

CCA3

Modeling & Monitoring

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and other colleagues



‘combination of modelling and monitoring’ - any method that makes use of both models and monitoring to provide improved information on air quality.



... WG2-SG1 ...

Monitoring & Modelling: examples

Application 1: Assessment of air quality levels to establish the extent of exceedances and establish the population exposure

Application 2: Forecasting air quality levels for short term mitigation and public information and warnings

Application 3: Source allocation to determine the origin of AQ standard exceedances and provide a knowledge basis for planning strategies

Application 4: Assessment of plans and measures to control AQ exceedances

Data integration
(bringing together various data sources)

Data fusion
(statistical methods like bias correction)

Data assimilation
(monitoring data guide models)



... WG2-SG1 ...

Monitoring & Modelling

Data integration



It does not necessarily refer to any combined use of the same type of data for improved modelling.

Data fusion

(generally statistical in nature)

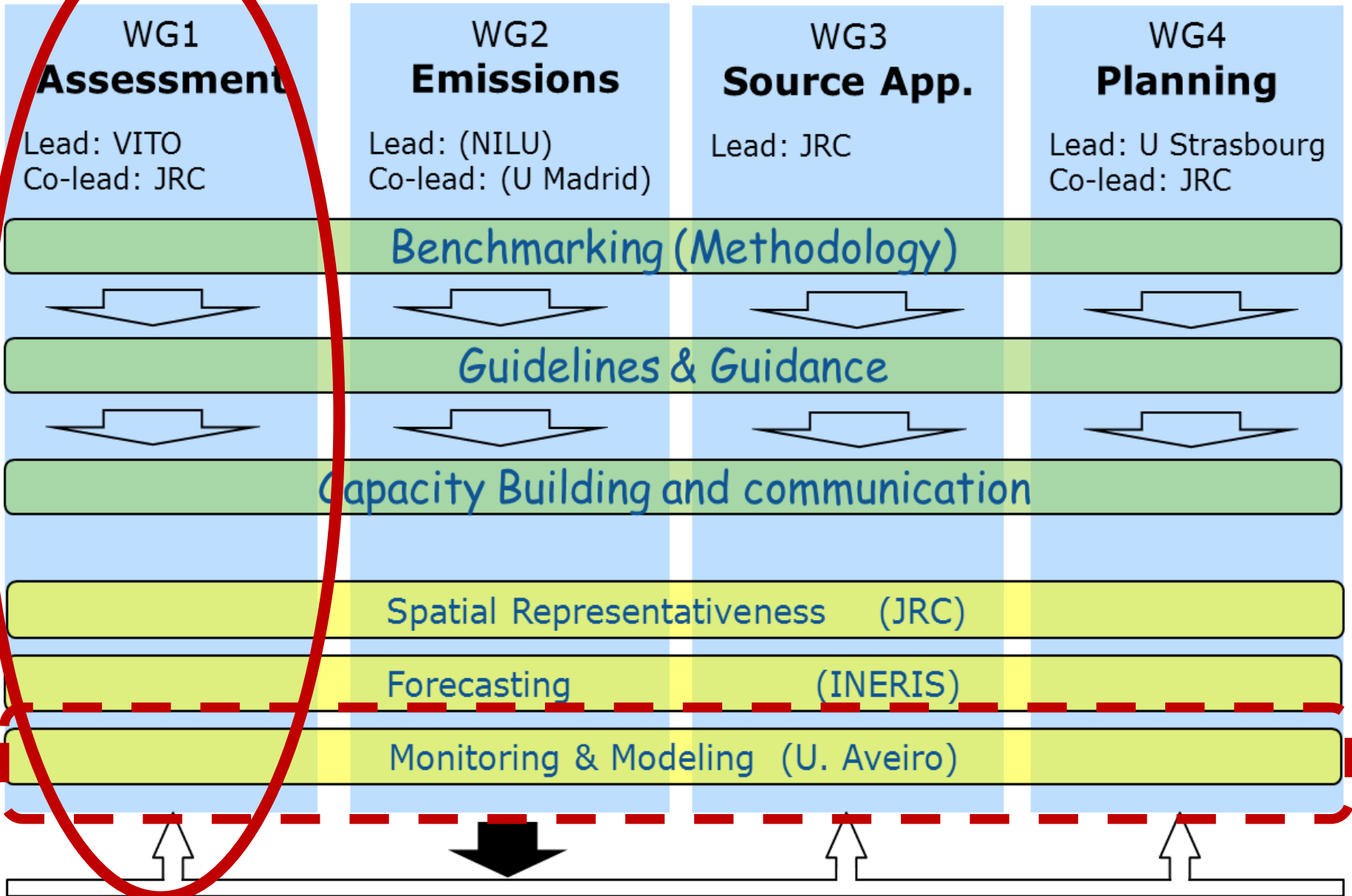
Can also be seen as post processing methods for modelling results ('passive data assimilation').

Data assimilation

(physical and chemical character of the problem, as described by the model, is followed)

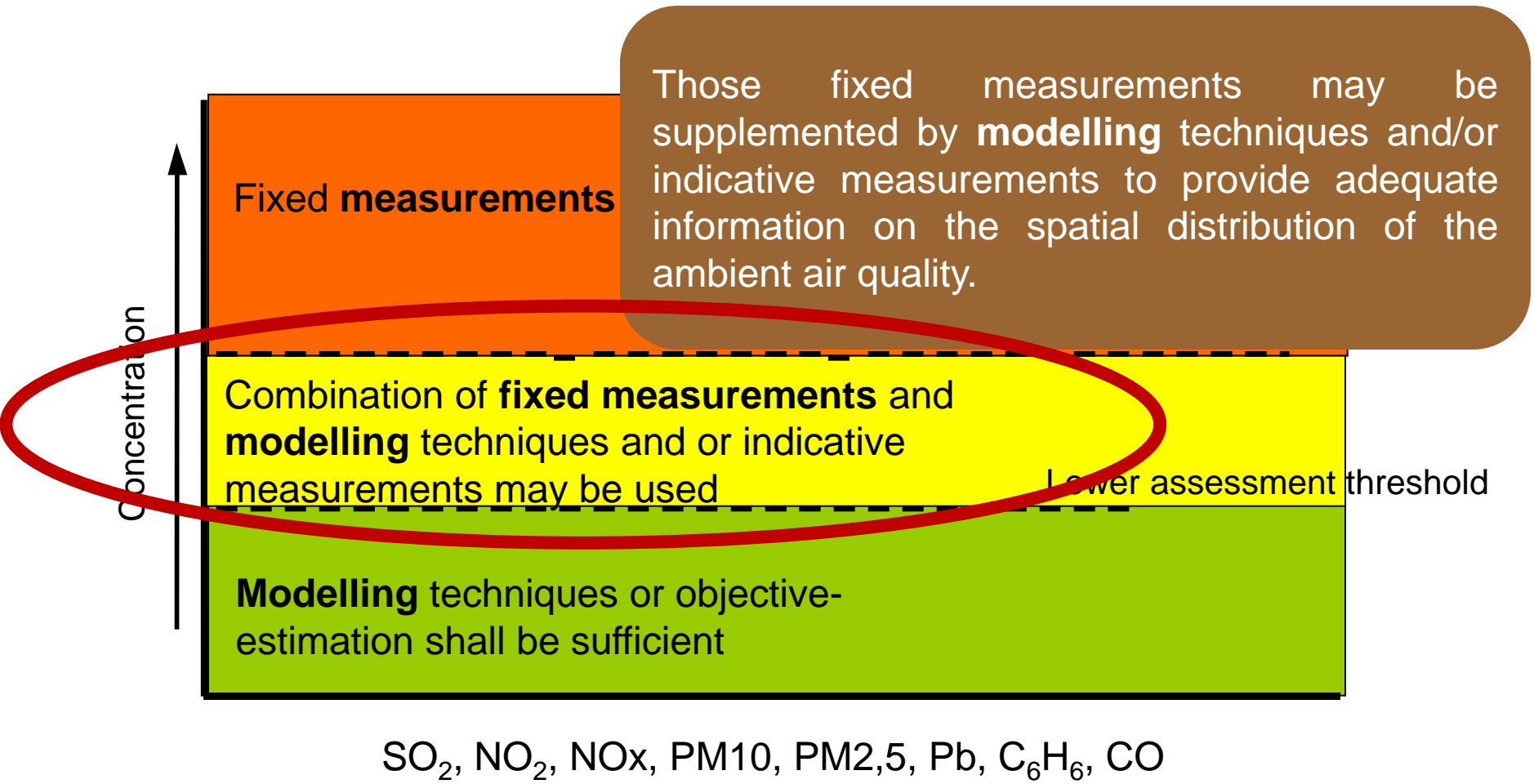
Monitoring data is used to guide models towards monitoring results during the model integration.

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Air Quality Directive | assessment criteria

Assessment strategy depends on upper and lower assessment thresholds



The approach

Monitoring

- 1.** Monitoring stations selection and data treatment, for the period 2006-2010
- 2.** Comparison with the upper and lower thresholds, for every pollutant
- 3.** 2010 data treatment for the model evaluation

Modelling

- 1.** Model application to Portugal (5 km x 5 km), 2010 and 2011
- 2.** Bias correction based on the multiplicative ratio adjustment technique
- 3.** Evaluation (using the DELTA tool when possible)

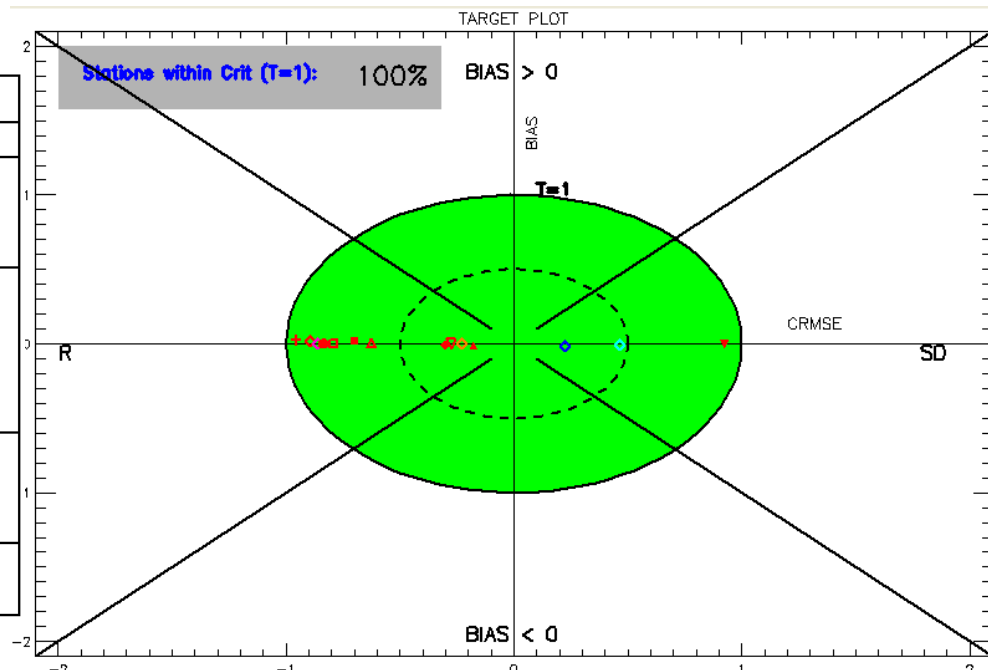
AQ assessment based on a combination of Modelling and Measuring values

Delta Tool V3.3 application

Air quality for Portugal 2010 (5 km x 5 km resolution)

NO₂

		SUMMARY STATISTICS		Nb of stations/groups: 14 valid / 15 selected	
INDICATOR					
OBS	Mean				
	Exceed,				
TIME	Bias				
	Corr				
	StdDev				
SPACE	Corr				
	StdDev				
AOD	RDE				



How to validate when using a combination of monitored and modelled data?

What is the current practice?

How to validate?



Leave one out

The “integration” is performed n times and each time one of the stations is used to test the results and the others $n-1$ stations are used for the “integration”



Large number of re-analyses,
but “simple”

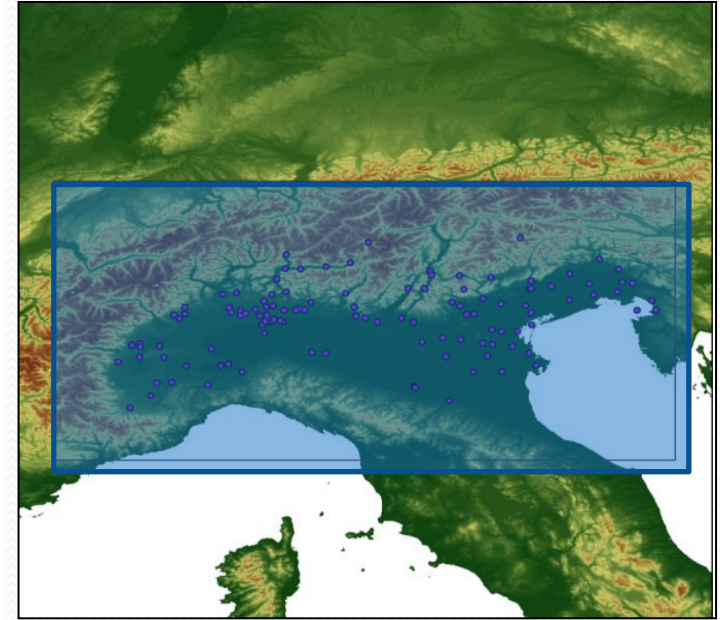
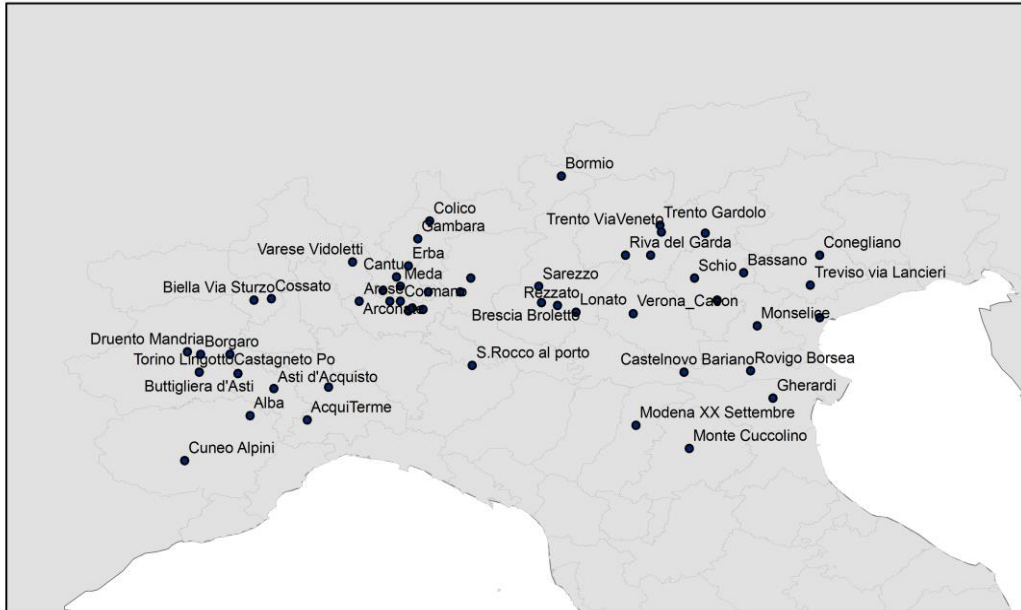
Group approach

A set of $n_1 < n$ stations is selected for the validation and the others $n-n_1$ are used for the “integration”.



More robots, but how to select
the stations?

Case study: Modeling Setup



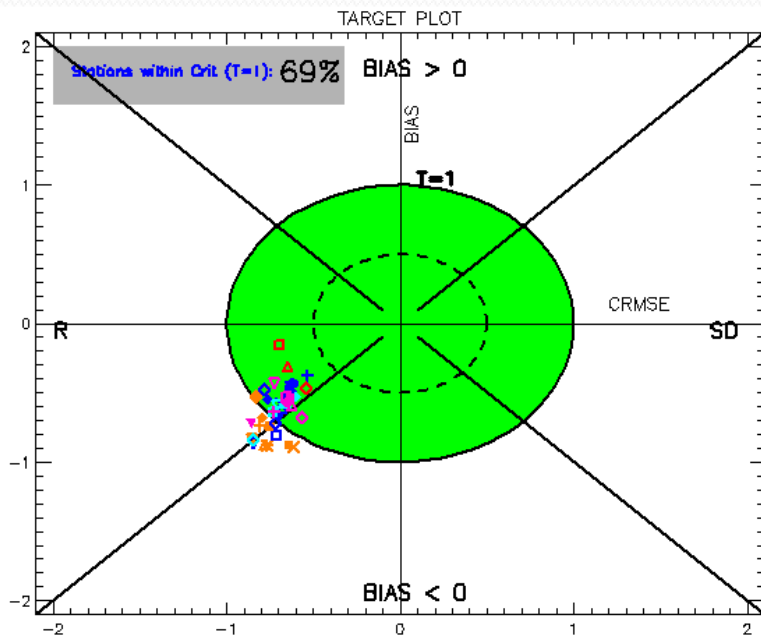
- Measures: 50 monitoring sites (suburban, urban and rural background)
- Model: TCAM
- Year: 2005
- Domain resolution: $6 \times 6 \text{ km}^2$ (POMI exercise)
- Pollutants: PM₁₀

Re-analysed field Validation

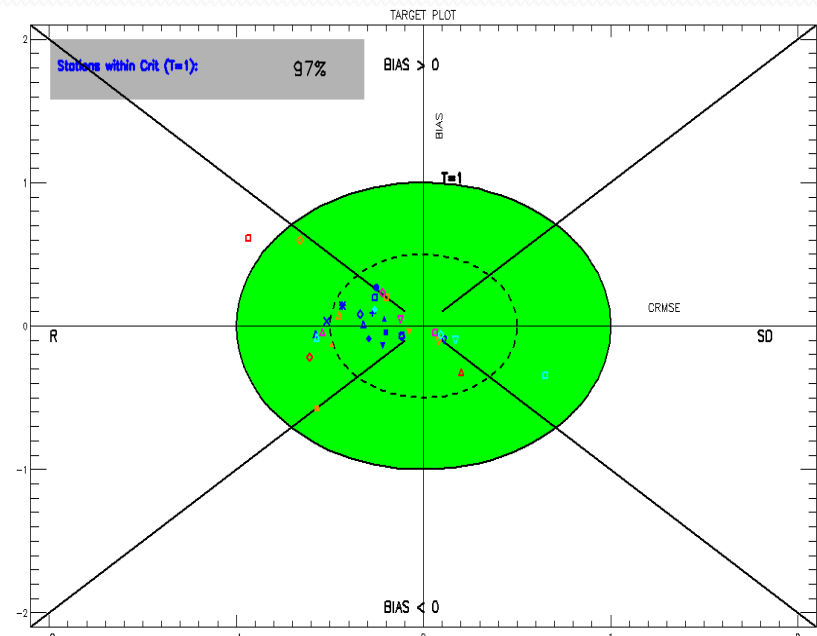
- Montecarlo approach
 - 100 re-analysis randomly selecting 20% of the stations for the validation
 - How to aggregate the results of the 100 re-analysis?
 - Each station selected in the validation is considered in the worst case (**higher RMSE**)

Re-analysed field validation

TCAM



Re-analysed



◇ Castagagneto	✕ BIELLA_Sturzo	▼ Meda	□ Riva_delGard	■ Venezia_Saccoa	Strt/end Ind: 1-8760 Model (s): ISOTCAM Parameter: PM10 Scen: 2005 Extra Values: No Season: Year Day hours: All 24h Time Average: Preserved Daily stats: Mean
□ Torino_lingot	✕ COSSATO	+ Milano_Verzie	△ Rovereto_Larg	■ Rovigo_Borsea	
△ Bargarò	✕ Saronno_Santu	● VIMERCATE	△ Trento_Gardol	■ Castelnovo_Ba	
▽ DruentoMandri	□ Erba	✕ OSIO_SOTTO	△ Trento_ViaVen	◇ MODENA_XXLSET	
◇ ALESSANDRIA_N	▽ Cantù	✕ Brescia_Brola	△ Verona_Casan	◇ Monte_Cuccoli	
◇ ALESSANDRIA_L	▽ Bormio	✕ REZZATO	◇ Schio	△ FELGHERARDI	
▽ Alba	◇ Arese	□ SAREZZO	◇ VICENZA_Quart		
+ ASTLDACQUIST	■ Milano_Juvana	△ S_ROCCO_ALPB	◇ Conegliano		
○ Buttiglierada	△ Limite_dLPia	◇ Borgo_Valsuga	◇ Treviso_viaLa		

How to validate?

n = 25



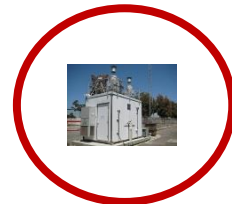
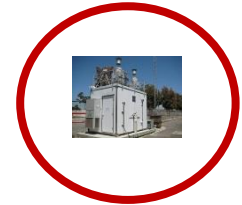
How to validate?

n = 25



Randomly select 20% and exclude them from the “integration”.

For those calculate the RMSE.



How to validate?

n = 25

Randomly select 20% and exclude them from the “integration”.

For those calculate the RMSE.

Repeat this process several times; every station has to be excluded at least once

	RMSE (each reanalysis)										Maxim	
station												
1												
2												
3												
4												
5												
...												

We select the worst case for each monitoring station for the final re-analysed information



We validate the re-analysed field with the monitoring stations measured values



DELTA tool



How to validate?

based on a Monte Carlo approach

1. A set of n Monte Carlo re-analyses has to be done
 - a) For each one randomly select 20% of the stations to be used as validation stations (do not use them to perform the re-analysis)
 - b) Compute for each station i (at least) in each re-analysis j the RMSE (i,j)
2. Compute for each station i the maximum of RMSE (i,j). Let be $\text{vect_max}(i)$ the number of the re-analysis associated to the maximum RMSE for station i
3. Create a CDF file to be used in the DELTAtool by selecting for each station i the $\text{vect_max}(i)$
4. Use the Deltatool as if the CDF file was the CDF of a single model



Who wants to test this approach?

UNIBS

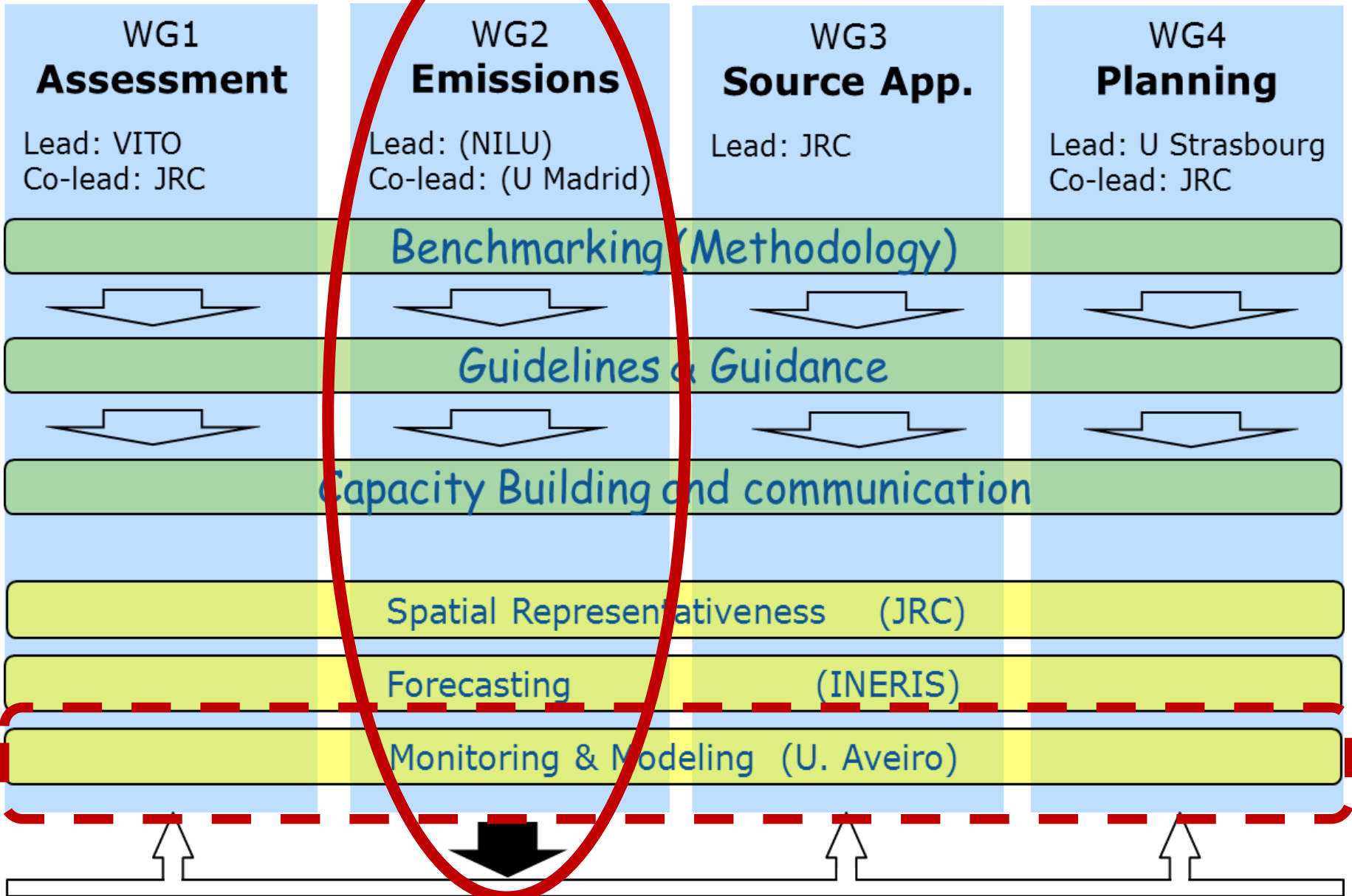
UAVR

VITO

INERIS

To present results and conclusion at the next technical meeting

Steering Group [JRC, VITO, NILU, U. Strasbourg, DG ENV, EEA]

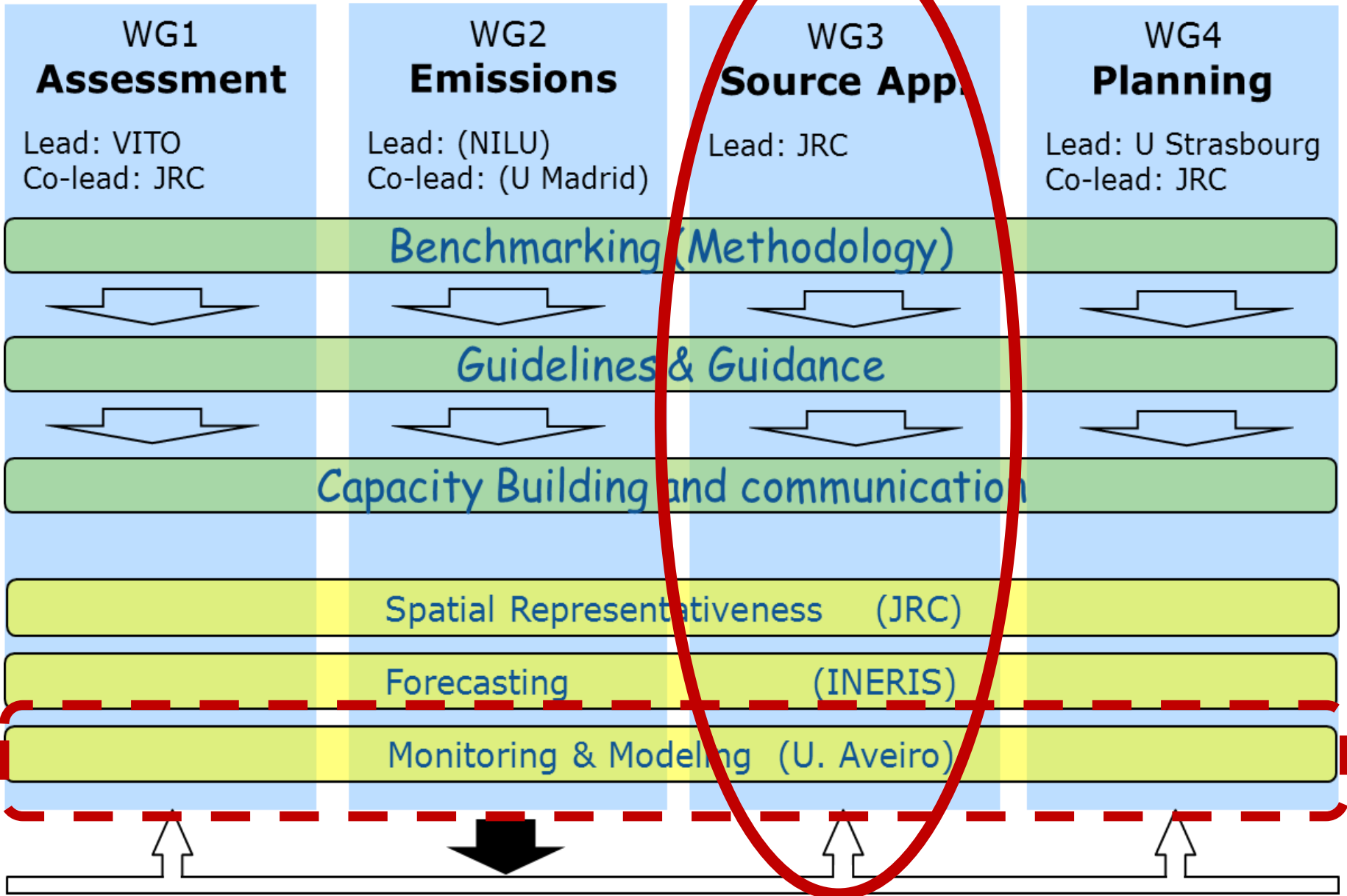


For urban areas and focusing on traffic road emissions, ...

... does it make sense to use air quality monitored data from traffic stations to improve emissions?

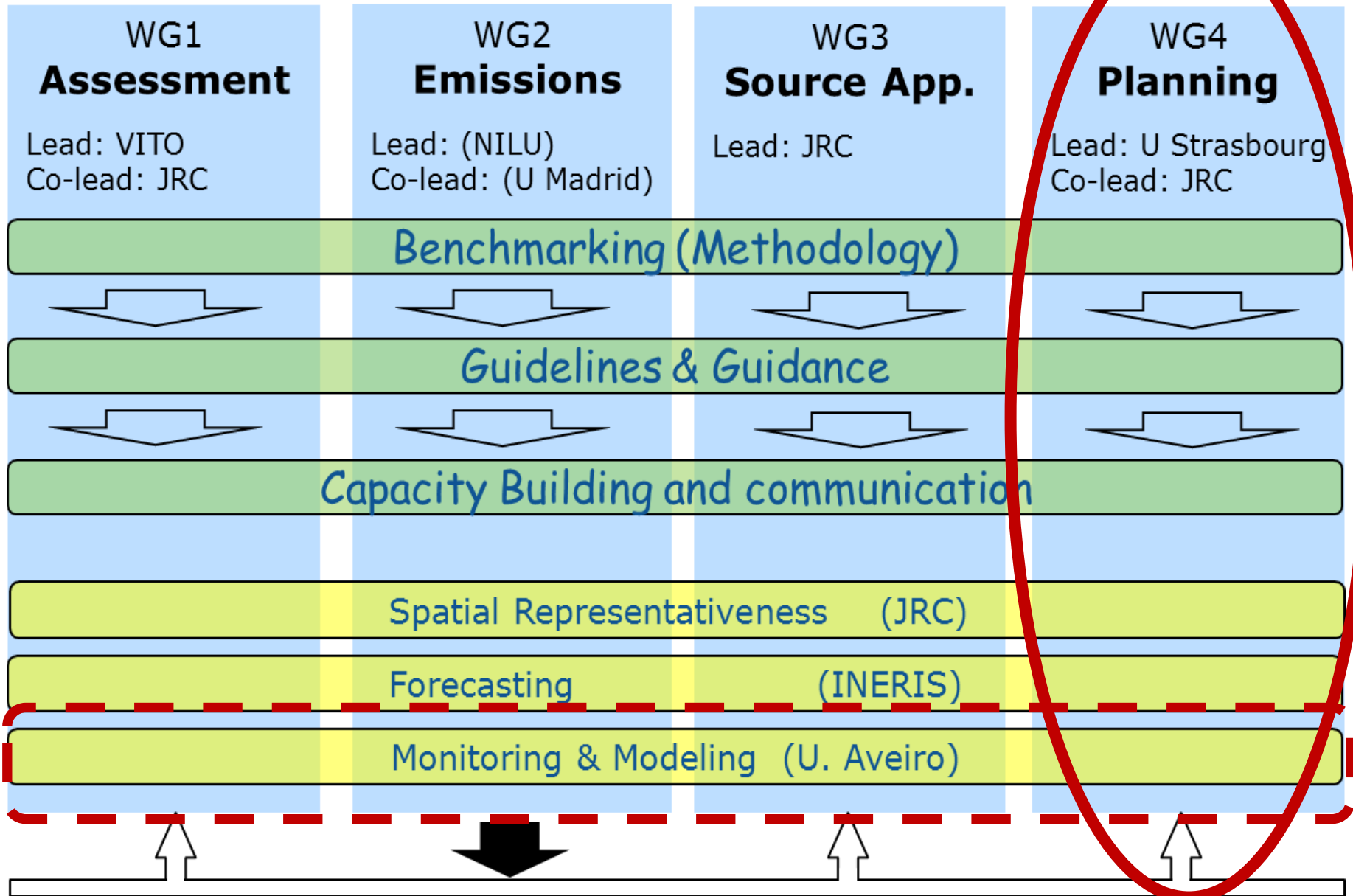


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How to do the best use of monitored data to improve source apportionment (receptor and source oriented) results?

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No reference technique is proposed so far to check the quality of the models used to quantify the impact of emission reduction scenarios in air quality plans.

Alain's proposal!

WORK PLAN IDEAS 2015

- How to validate model outputs after combination of M&M?
- How to arrive to an independent model evaluation?
- How can this be incorporated into the model quality objectives and model evaluation tool?

monitoring/modelling and its incorporation into the model quality objectives and model evaluation tool.

3. USE OF M&M FOR PLANNING PURPOSES

- Propose a methodology for model validation and benchmark.

4. QUALITY OF MONITORING DATA: NETWORK QUALITY

- Definition of relevant actors on the development and organization of monitoring networks to ensure high quality information.

Requests to participants | Meeting June 2015

1. REVIEWING METHODOLOGIES

- Update the compilation of monitoring & modelling practices/experiences

2. GUIDANCE ON MODEL VALIDATION WHEN USING M&M

- Common procedures to arrive at an independent model evaluation
- Quality control/quality assurance of the monitoring data

3. USE OF M&M FOR PLANNING PURPOSES

- List of planning exercises already applied and under study (“dynamic” evaluation)
- Experiences on using monitoring data for air quality management purposes

4. QUALITY OF MONITORING DATA: NETWORK QUALITY

- Criteria for the monitoring network
- Network design
- Problems and questions

Contribution to WG1 Guidance document

- update the review document produced during the previous FAIRMODE phase
- include the testing of Claudio's proposal

Next technical meeting



Thank you for your attention

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