AeroCom wrapup

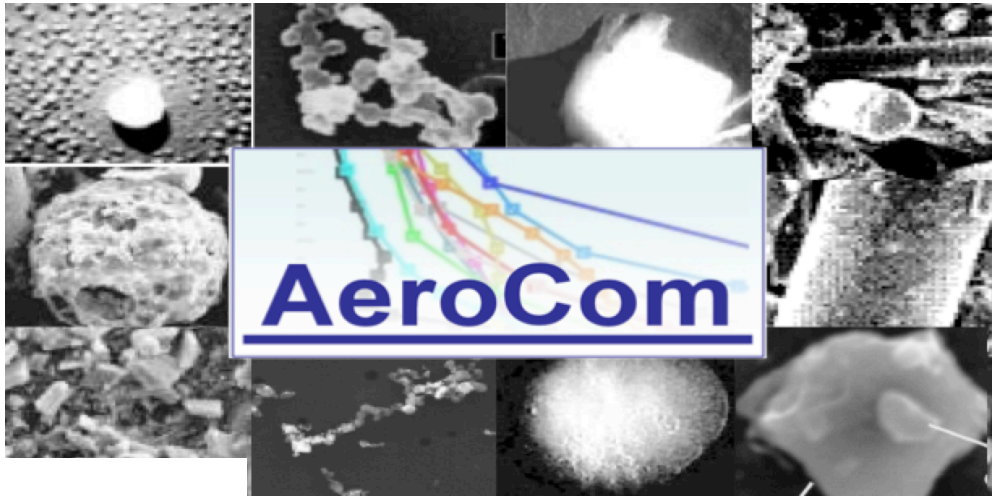
Barcelona 15 June 2015

AeroCom workshop 2019

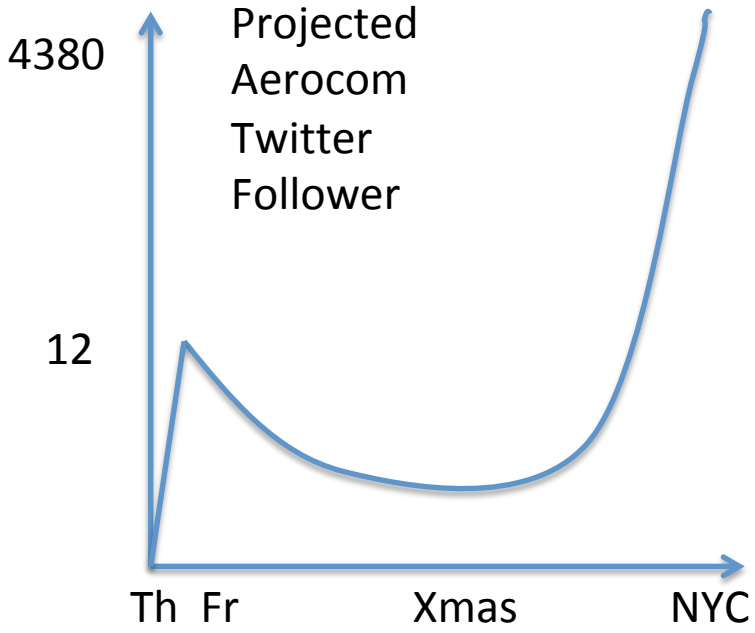
Special thanks

Carlos Pérez Garcia-Pando, Alexis Chantasack , Sara Basart, Maria Goncalves, Martina, Dene, Jeronimo Escribano, + BSC team ++ Stefan Kinne

New Communication strategy and goal



https://twitter.com/AerocomMetno



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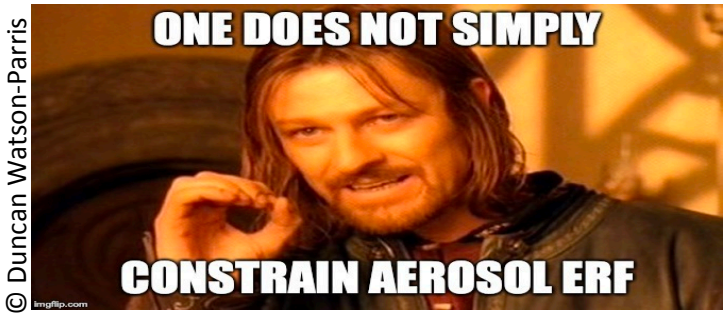
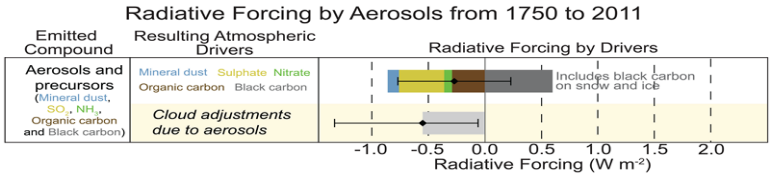
Apple to oranges?

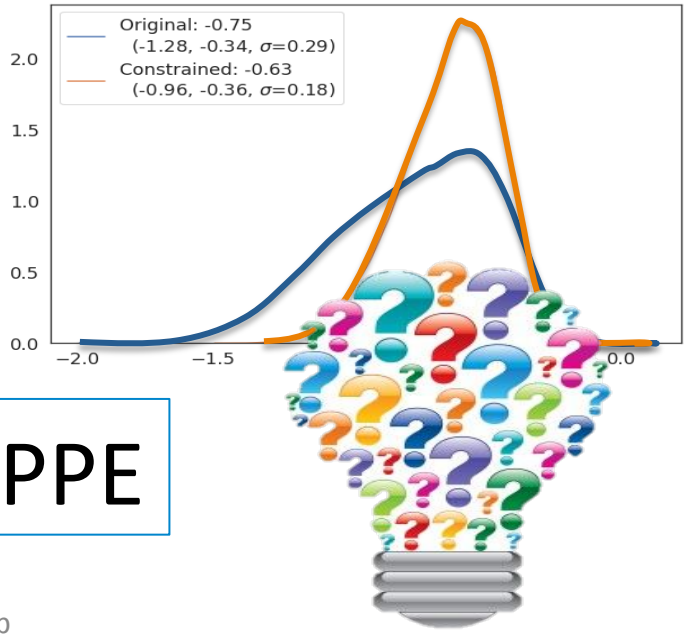
artist Edward Gryspeerdt

artist Lucia Deaconu



© Duncan Watson-Parris





1. Constrain models using observations

PPE

2. Compare (constrained) models to each other

$M_{ulti}M_{odel}PPE$

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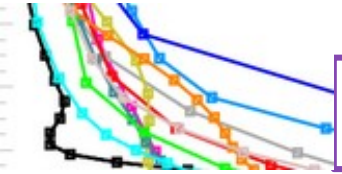

The aerosol forcing is still uncertain!

- **Anthropogenic AOD and total AOD are correlated in models and aerosol retrievals can further be used to constrained anthropogenic AOD**
  - Why? Are the total coarse mode aerosol (sea salt and mineral dust) better constrained by satellite retrievals, so uncertainties are mainly caused by aerosol species which has anthropogenic and natural contributions?
  - What is the maximum global AOD (550 nm) from satellite retrievals?

- **Black carbon has a weak surface temperature change caused by strong negative rapid adjustments**.
  - Forcing and temperature change seem to scale linearly for emissions increasing up to at least a factor of 10.

- **Aerosol forcing (ERF) stronger negative than -2 Wm^{-2} in climate model simulations**
  - Fine mode aerosols causing almost entirely the global mean forcing, but with regional variations.

- **Several studies indicate increase in dust over the industrial era.**
  - Coarse mode mineral dust strongly underestimated in climate models
  - The magnitude of the missing coarse mode of mineral dust on the (direct) radiative effect is +0.15 Wm^{-2} compared to recent estimate and even stronger than in AeroCom models.

We must work harder!

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Focus !!

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New AeroCom/AerChemMIP model generation

AOD analysis with AeroCom tools

Model	Anthro AOD	Natural AOD	Total AOD
CESM2_historical	0.014	0.128	0.141
GEOS-i33p2-met2010_AP3-CTRL	0.016	0.110	0.125
CESM2-WACCM_historical	0.019	0.125	0.144
ECHAM6.3-HAM2.3-met2010_AP3-CTRL	0.023	0.125	0.148
NorESM2-LM_historical	0.032	0.141	0.173
OsloCTM3v1.01-met2010_AP3-HIST	0.028	0.102	0.130
IPSL-CM6A-LR_historical	0.030	0.081	0.111
GFDL-CM4_historical	0.045	0.105	0.150
CanESM5_historical	0.045	0.100	0.146
CAM5-ATRAS_AP3-HIST	0.041	0.083	0.125
MIROC-SPRINTARS_AP3-CTRL	0.033	0.065	0.097
Mean	0.030	0.106	0.135
Standard Deviation / Mean	38%	22%	15%

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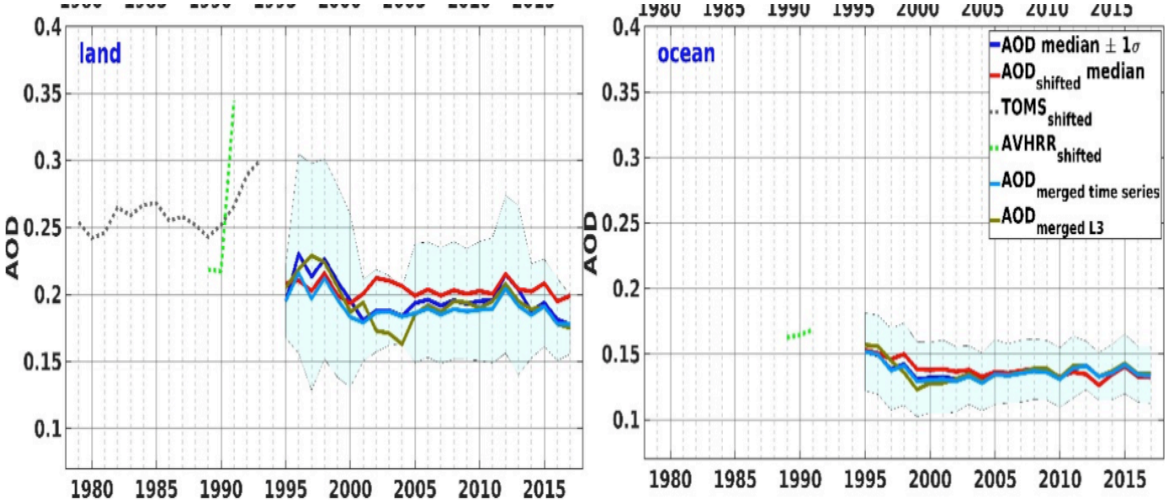
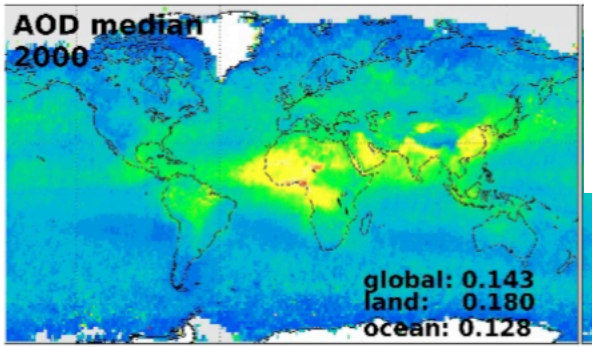
AeroSat

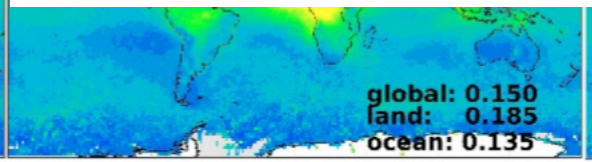
AOD median 0.145

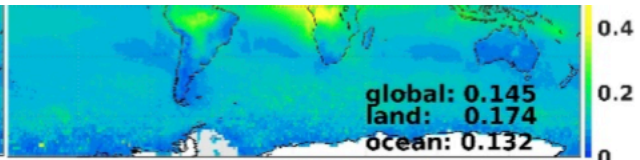
plus minus 0.05 ?

stddev 30% ?









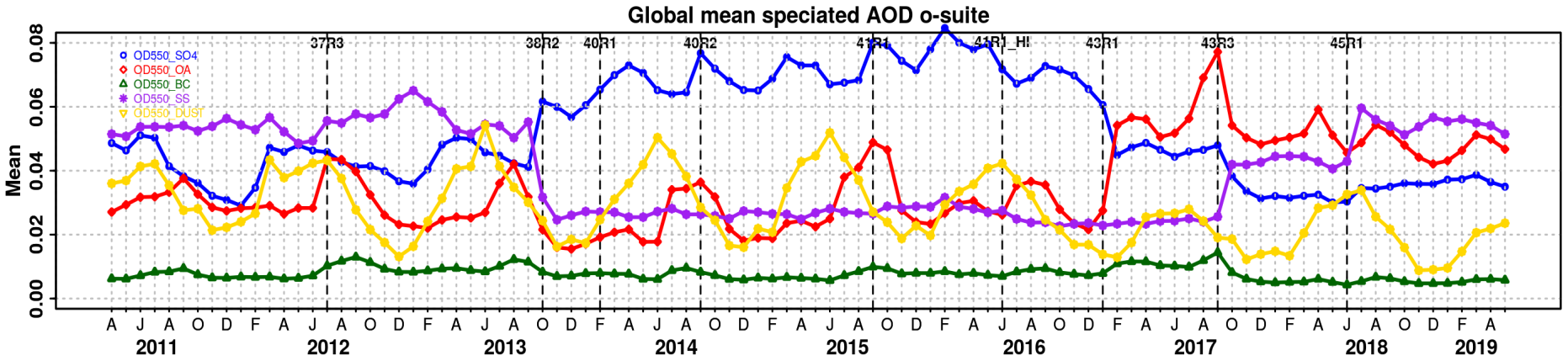
Merging regional and global AOD records from 15 available satellite products

Larisa Sogacheva[1], Thomas Popp[2], Andrew M. Sayer[3,4], Oleg Dubovik[5], Michael J. Garay[6], Andreas Heckel[7], N. Christina Hsu[8], Hiren Jethva[3,4], Ralph A. Kahn[8], Pekka Kolmonen[1], Miriam Kosmale[2], Gerrit de Leeuw[1], Robert C. Levy[8], Pavel Litvinov[9], Alexei Lyapustin[8], Peter North[7], Omar Torres[10]

https://doi.org/10.5194/acp-2019-446
Preprint. Discussion started: 21 June 2019

CAMS IFS o-suite AOD speciation

Seasalt
Organic
Sulphate
Dust
Black Carbon



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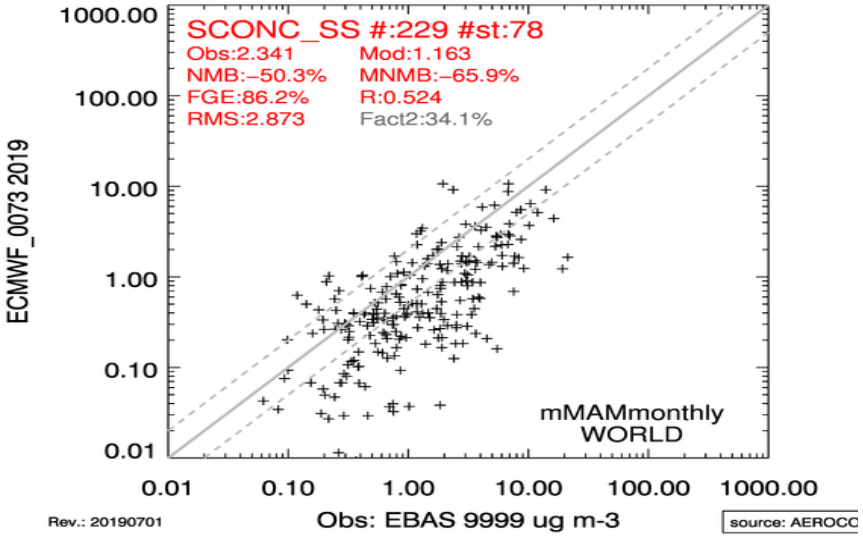
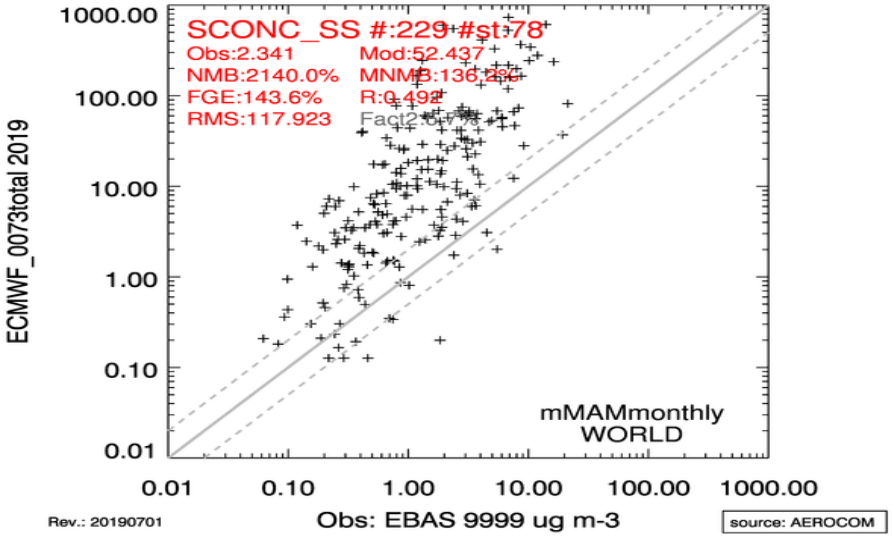
Evaluation attempt of surface sea salt concentration, CAMS-IFS model versus EBAS database

PM10 sea salt



Total sea salt



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SAM-CAAM *15 Required Variables*

[Systematic Aircraft Measurements to Characterize Aerosol Air Masses]

1. AEROSOL PROPERTIES FROM *IN SITU* MEASUREMENTS & INTEGRATED ANALYSIS

	Abbrev.	Required Variable
1	EXT	Spectral Extinction
2	ABS	Spectral Absorption
3	GRO	Hygroscopic Growth
4	SIZ	Particle Size
5	CMP	Particle Type (a composition constraint)
6	PHA	Single-scattering Phase Function
7	MEE	Mass Extinction Efficiency
8	RRI	Real Refractive Index

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Kahn et al., BAMS 2017

Aerosol variables vs capabilities of different instrument suites

Geophysical Variable	Backscatter Lidar	HSRL		Polarimeter	Polarimeter & BSL	Polarimeter & 2β + 1α	Polarimeter & 3β + 2α
		2β + 1α	3β + 2α				
Aerosol extinction profile	–	√	+		√ (TBD)	+	++
Near-surface aerosol extinction profile	–	√	+		–	√	++
Aerosol column absorption				√ (TBD)	√	+	++
Aerosol absorption profile					?	√	√
Aerosol size distribution parameters profile		–	√		?	?	?
Aerosol (column non-sphericity) non-spherical AOD	√ (TBD)	√	√	√ (TBD)	√	√	√
Aerosol (non-sphericity profile) non-spherical extinction profile	√ (TBD)	√	√		√	√	+
Aerosol column complex refractive index				–	√	+	++

– Less capability than ACCP Minimum requirement
√ Meets or somewhat exceeds Minimum (advances on A-train/PoR)
+ Significantly exceeds Minimum

Proposal for new Aerosol ECVs

Maintain AOD, SSA and $F_z(\sigma_{ep})$ as ECVs
Add notes insisting upon the importance of AAOD, Fine/Coarse AOD.

4 Aerosol size-related ECV

Particle Number (Volume) Size Distribution. In-situ and column integrated. Note indicating that Extinction Angström Exponent can be used as proxy.

5 Aerosol cloud forming potential-related ECV

Number of Cloud Condensation Nuclei at a given supersaturation is key to first-order (twomey effect) indirect effect

6 Aerosol chemical composition-related ECV

Mass-fraction of inorganic/organic/Black-Carbon and dust aerosol. Note saying Absorption Angström exponent can be used under some assumption. **Also complex refractive index** under known RH

DUGNAD

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AeroCom DUGNAD 2019/2020

- *AeroCom 2019 workshop presentations on web (please react when we send around draft)*

- *SSC Mian, Stefan, Kostas, Bjørn, Gunnar, Michael, + ????*
- *Responsibility Telecons, Paper & Experiment follow-up, Next Workshop, Comm*
- *Minutes will be send around to experiment/analysis responsibles*

- *Special telecons to discuss papers, experiments with larger rounds*
  (please propose, SSC will organise)

Modellers: Document Models, Papers, Simulations... / Correct output of your model
Data friends: produce accessible understandable benchmark datasets

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“AeroCom” Papers 2019

Set up a google doc sheet => extract to pdf,twitter,email...
with Title + Lead author/contact + submission deadline ambition + 3 bullet points
More detailed outlines by end of October (tables, figures, structure)
Focus telecons for papers 2019 (SSG initiates):

- Evaluation PD and Control
- Forcing history and Control (ERF and direct effect)
- Trends
- Absorption
- Aircraft evaluation
- In-situ and hygroscopcity
- Dust
- Indirect effects
- Measurement Requirements paper(s)

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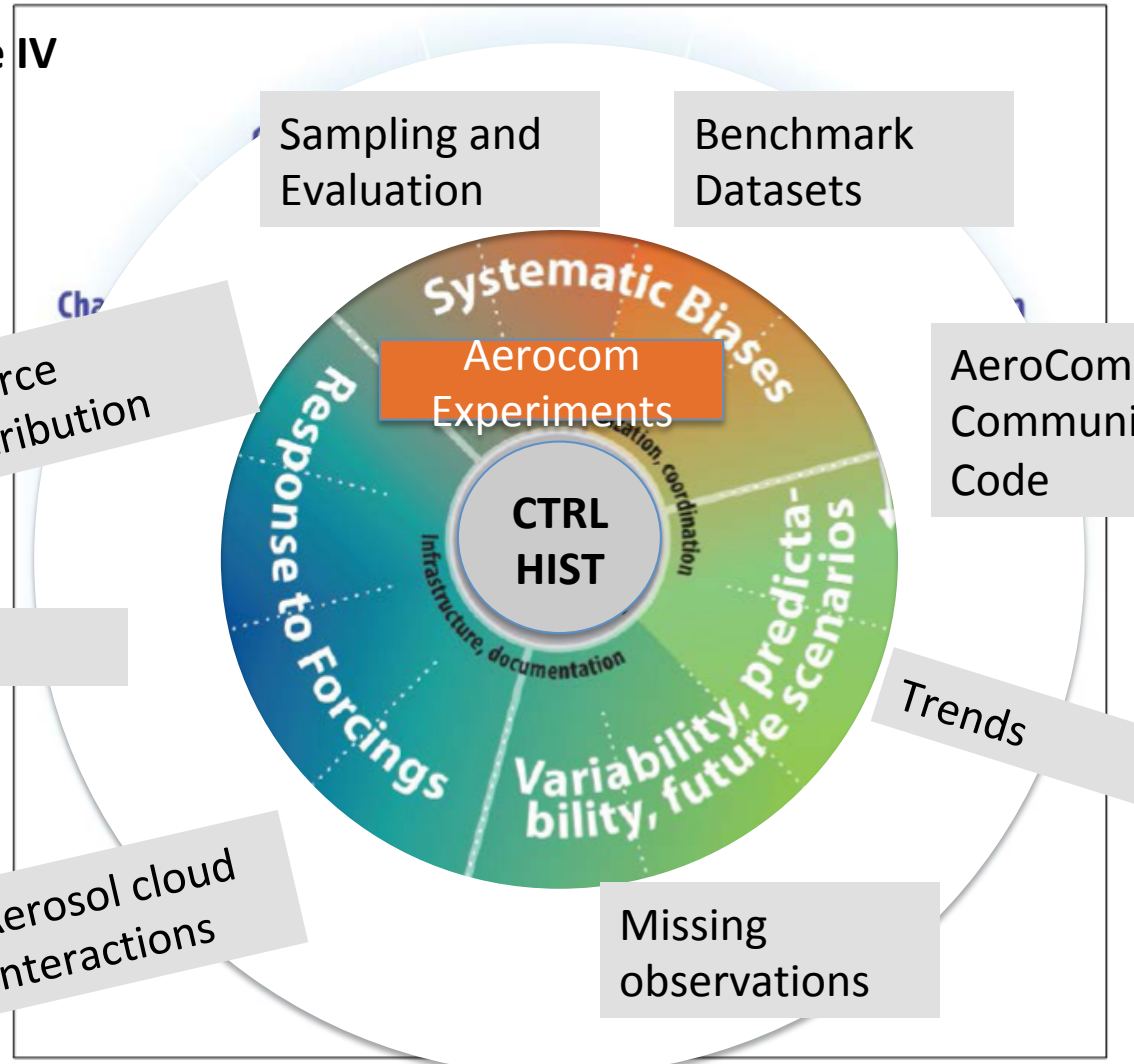
AeroCom phase IV



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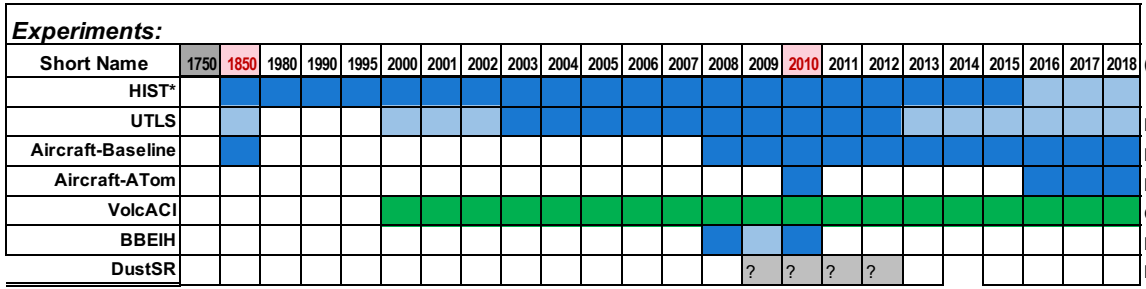
AeroCom model experiments:

- Sign up sheet of participating in model experiments and timeline
- Maximize the benefits and optimize the model simulation strategy
- Example below: one BASE simulations, specific purturbations

Common BASE simulations with un-common perturbations:



Base Perturbation Runs:

(BASE = simulation with all emissions)

BASE	VOL0	FIR0	ANT0	EAS0	SAS0			
BASE								
BASE	ExpA	ExpB	ExpC	ExpNuc	ExpSO2	ExpIon	ExpTer	ExpOrg
CRTLv	Hol-CE	Kil-CE						
BASE	BBIH	NOBB	BBEM					
BASE	various regional tags							

*1980-2015

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Suggested near future effort:

- Effectively diagnose model differences:
  - Implement the CO50 transport tracer (required, min effort)
  - Implement the removal tracer Pb-210 (recommended)
  - A generic land source tracer with specified loss? (e.g. for dust transport diagnostics)
  - Hygroscopic growth and water fraction in AOD
  - Benchmark dataset list
- Collaborative effort between AeroCom and AeroSAT:
  - Dust – AeroSAT provides synthesized dust dataset for AeroCom model evaluations, comparing model and IASI 10 um AOD
  - Clear sky AOD and flux: finding a common ground/approach to compare the same fruit
  - Aerosol simulator for proper comparison between model and satellite data (limitations of type of satellite data that can be applied with the simulator?

Next AeroCom workshops

- New York City :: 2020 *Tsigaridis*
- Oslo/Stockholm :: 2021/2022 *Schulz/Storelvmo/Zieger*
- Nanjing :: 2021/2022 *Minghuai Wang*

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Special thanks

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