Remote sensing evaluation of AEROCOM models

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L. Clarisse, O. Dubovik, M. Garay, O. Hasekamp, A. Heckel, T. Holzer-Popp, L. Klueser, P. Leonard, G. de Leeuw, R. Levy, A. Lyapustin, P. North, J. Redemann, A. Sayer, V. Sayer, L. Sogacheva, G. Thomas, O. Torres

Goals

- Inventory model – obs discrepancies
- Identify model errors
- Understand basic causes of those errors

- $M - O = \varepsilon_M + \varepsilon_O + \varepsilon_{xyt}$

- Inventory obs diversity / errors (ground truth)

Basic idea

- Ask remote sensing groups to provide aggregated product (1^{o} x 1^{o} x 30^{min})
- Ask model groups to provide high-frequency output (3^{hr}) of AOT, AE, SSA for CTRL run
- Collocate and analyse datasets
  - CIS tool (www.cistools.net) & prototype

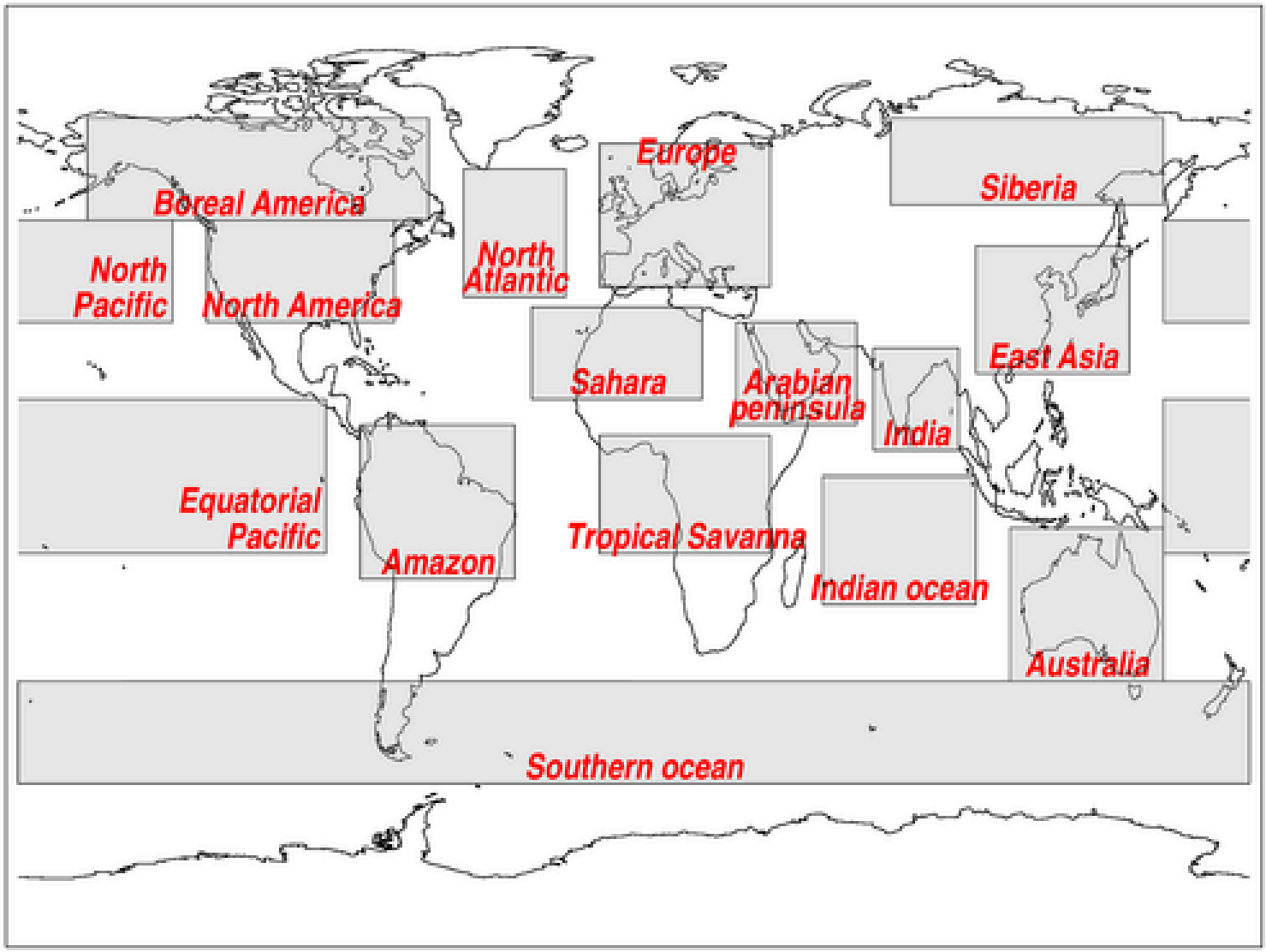
Remote sensing product L3U

Index	Time	Longitude	Latitude	od550aer	od550aer_s	od550aer_s	…	…	…	nobs	pixelsize
1	01:15:00	10.5	-30.5								
2	01:15:00	11.5	-30.5								
3	01:15:00	12.5	-30.5								
4	01:45:00	5.5	-45.5								
5	01:45:00	6.5	-45.5								
6											
7											
8											
9											
10											
11											

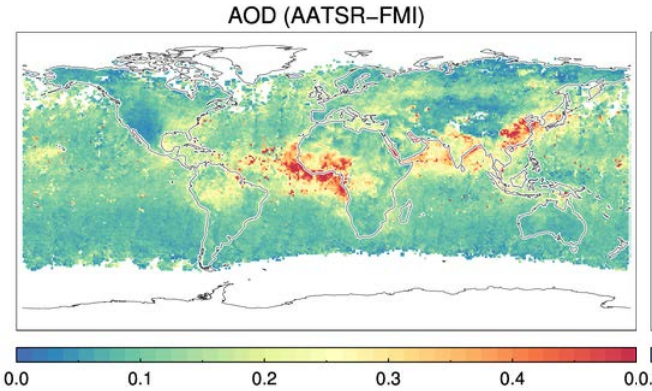
Satellite	Sensor	Product	Contact	Institute	Params	Comments
Aura	OMI	OMAERUV	P. Leonard/O. Torres	NASA	od550aer, od550dust, abs550aer	received
Aqua	MODIS	MAIAC	A. Lyapustin			delayed
Aqua	MODIS	DarkTarget	R. Levy/V. Sayer	NASA	od550aer, od550fine	received
Aqua	MODIS	DeepBlue	A. Sayer	NASA	od550aer	received
CALIPSO + Aura	CALIOP + MODIS + OMI		J. Redemann	NASA		delayed
ENVISAT	AATSR	ADV	L. Sogacheva	FMI	od550aer, od550fine	received
ENVISAT	AATSR	AER-PRODUCTS-SU	A. Heckel/P. North	Swansea U.	od550aer, od550fine	received
ENVISAT	AATSR	ORAC	G. Thomas	RAL	od550aer, od550fine od550dust, abs550aer	received
MetopA	IASI	IMARS	L. Klueser	DLR-DFD	od550dust	in progress
MetopA	IASI	MAPIRdust	S. Vandenbussche	BIRA-IASB	od550dust	received
MetopA	IASI	ULBNN	L. Clarisse	ULB	od550dust	received
PARASOL	POLDER		O. Dubovik	U. Lille		?
PARASOL	POLDER		O. Hasekamp	SRON		delayed
Seastar	SeaWiFS	DeepBlue	A. Sayer	NASA	od550aer	received
Terra	MODIS	MAIAC	A. Lyapustin			delayed
Terra	MISR		M. Garay	NASA		?
Terra	MODIS	DarkTarget	R. Levy/V. Sayer	NASA	od550aer, od550fine	received
Terra	MODIS	DeepBlue	A. Sayer	NASA	od550aer	received

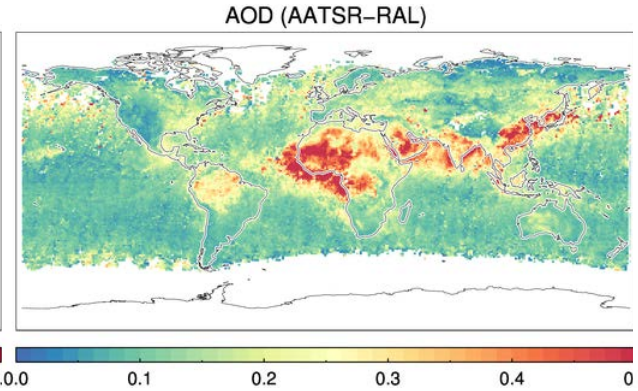
Methodology

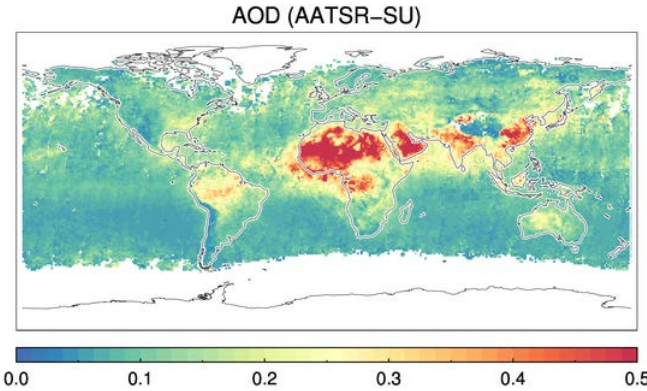
- Collocate L3U products within 1^{hr}
  - expect representation errors to be acceptable
  - further control through nobs * pixelsize
- Linearly interpolate model data to obs
- Average everything over:
  - a year (global map)
  - a region & 10 days (time-series)

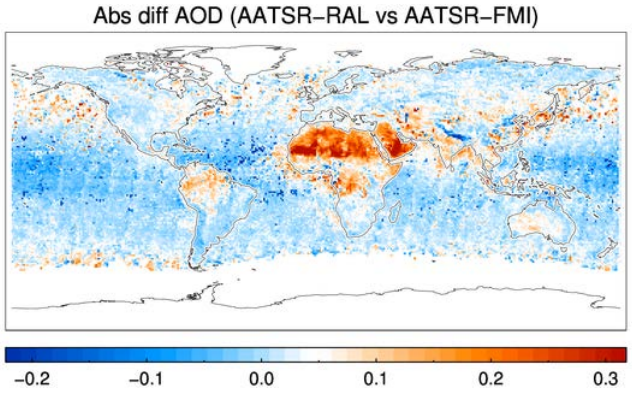

Boreal America
North Pacific
North America
North Atlantic
Europe
Siberia
East Asia
Sahara
Arabian peninsula
India
Equatorial Pacific
Amazon
Tropical Savanna
Indian ocean
Australia
Southern ocean

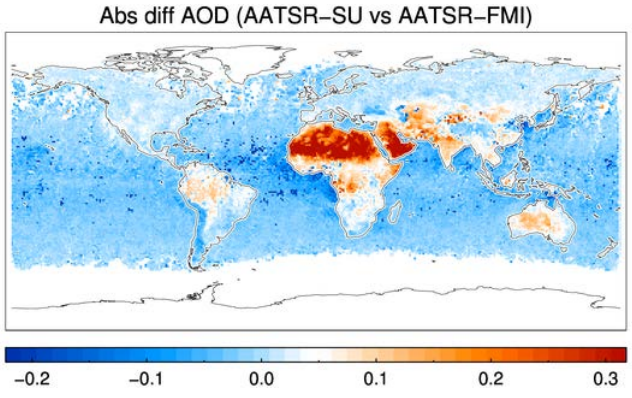
ENVISAT-AATSR

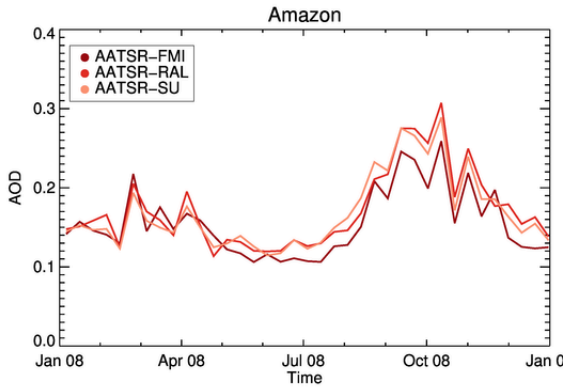


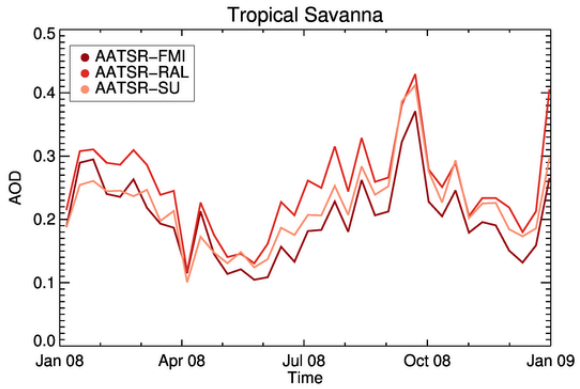


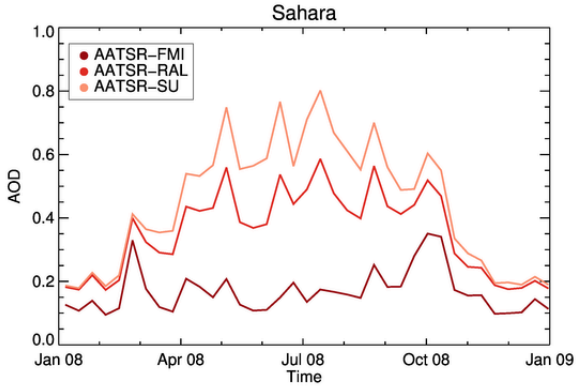


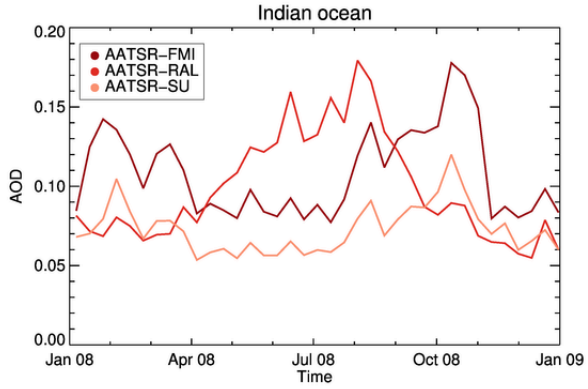




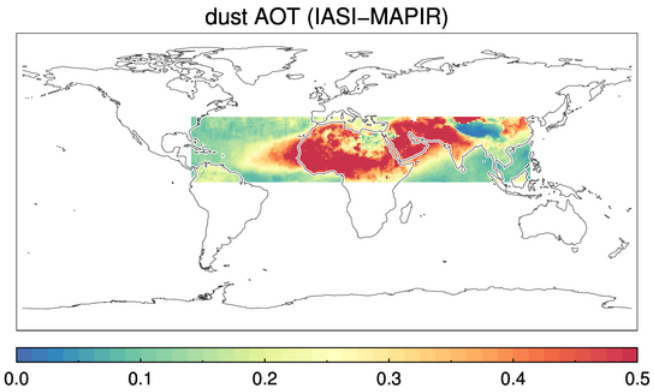


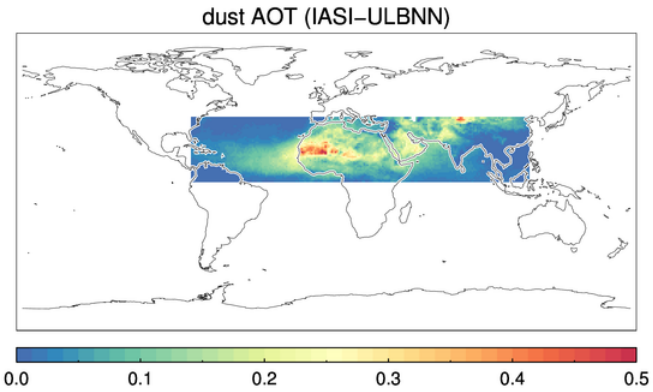


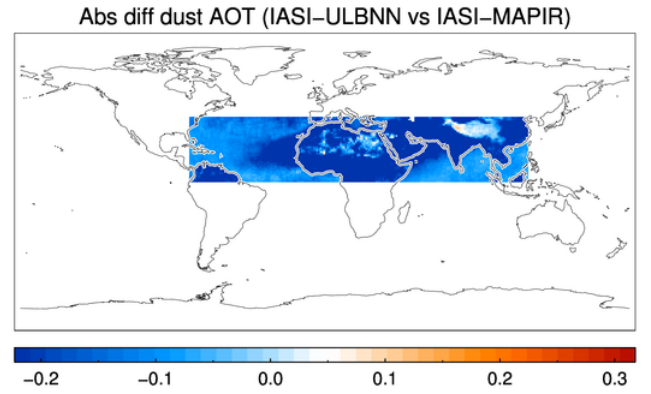


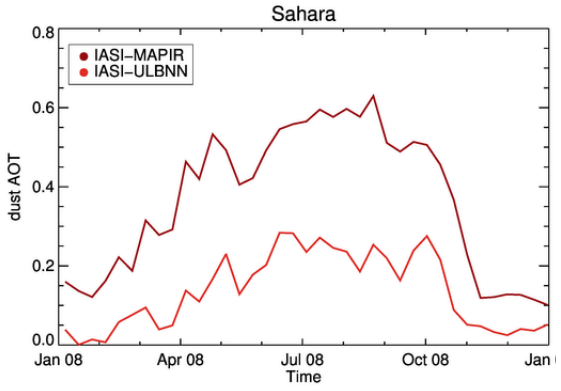


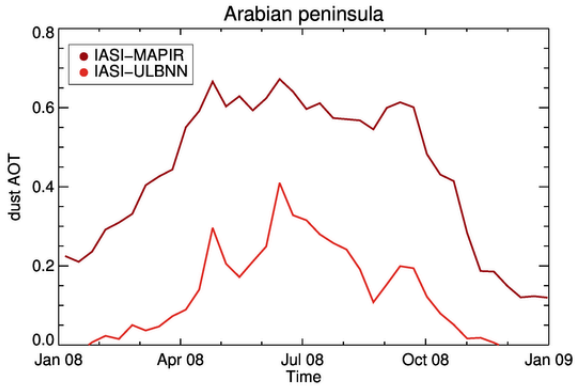
MetopA-IASI

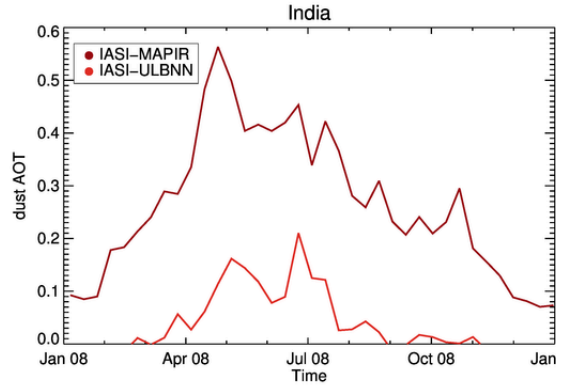

dust AOT (IASI–MAPIR)
0.0
0.1
0.2
0.3
0.4
0.5

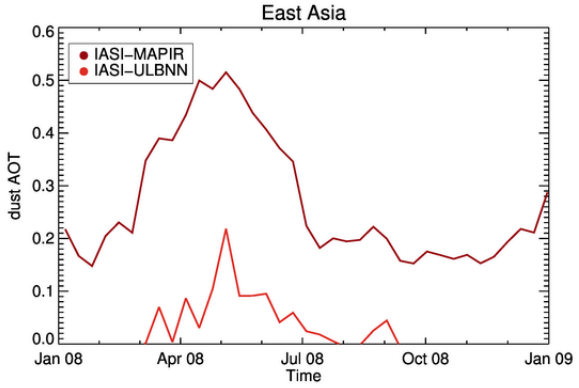

dust AOT (IASI–ULBNN)
0.0
0.1
0.2
0.3
0.4
0.5

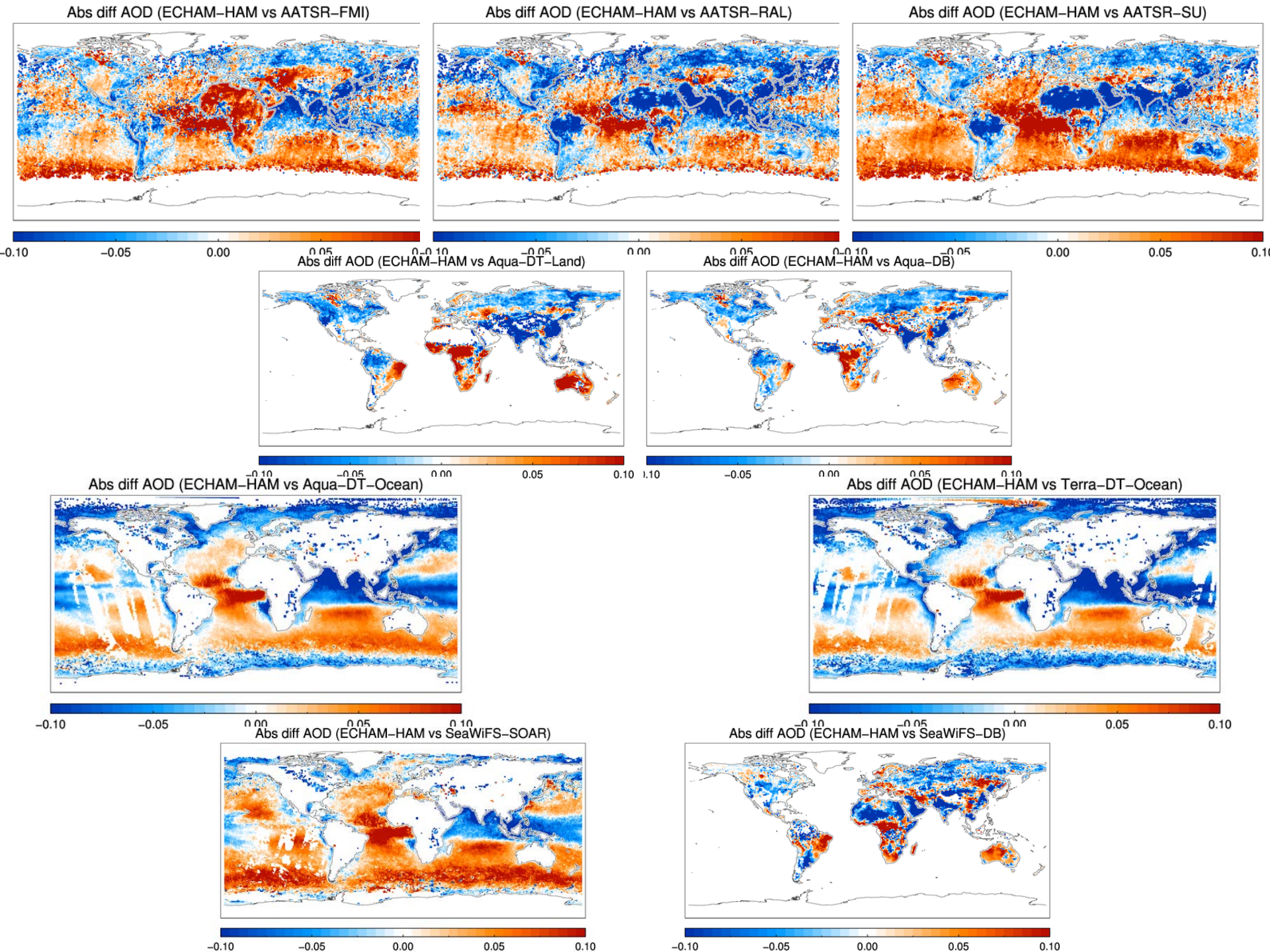

Abs diff dust AOT (IASI–ULBNN vs IASI–MAPIR)
−0.2
−0.1
0.0
0.1
0.2
0.3


Sahara
IASI–MAPIR
IASI–ULBNN
dust AOT
0.0
0.2
0.4
0.6
0.8
Jan 08
Apr 08
Jul 08
Oct 08
Jan
Time

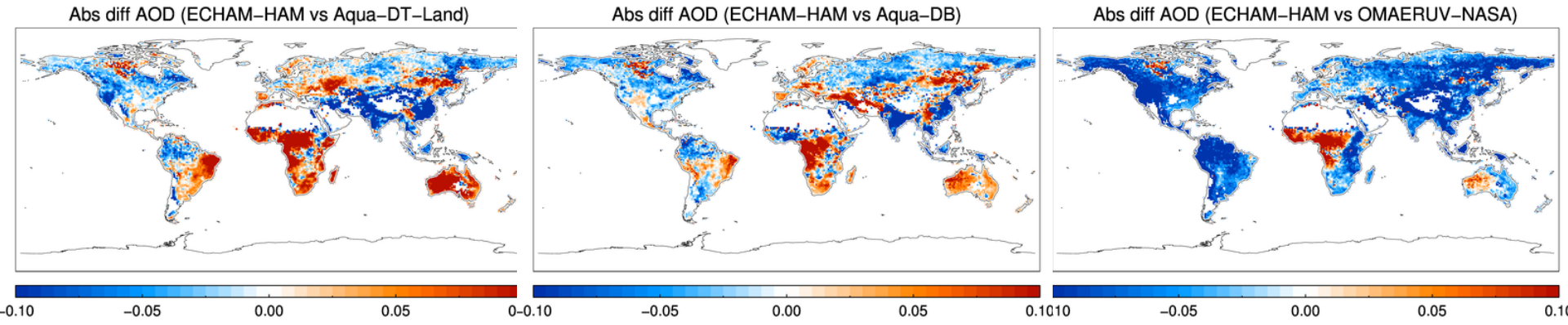

Arabian peninsula
IASI–MAPIR
IASI–ULBNN
dust AOT
0.0
0.2
0.4
0.6
0.8
Jan 08
Apr 08
Jul 08
Oct 08
Jan 09
Time

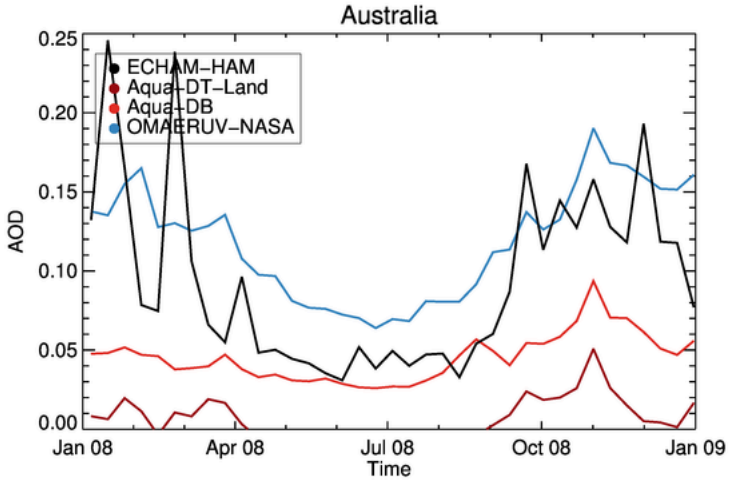

India
IASI–MAPIR
IASI–ULBNN
dust AOT
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Jan 08
Apr 08
Jul 08
Oct 08
Jan
Time

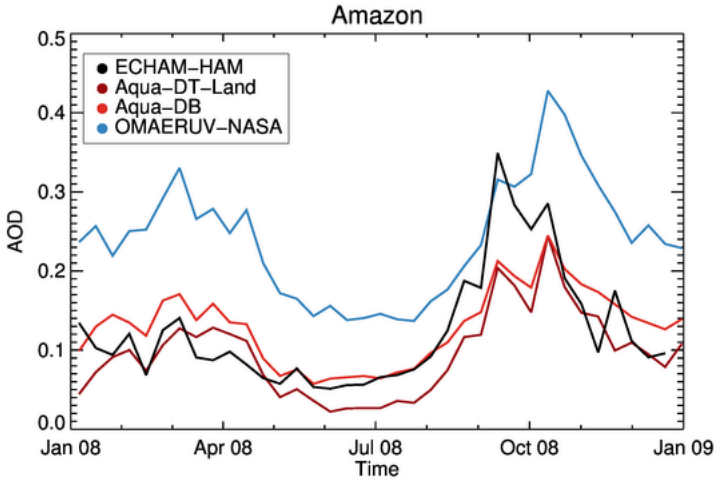

East Asia
IASI–MAPIR
IASI–ULBNN
dust AOT
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Jan 08
Apr 08
Jul 08
Oct 08
Jan 09
Time


Abs diff AOD (ECHAM−HAM vs AATSR−FMI)
Abs diff AOD (ECHAM−HAM vs AATSR−RAL)
Abs diff AOD (ECHAM−HAM vs AATSR−SU)
−0.10 −0.05 0.00 0.05 0.10
Abs diff AOD (ECHAM−HAM vs Aqua−DT−Land)
Abs diff AOD (ECHAM−HAM vs Aqua−DB)
−0.10 −0.05 0.00 0.05 0.10
Abs diff AOD (ECHAM−HAM vs Aqua−DT−Ocean)
Abs diff AOD (ECHAM−HAM vs Terra−DT−Ocean)
−0.10 −0.05 0.00 0.05 0.10
Abs diff AOD (ECHAM−HAM vs SeaWiFS−SOAR)
Abs diff AOD (ECHAM−HAM vs SeaWiFS−DB)
−0.10 −0.05 0.00 0.05 0.10

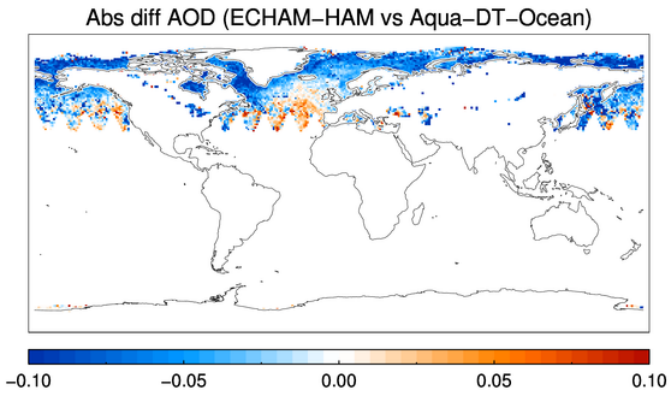
Aqua-MODIS & Aura-OMI

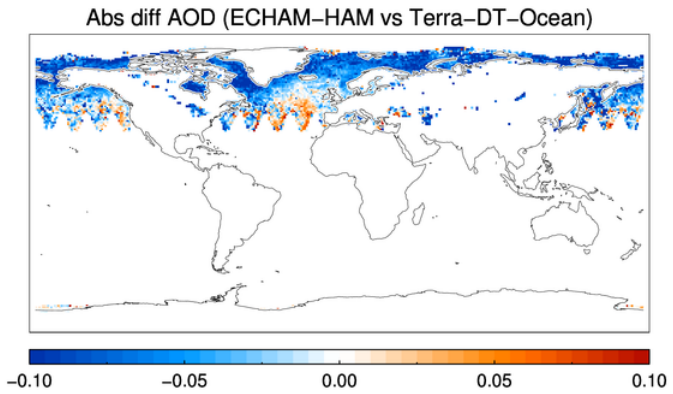


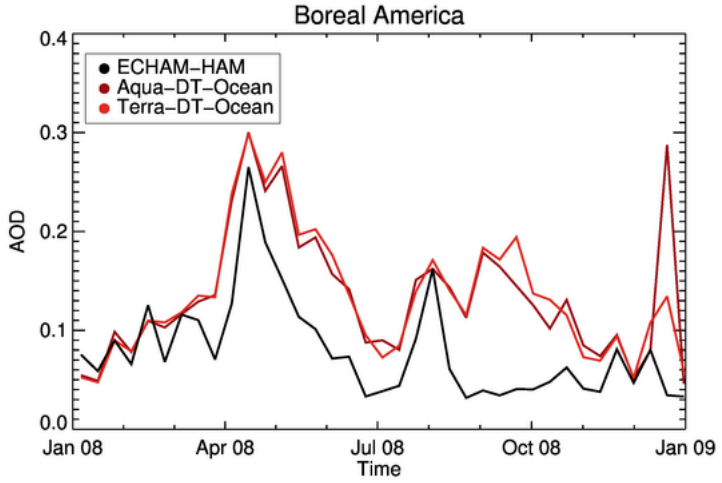


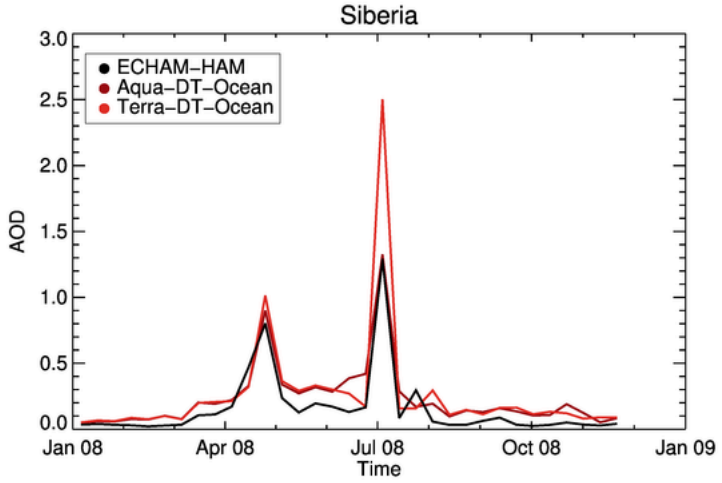


Aqua-MODIS & Terra-MODIS





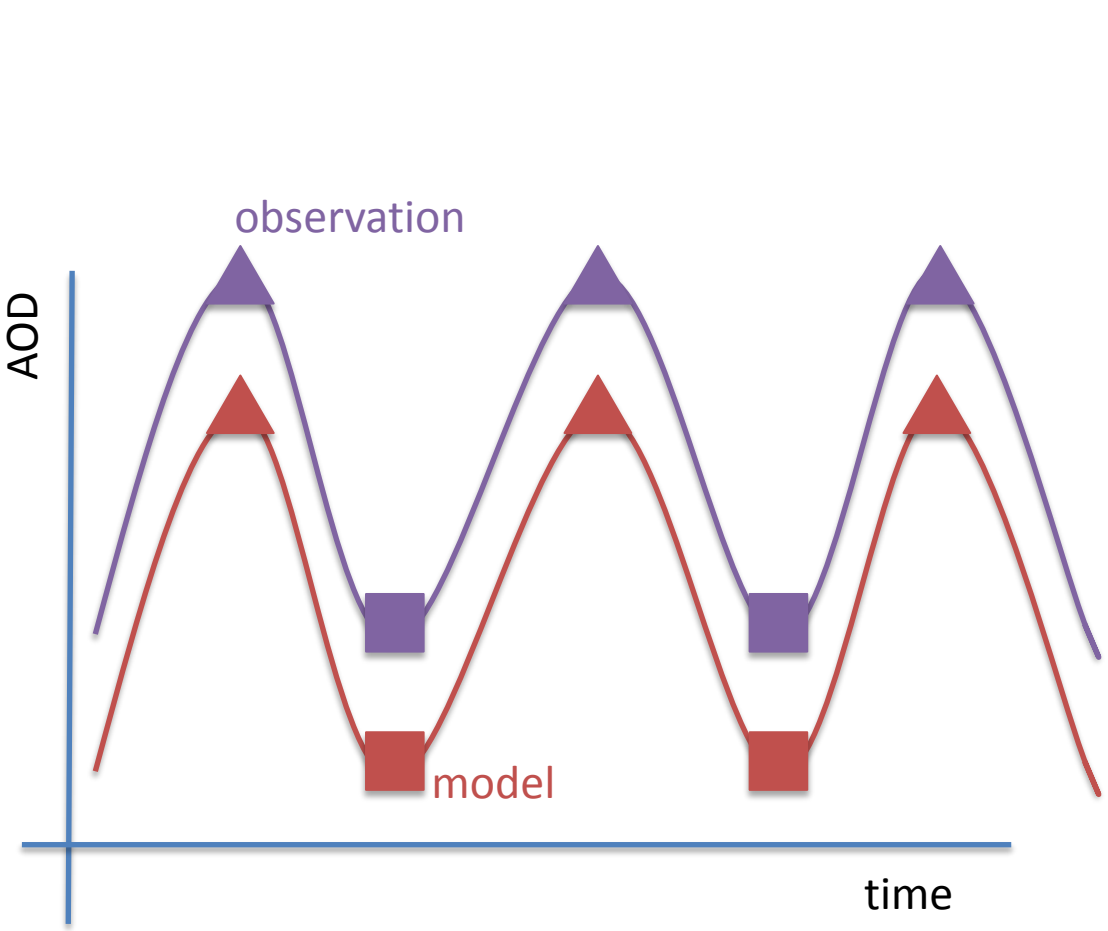


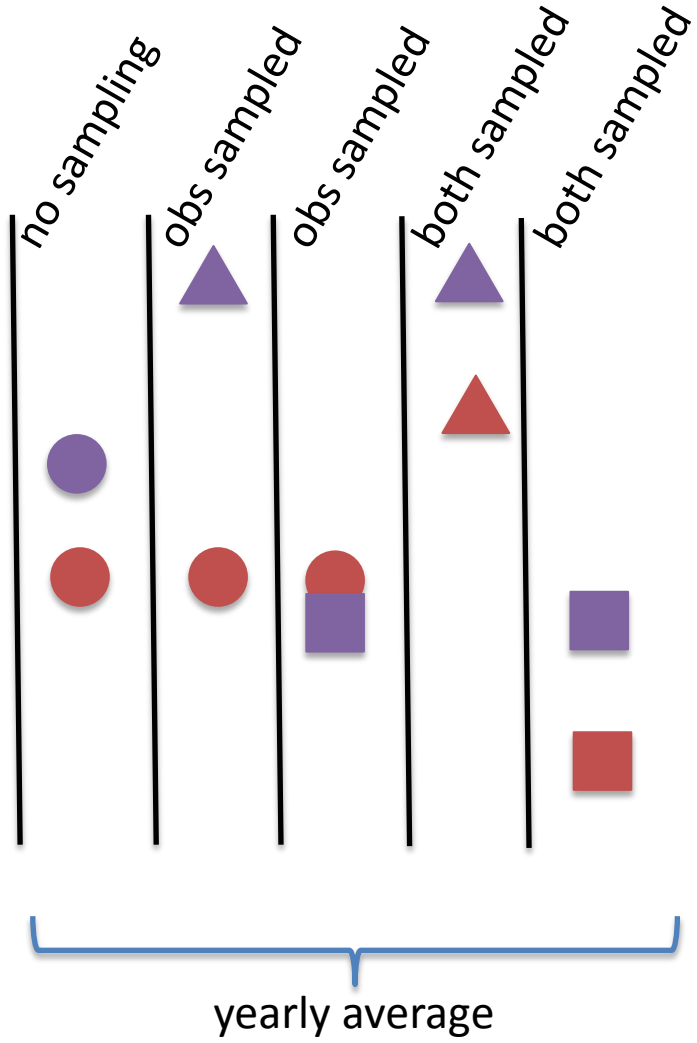


Summary

- Collecting remote sensing data
  - hopefully even more data in next 6 months
  - if interested to join: req. document exists
- Analysis software (CIS & prototype)
- Started charting differences between data
  - areas where observations agree: model error !?
  - areas where observations disagree: observational error
- At least two papers planned
  - comparison of remote sensing data
  - evaluation of AEROCOM models
- Data will be made available at some point
  - track AEROCOM model development
  - AerChemMIP, CMIP evaluation ?

Impact of sampling





Impact of sampling