Revision of
The European Guide on Air Pollution Source Apportionment with Receptor Models
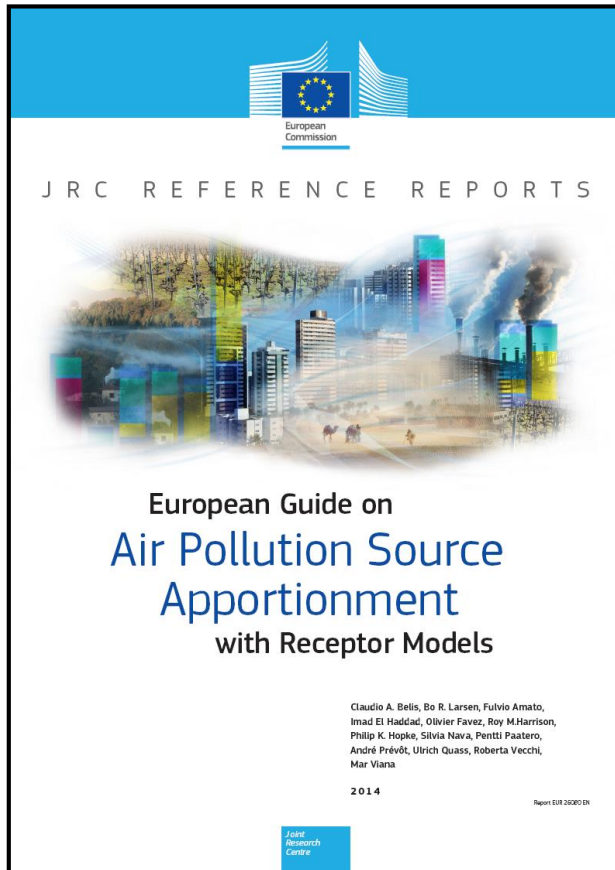
C.A. Belis (JRC) & O. Favez (INERIS)

S. Gilardoni, M. Paglione & S. Decesari (CNR-ISAC), L. Diapouli, M. Manousakas & S. Vratolis (NCSR-Demokritos), P. Salvador (CIEMAT) , M. Mircea (ENEA)

and the source apportionment community

Fairmode Technical Meeting, Tallinn, 26/06/2018

Common Protocol: Driving elements

JRC REFERENCE REPORTS

European Guide on
Air Pollution Source Apportionment
with Receptor Models

Claudio A. Belis, Bo R. Larsen, Fulvio Amato,
Imad El Haddad, Olivier Favez, Roy M.Harrison,
Philip K. Hopke, Silvia Nava, Pentti Paatero,
André Prévôt, Ulrich Quass, Roberta Vecchi,
Mar Viana

2014
Report EUR 26080 EN

- The main objective is to promote the best available operating procedures and to harmonize their application across Europe.

- Promote implementation of the protocol in new studies

- Establish a feed-back mechanism from users in Ms

- Schedule dissemination and capacity building activities

Authors: C.A. Belis, B. R. Larsen, F. Amato, O. Favez, I. El Haddad, R.M. Harrison, A.S.H. Prévôt, S. Nava, U. Quass, R. Vecchi, M. Viana, P. Paatero

Common Protocol: Driving elements

- The main objective is to promote the best available operating procedures and to harmonize their application across Europe.

- There are sections targeted to customers interested in source contribution estimations for abatement measures design

- The text is structured in different levels of complexity according to the reader skills

- Contains tutorials, technical recommendations and check lists

- It is not meant to report all the information but to orient the reader to the relevant information sources

Common Protocol Outline

PART A: INTRODUCTION TO SOURCE APPORTIONMENT WITH RECEPTOR MODELS

Presents the work and provides the unskilled reader with basic elements on Source Apportionment and Receptor Modelling

PART B: STANDARD RECEPTOR MODEL TECHNICAL PROTOCOL

Is the core of the document. Contains description of the steps required in the most traditional and widespread Receptor Modelling techniques with particular reference to CMB and Factor Analysis

PART C: ADVANCED TOOLS

This section contains innovative and advanced methods most of which under continuous development. Also methods on trajectories that although have been available for long time their potentials have not been completely exploited

Common Protocol Outline

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PART C: ADVANCED TOOLS
- Trajectory analysis in source apportionment
- Constrained and expanded models in factor analysis
- The use of PMF in AMS data processing
- The Aethalometer model
- Carbonaceous fraction: radiocarbon and tracer analysis

Revision process

Previous FAIRMODE meetings:

- **Selection of the main sections to be revised or added**

- **Some experts volunteered for reviewing/writing these sections**

2nd semester 2017: collection of the feedbacks/inputs

1st semester 2018: Compilation of feedbacks/inputs in a first revised document

REVISED RM PROTOCOL

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First revised version

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1. PRELIMINARY EVALUATION OF THE STUDY AREA

2. DEFINING A METHODOLOGICAL FRAMEWORK

3. EXPERIMENT DESIGN - CRITERIA FOR SITE AND SPECIES SELECTION AND ESTIMATION OF MINIMUM NUMBER OF SAMPLES

4. DATA COLLECTION / FIELD WORK / CHEMICAL ANALYSIS

5. KNOWING YOUR DATASET: BASIC STATISTICS

6. PRELIMINARY DATA QUALITY CHECKS

7 INPUT DATA UNCERTAINTY CALCULATION

8 CHEMICAL MASS BALANCE MODELS

9. FACTOR ANALYSIS I: SELECTION OF THE NUMBER OF FACTORS AND DEALING WITH ROTATIONAL AMBIGUITY (PMF)

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14. AETHALOMETER MODELS

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16. USE OF PROTON-NUCLEAR MAGNETIC RESONANCE (1H-NMR) SPECTROSCOPY DATASETS FOR WSOC SOURCE APPORTIONMENT

17. WIND AND TRAJECTORY ANALYSIS IN SOURCE APPORTIONMENT

18. TESTS FOR MODEL PERFORMANCE VALIDATION

19. REPORTING RESULTS AND METHODOLOGY

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New

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req...

A few addings

traditional/widespread RM techniques with particular references to CMB and factor analysis

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STANDARD RECEPTOR MODEL TECHNICAL PROTOCOL

1. *PRELIMINARY EVALUATION OF THE STUDY AREA*
2. DEFINING A METHODOLOGICAL FRAMEWORK
3. EXPERIMENTAL DESIGN

PRELIMINARY ACTIVITIES

4. DATA COLLECTION / FIELD WORK/ CHEMICAL ANALYSES

FIELD AND LAB WORK

5. KNOWING YOUR DATASET: BASIC STATISTICS
6. PRELIMINARY DATA QUALITY CHECK
7. INPUT DATA UNCERTAINTY CALCULATION

DATA PRE-TREATMENT

8. CHEMICAL MASS BALANCE MODELS

RECOMMENDATIONS SPECIFIC FOR CMB

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Now include :

- **Constrained and expanded models (as initially written)**

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- **Aerosol mass spectrometer data processing (reviewed by S. Gilardoni & O. Favez), notably with:**

> **Extended introduction to the relevance of Organic Aerosol (OA) source apportionment.**

> **Introduction and presentation of the SoFi toolkit *(PSI, F. Canonaco)* for OA mass spectra constrained analysis.**

> **Brief review of recent studies allowing for the combination between OA mass spectra and other types of datasets (e.g., PTR-MS, Aethalometer, off-line chemistry …).**

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NB: Also to be discussed in line with COST COLOSSAL WG2 activities (next meeting to be hold in Sept. 2018).

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- **Description of the new methodologies proposed along with USEPA PMF toolkit (v5) for the estimation of output uncertainties (by M.-I. Manousakas)**

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        → To be added to the section dedicated to the "tests for model performance validation" ?

REVISION OF THE "<u>AETHALOMETER MODEL</u>" SECTION :

(revised by L. Diapouli), notably with:

> **A full description of the methodology allowing for the distinction between fossil fuel and biomass burning black carbon fractions (BC_{ff} and BC_{wb}).**

> **Extended discussion on the limitations and the use of complementary datasets.**

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> **Extended discussion on the limitations and the use of complementary datasets.**

NB: Also to be discussed in line with COST COLOSSAL WG3 activities, and further results arising from the winter 2017-18 EMEP campaign.

REVISION OF THE "<u>WIND & TRAJECTORY ANALYSIS IN SOURCE APPORTIONMENT</u>" SECTION :

(revised by P. Salvador & S. Vratolis), notably with:

> **> Extended description of various Trajectory Statistical Methods (TSM).**

> **> Extended discussion on the limitations and on the complementarity of the different methodologies.**

> **> Case studies taken from the literature**

ADDING OF A NEW SECTION DEDICATED TO "THE USE OF PROTON-NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY DATASETS FOR WATER-SOLUBLE ORGANIC CARBON (WSOC) SOURCE APPORTIONMENT"

(by M. Paglione & S. Decesari)

Revision process

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- Some experts volunteered for reviewing/writing these sections

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1st semester 2018: Compilation of feedbacks/inputs in a first revised document

October 2018: Release of the revised version …

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… as a online FAIRMODE living document
(to be discussed/confirmed here)

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October 2018: Release of the first final revised version

In between:
- **the current draft should be updated (based on your comments) and broadly distributed, by mid-July**
- **for additional comments and inputs to be delivered by mid-Sept.**

Thank you !