Overview on AeroCom experiments and (associated) diagnostics

Michael Schulz

Why AeroCom encourages joint decentralised experiments

- Complex scientific problems benefit from broad community input and discussion
- Curiosity is better justified if others are willing to contribute
- “First author” analysis is very efficient/rewarding (no funding – database and paper as outcome)
- Model experiments are relatively cheap
- Data harmonizing comes as a side effect (almost)
- No central organising capacity anyway

Why decentralised experiments are not ideal

- Submission&analysis can not be done on schedule
- Harmonisation of data is minimal, subject to communication problems, missing definitions, missing documentation
- Planning is done adhoc, once per year,
  occasionally in between
- Analysis relies often on one person,
  multiple authors reduce individual coauthor responsiveness
  (its good to include 2-5 more “very“ active coauthors)

6 Questions for any new AeroCom experiment

- ❑ Do you want an experiment or additional diagnostics?
- ❑ Have you studied the AeroCom wiki page on database, output, experiments for more than 10 seconds?
- ❑ Do you have an account for the AeroCom server and have you checked the output which is already available?
- ❑ Do you know AeroCom/AerChemMIP variable names and formatting requirements? Which can be (re)used?
- ❑ Can you piggyback on an existing experiment by asking modellers to submit additional diagnostics?
- ❑ Can you write a model experiment motivation and description? Has someone tested the concept with a single model?

Overview
Phase III AeroCom model experiments

Control 2016 (simulating 2010)

- Remote Sensing
- Aircraft Data Evaluation
- INSITU
- INSITU particle size
- COARSE Map
- Warm rain fraction
- Holuhraun
- Lagrangian model evaluation
- ORACLES
- ATOM

AeroCom Historical

- Natural Aerosols (EU Crescendo)
- ACRI
- UTLS
- Insitu trends
- **AerChemMIP tier 1**

Biomass Burning

MMPPE

Anthropogenic Dust

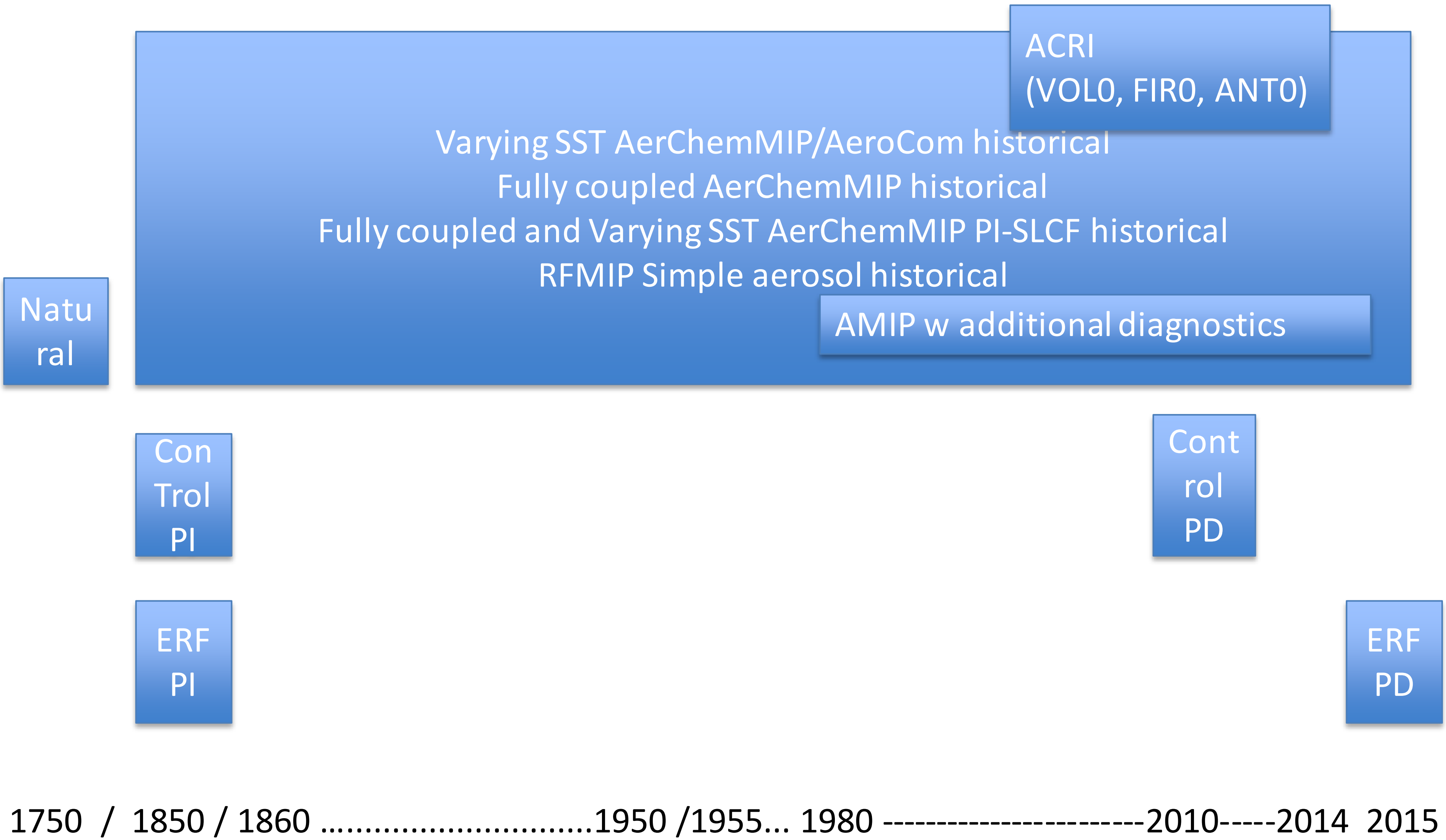
HTAP BASE plus perturbations

Aerosol Lifetime Fukushima ✔

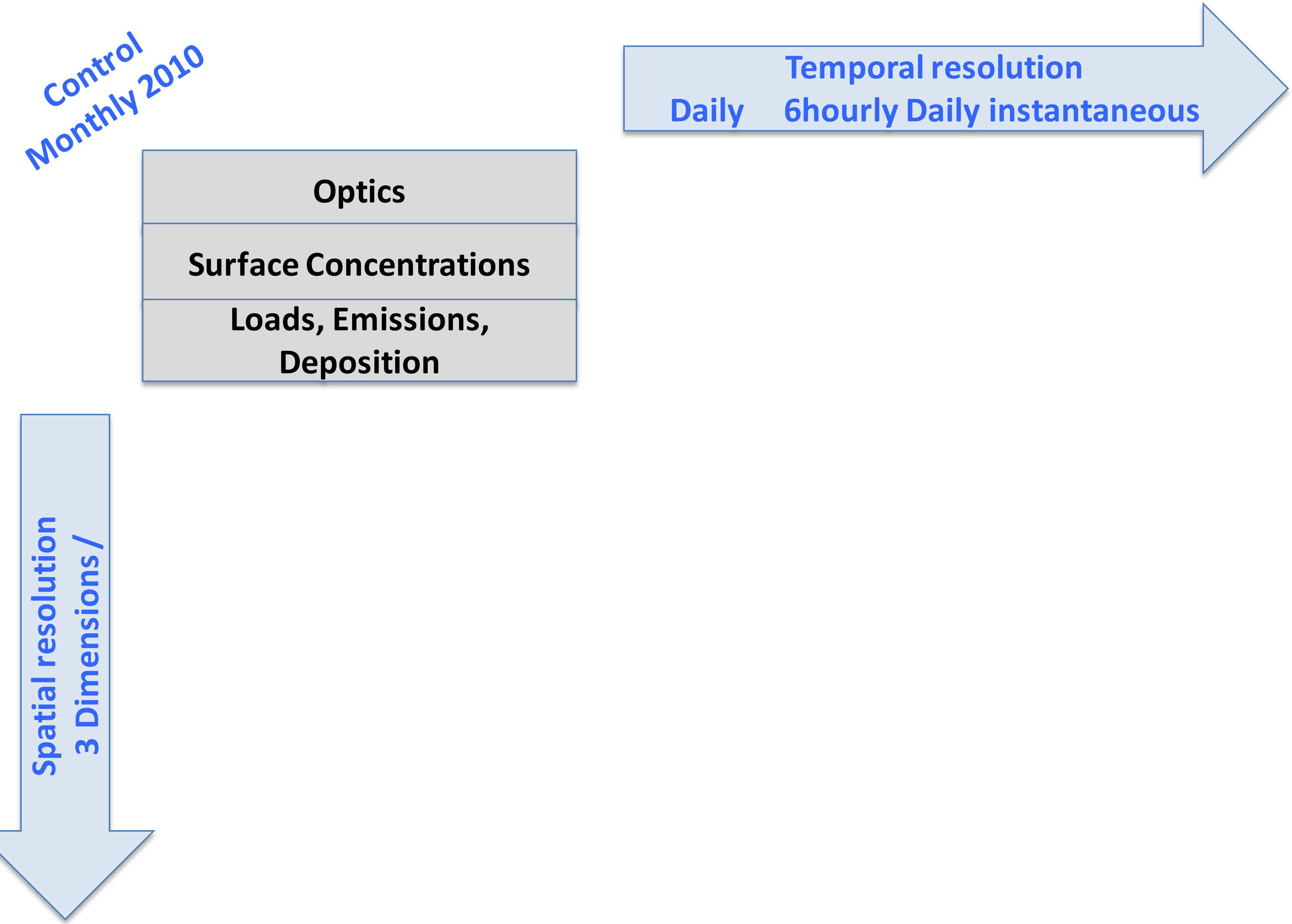
Nitrogen ✔

Control 2015 ✔

Periods simulated in AeroCom experiments a



Diagnostics



Portrait Diagram Display of Relative Error Metrics

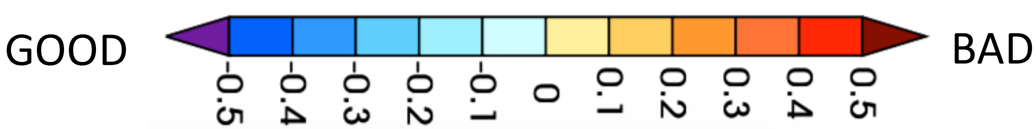
AeroCom Phase III Models vs Multiple Observational datasets

Variable	Observation	AeroCom-Median2000	CAM5-CTRL2016	CAM53-Oslo-AP3-CTRL2016-PD	Chaser	CNRM_CM6.2_CTRL2015	ECHAM-Salsa-CTRL2015	ECHAM6-HAM2	EMEP_BASE	GEOSChem-v11-CTRL2016	GFDL-AM3p10-GLOFIR1	GISS-MATRIX-NGLOBASE	GOCARTv5Base	IFS-AP3-CTRL2016-PD	IMPACT	INCA-BCinCTRL2016PD	INCA-GLOFIR1	OsloCTM3-CTRL2015	OsloCTM3-CTRL2016	SprintarsT213_CTRL2016	TM5-CTRL2016	Variation
Aerosol Optical Depth																						
Total AOD	Aeronet Sun mode	-0.45	-0.02	0.14	2.38	0.10	-0.04	-0.06	0.08	-0.22	0.02	0.23	-0.27	-0.23	0.03	0.19	0.11	-0.12	-0.30	0.05	-0.21	57%
Coarse mode AOD	Aeronet SDA			1.22		-0.04	0.00	0.11		-0.01				-0.18	-0.33	0.29		-0.15		0.00	0.07	41%
Fine Mode AOD	Sky inversion	-0.42	-0.52	0.28	0.08						-0.02	0.10			0.08	0.30	-0.05	0.00	0.00		-0.26	25%
Surface Concentration																						
Black Carbon	EMEP			0.05		0.04	-0.02	-0.02		0.00		0.11		0.05						-0.01	-0.02	4%
Dust	Aeroce Climatology	0.13		-0.07		0.02	-0.04	0.10	0.00	-0.12		0.30		0.00		0.08		-0.05		-0.07	0.52	18%
Sulfate	EMEP	0.31		0.30		2.19	0.19	0.52	-0.15	-0.07		0.06	-0.30	0.04			-0.26	-0.04		-0.18	-0.10	63%
Seasalt	EMEP			-0.57		23.88	0.14	0.00	-0.66	-0.60		0.60	1.74	-0.49		1.91		0.64		-0.43	-0.12	663%
Wet Deposition																						
Sulfate	EMEP			0.02		0.00			-0.44	0.00		0.00									0.00	18%
		2000	2010	2010	2010	2010	2010	2010	2010	2010	2008	2010	2010	2010	2008	2006	2008	2010	2010	2010	2010	

$$E'_{mfr} = \frac{E_{mfr} - \overline{E_{fr}}}{\overline{E_{fr}}}$$

E_{mfr} = RMS error of model m

$\overline{E_{fr}}$ = typical model error



Participating Models is this correct

CTRL2016	Historical	AerChemMIP
NorESM2	NorESM2	NorESM2
INCA	INCA	INCA
GISS Matrix	GISS Matrix	GISS Matrix
GISS Oma	GISS Oma	GISS Oma
UKESM/Hadgem	UKESM/Hadgem	UKESM/Hadgem
SPRINTARS	SPRINTARS	SPRINTARS
GMI	GMI	GMI
CNRM-CM6	CNRM-CM6	CNRM-CM6
TM5/EC-EARTH	TM5/EC-EARTH	TM5/EC-EARTH
ECHAM6-HAM2	ECHAM6-HAM2	ECHAM6-HAM2
GFDL	GFDL	GFDL
CAM5/CESM2	CAM5/CESM2	CAM5/CESM2
IFS	IFS	IFS
ECHAM-SALSA	ECHAM-SALSA	ECHAM-SALSA
GEOSCHEM	GEOSCHEM	GEOSCHEM
OsloCTM3	OsloCTM3	OsloCTM3
IMPACT	IMPACT	IMPACT
GOCART	GOCART	GOCART
EMEP	EMEP	EMEP

Participating Models

MMPPE	BB	INSITU	RemSens
NorESM2	NorESM2	NorESM2	NorESM2
INCA	INCA	INCA	INCA
GISS Matrix	GISS Matrix	GISS Matrix	GISS Matrix
GISS Oma	GISS Oma	GISS Oma	GISS Oma
UKESM/Hadgem	UKESM/Hadgem	UKESM/Hadgem	UKESM/Hadgem
SPRINTARS	SPRINTARS	SPRINTARS	SPRINTARS
GMI	GMI	GMI	GMI
CNRM-CM6	CNRM-CM6	CNRM-CM6	CNRM-CM6
TM5/EC-EARTH	TM5/EC-EARTH	TM5/EC-EARTH	TM5/EC-EARTH
ECHAM6-HAM2	ECHAM6-HAM2	ECHAM6-HAM2	ECHAM6-HAM2
GFDL	GFDL	GFDL	GFDL
CAM5/CESM2	CAM5/CESM2	CAM5/CESM2	CAM5/CESM2
IFS	IFS	IFS	IFS
ECHAM-SALSA	ECHAM-SALSA	ECHAM-SALSA	ECHAM-SALSA
GEOSCHEM	GEOSCHEM	GEOSCHEM	GEOSCHEM
OsloCTM3	OsloCTM3	OsloCTM3	OsloCTM3
IMPACT	IMPACT	IMPACT	IMPACT
GOCART	GOCART	GOCART	GOCART
EMEP	EMEP	EMEP	EMEP