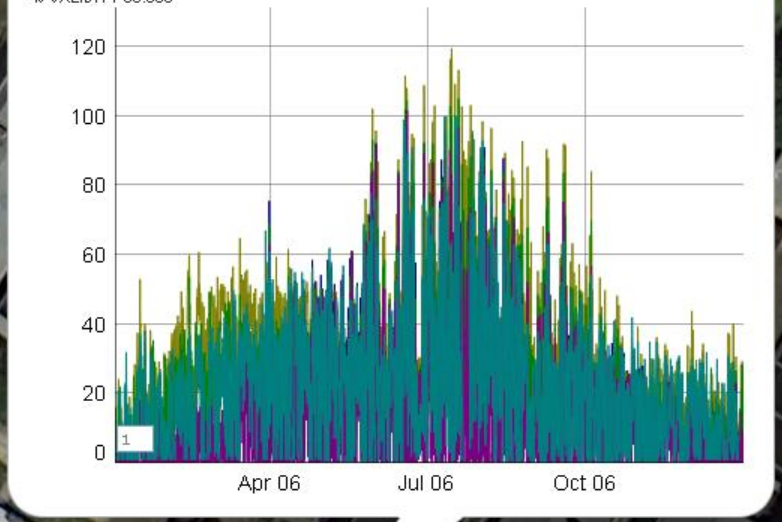


Red: hourly data
Blue: monthly
Green: quarterly

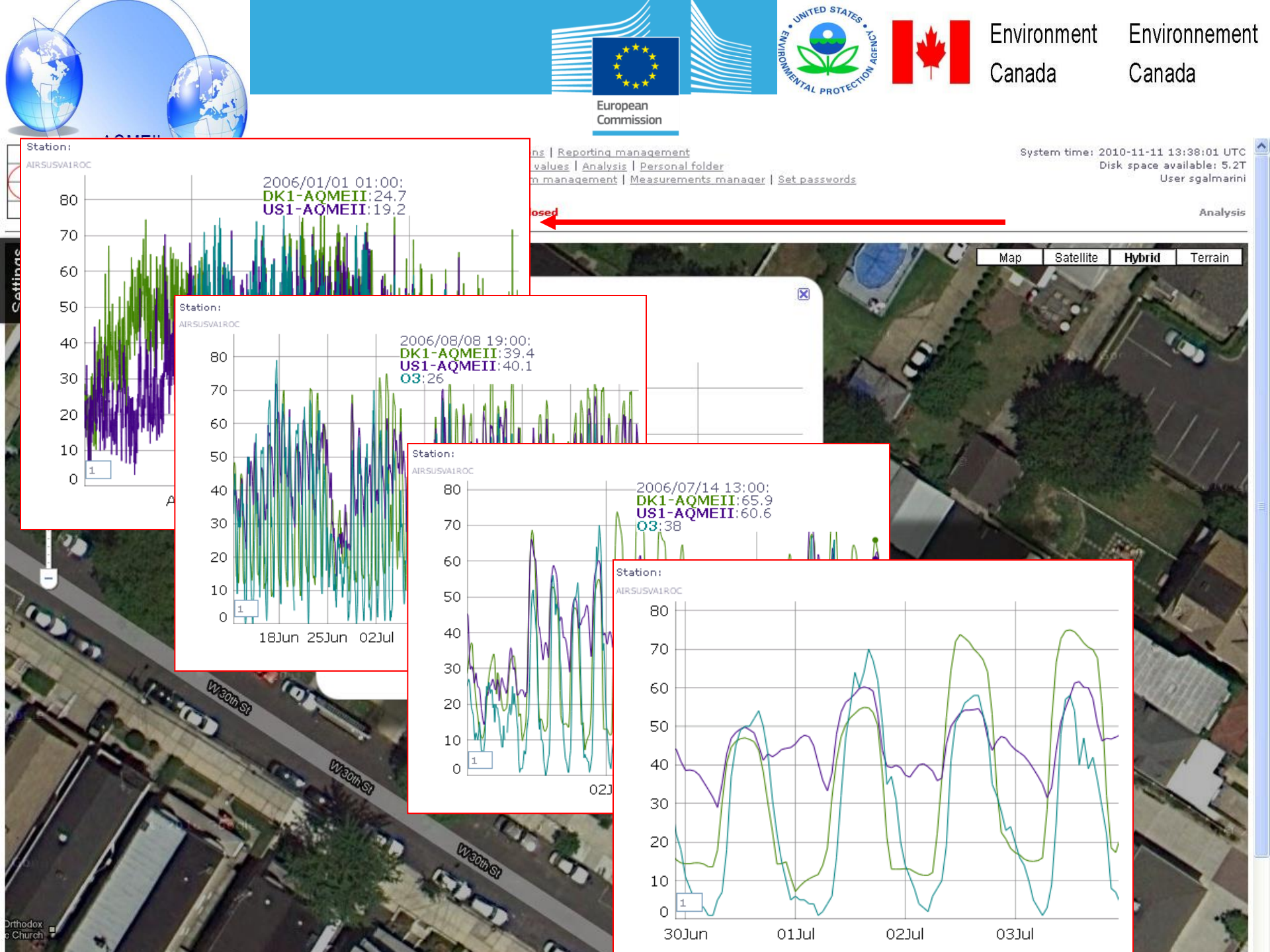
Settings

Map | Satellite | Hybrid | Terrain

LCODE AIRSUSNJ1BAY (00938)
NETWORK AIRS
STATION TYPE URB
MAX VALUE 100.000
% VALIDITY 96.998



W 30th St
W 30th St
W 30th St
Orthodox Church


European Commission
Environment Canada
Environnement Canada
Reporting management
Analysis
Personal folder
Measurements manager
Set passwords
System time: 2010-11-11 13:38:01 UTC
Disk space available: 5.2T
User sgalmarini
Analysis
Map
Satellite
Hybrid
Terrain
Station:
AIRSUSVA1ROC
2006/01/01 01:00:
DK1-AQMEII:24.7
US1-AQMEII:19.2
2006/08/08 19:00:
DK1-AQMEII:39.4
US1-AQMEII:40.1
O3:26
18Jun 25Jun 02Jul
2006/07/14 13:00:
DK1-AQMEII:65.9
US1-AQMEII:60.6
O3:38
30Jun 01Jul 02Jul 03Jul
W 30th St

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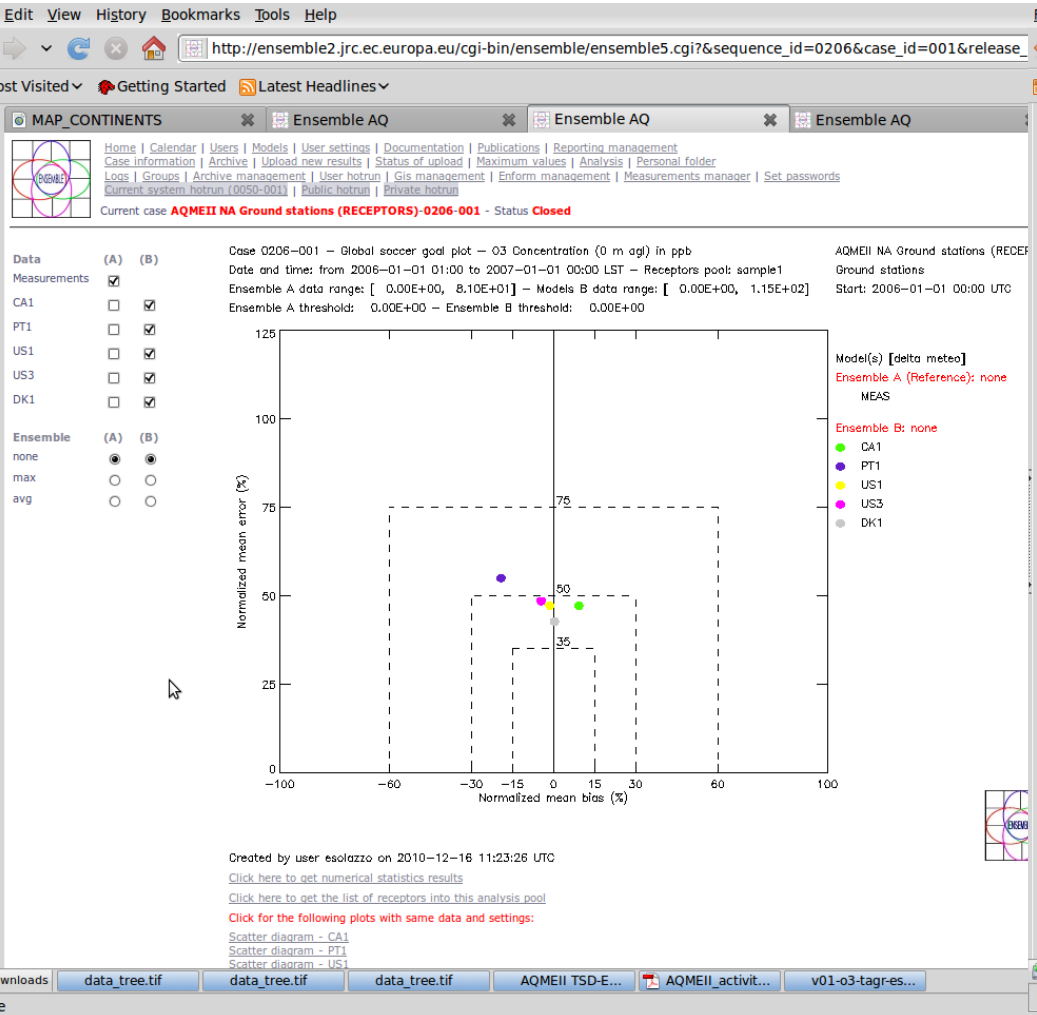
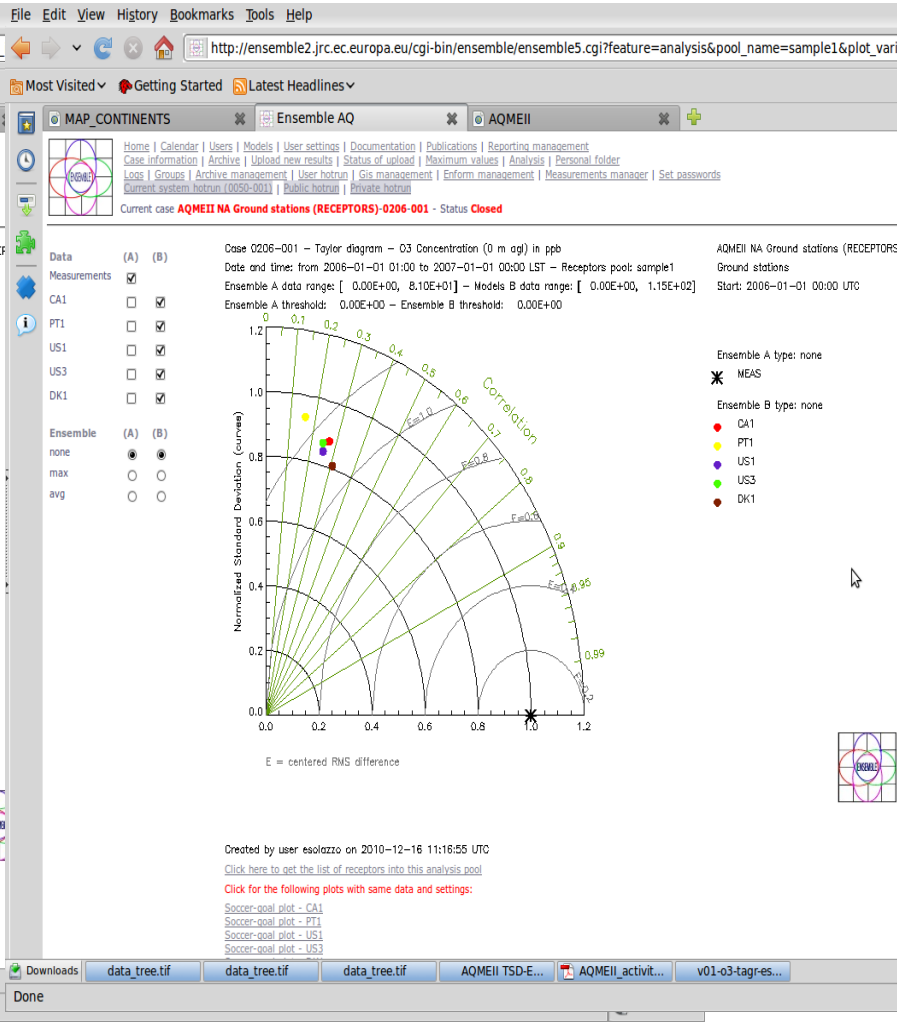
Examples of on line stat treatments with ENSEMBLE





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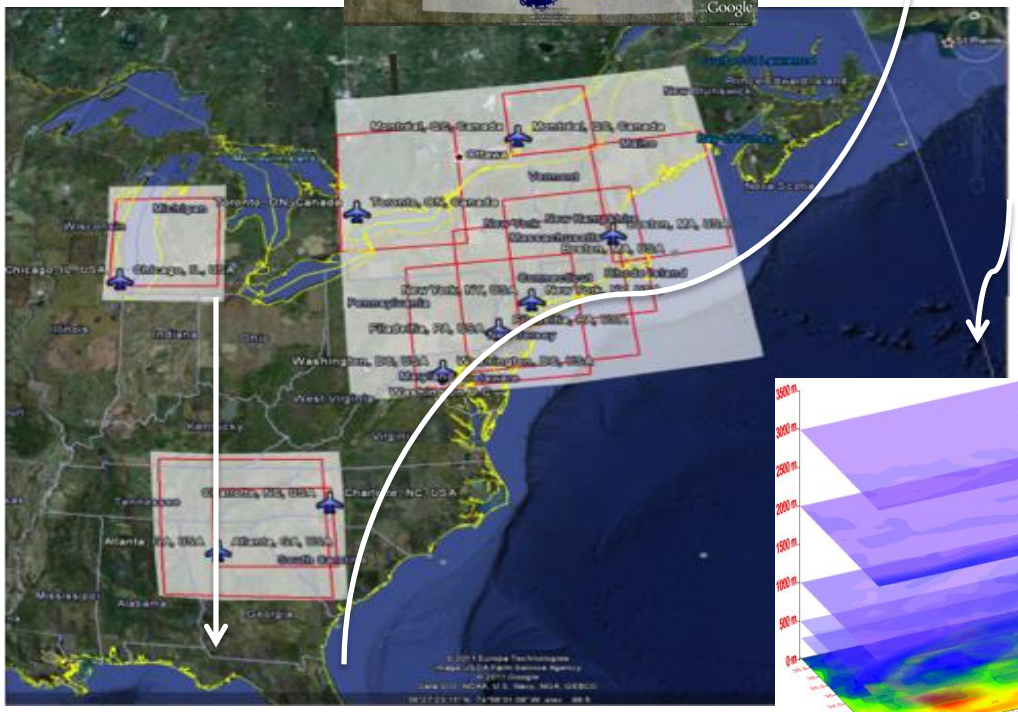
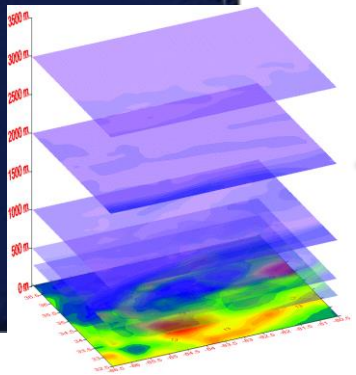
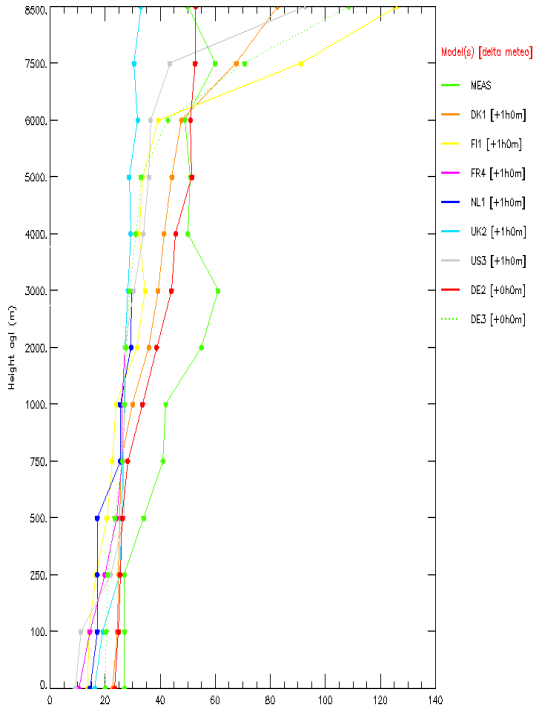
Extraction of measured profile identification of **x,y,z,t** of variable

Extraction of C(x,y,z,t) from model volumes closest to measured one







Selection of:

- The **airport**
- Time **period**
- **Flight** from available
- **Variable** of interest

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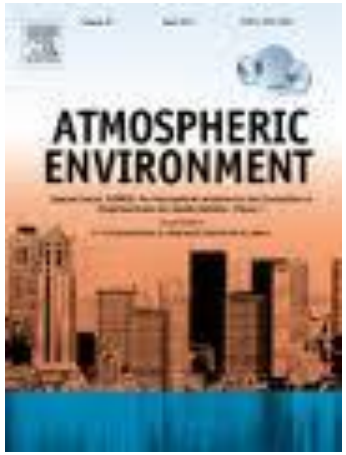
AQMEII AE Special issues



10 papers from participants
On diagnostic evaluation
EU-NA emission comparative analysis

Boundary conditions

EU-NA meteorological
comparative analysis

EU-NA monitoring data
comparative analysis

ENSEMBLE system
and AMET: data management,
Consultation and validation

EU-NA ozone model
Evaluation: collective analysis

EU-NA PMs model
Evaluation: collective analysis

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journal homepage: www.elsevier.com/locate/atmosenv

Announcement

The AQMEII two-continent Regional Air Quality Model evaluation study: Fueling ideas with unprecedented data

Stefano Galmarini [a], S. Trivikrama Rao [b]

[a] European Commission Joint Research Center, Institute for Environment and Sustainability (ispra, Italy
[b] Atmospheric Modeling and Analysis Division, U.S. Environmental Protection Agency, Research Triangle Park, NC, USA

Although strong collaborations in the air pollution field have existed among the North American (NA) and European (EU) countries over the past five decades, regional-scale air quality model developments and model performance evaluations have been carried out independently unlike in the climate or global air quality modeling community. Recognizing the need to build international cooperation for rapidly advancing the science in regional-scale photochemical air quality modeling systems, a team of scientists embarked on a project known as Air Quality Model Evaluation International Initiative (AQMEII) in 2009 (Galmarini et al., 2010; Rao et al., 2010, http://aqmeii.jrc.ec.europa.eu/). The aim of AQMEII is to provide a perma-

- Synthetic evaluation index definition,
- Specific model performance metrics;
- Graphical representations;
- Quantifying the nature and magnitude of model uncertainties;
- Reconciliation of the different nature of model results and observation uncertainties;
- Reconciliation of the different space-time representations of monitoring data, model outputs, and exposure;
- Ways to effectively communicate the linked space-time nature of air pollution fields, and the concept of probabilistic modeling.
- Detailed assessments of physical/chemical processes in models

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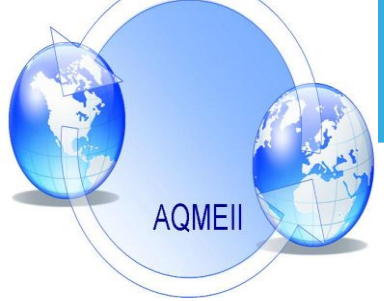

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AQMEII PHASE 2

Take advantage of the experience gained and the community gathered to move to the next step

In collaboration with

EuMetChem – Action ES1004

cost
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

European framework for on line integrated air quality meteorological modelling

Wg1: Strategy and framework of OL I models
Wg2: Interactions parameterisations and feed back processes
Wg3: Chemical data assimilation
Wg4: Evaluation

Action Lead: Dr. A. Baklanov – Grant holder: Prof. Nicolas Moussiopoulos

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NCAR
U.S. EPA
KIT
ZAMG
IfT Leipzig
RSE
University of Ljubljana, SPACE-SI
University L'Aquila
University of Herfortshire
University of Murcia
EMPA
BSC
DMI
Bulgarian National Institute of Meteorology and Hydrology (NIMH)
North Carolina State University
UK Met Office
University of Tartu
UPM-ESMG
Istanbul Technical Universtiy, Department of Meteorology
KNMI-TNO
"Laboratory of Heat Transfer and Environmental Engineering, Aristotle University of Thessaloniki"
Isac-CNR
Russian State Hydrometeorological University, Danish Meteorological University

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EUROPEAN COOPERATION
IN SCIENCE AND TECHNOLOGY

2006 and 2010 simulations for North America and EU

Emphasis on coupled processes and feedback

Inclusion of satellite data in ENSEMBLE platform

- Data uploaded on ENSEMBLE
- Simulation started
- Delivery of model results March-April
- End August workshop at ITM conference Miami (Florida)
- Workshop at JRC Ispra (October) for EU participants

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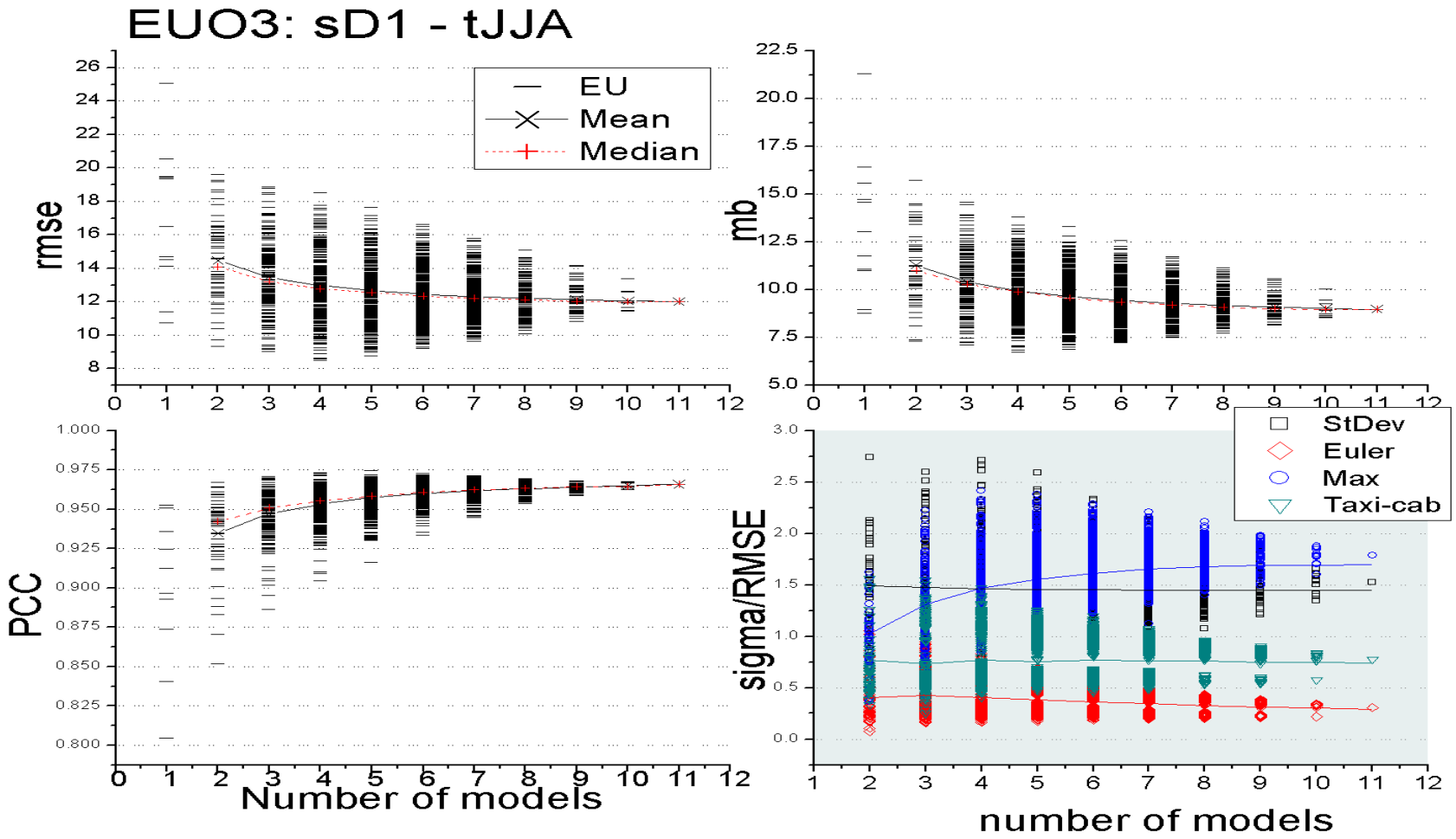

Est modus in rebus: analytical properties of multi-model ensembles
S. Potempski and S. Galmarini - ACP, 2009