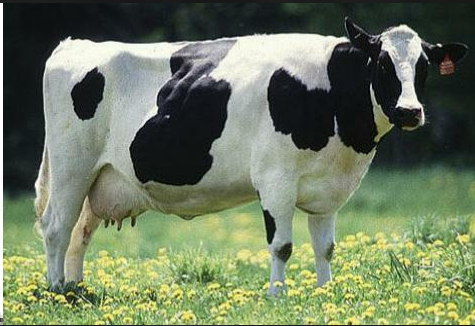


M7 development

TM Meeting December 2009

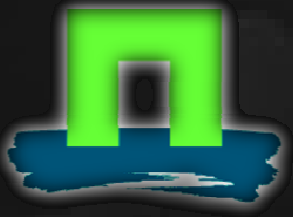


Joost Aan de Brugh



WAGENINGEN UNIVERSITY
METEOROLOGY AND AIR QUALITY





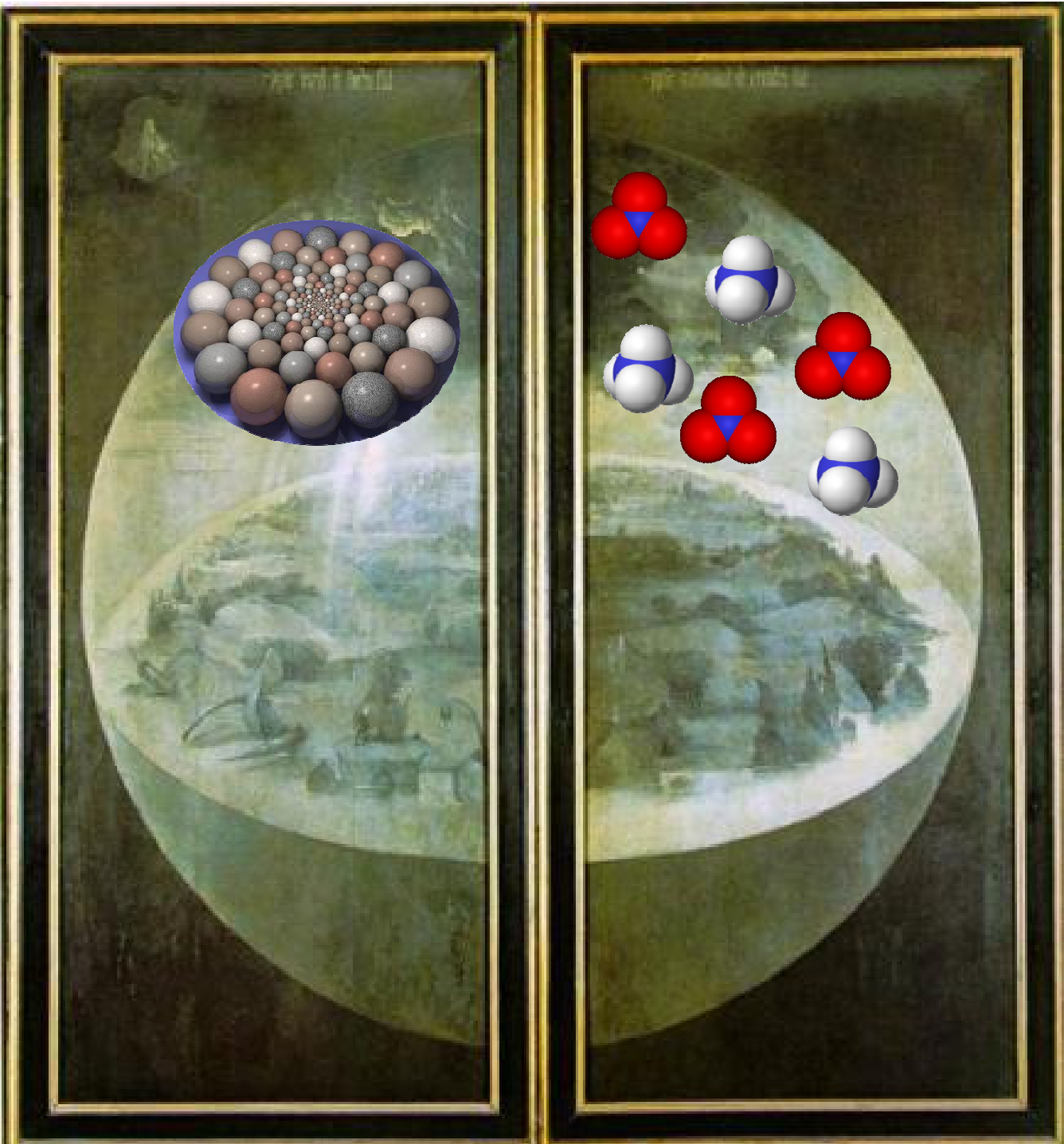
Contents



- M7 and EQSAM
- Optics
- Model validation
- Wet deposition
- Conclusion



M7 and EQSAM



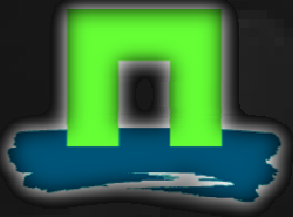
M7 and EQSAM



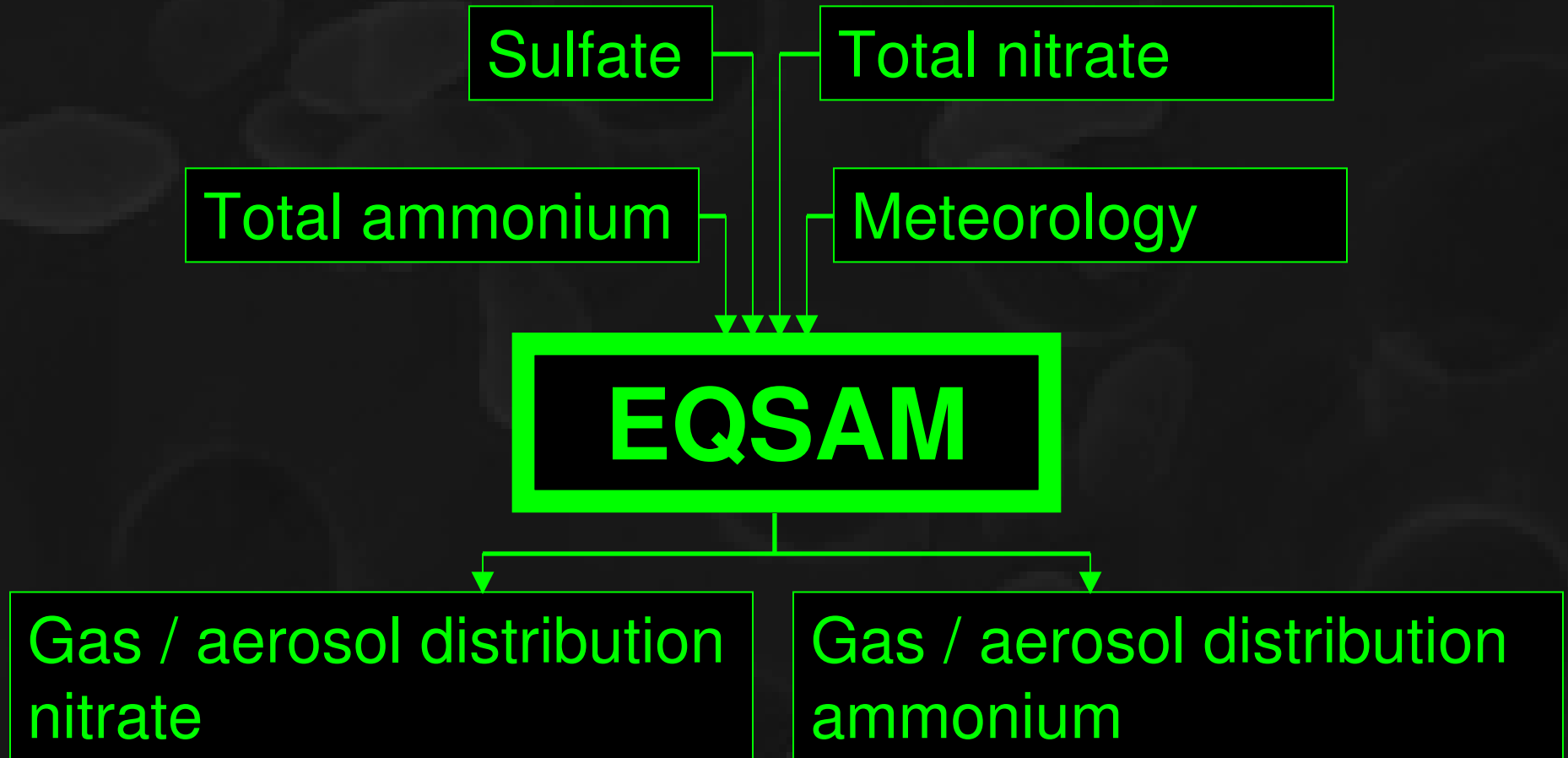
M7 and EQSAM



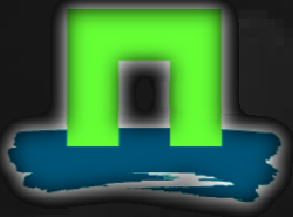
- M7
 - Size and solubility resolution
- EQSAM
 - Annomium and nitrate



EQSAM in TM5



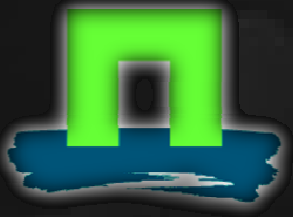
Aerosol ammonium and nitrate stuffed into mode 3



Challenges



- Desired modal distribution
 - Modes 2 and 4?
- Sedimentation
 - N3, AM3, NI3, SU3, BC3, OC3, SS3, DU3 on one Processor?

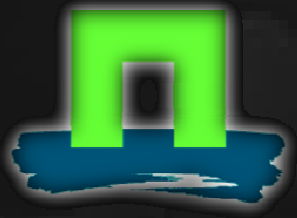


Challenges



- Desired modal distribution
 - Modes 2 and 4?
- Sedimentation
 - N3, AM3, NI3, SU3, BC3, OC3, SS3, DU3 on one Processor?
- Symptom treatment





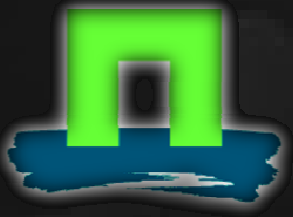
Solution





Solution





Solution





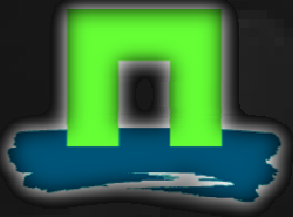
Optics



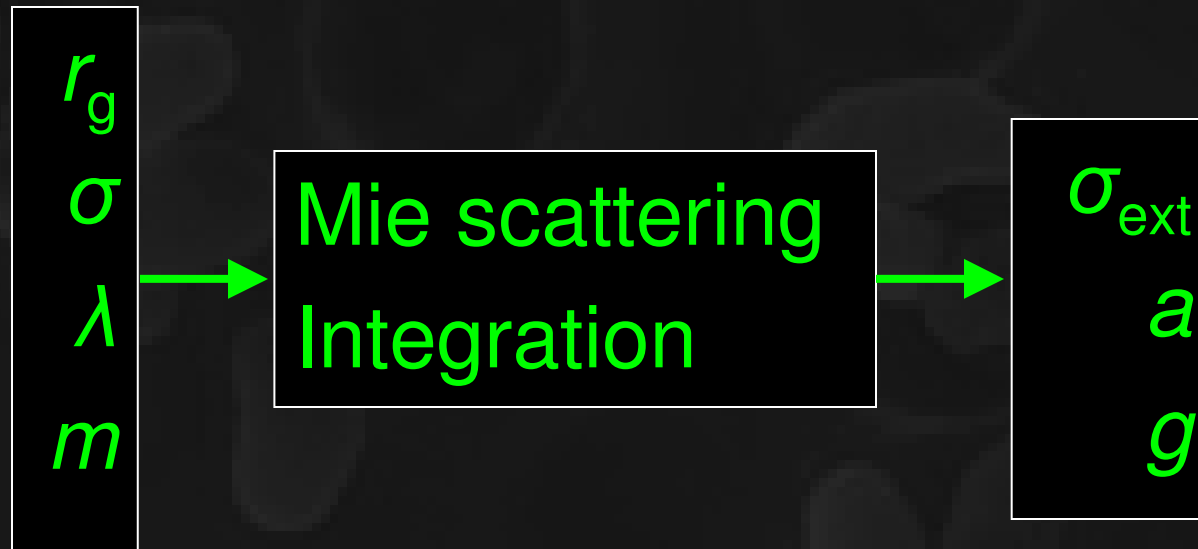
Optics

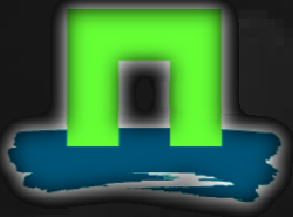


- Mie scattering
- Implementation

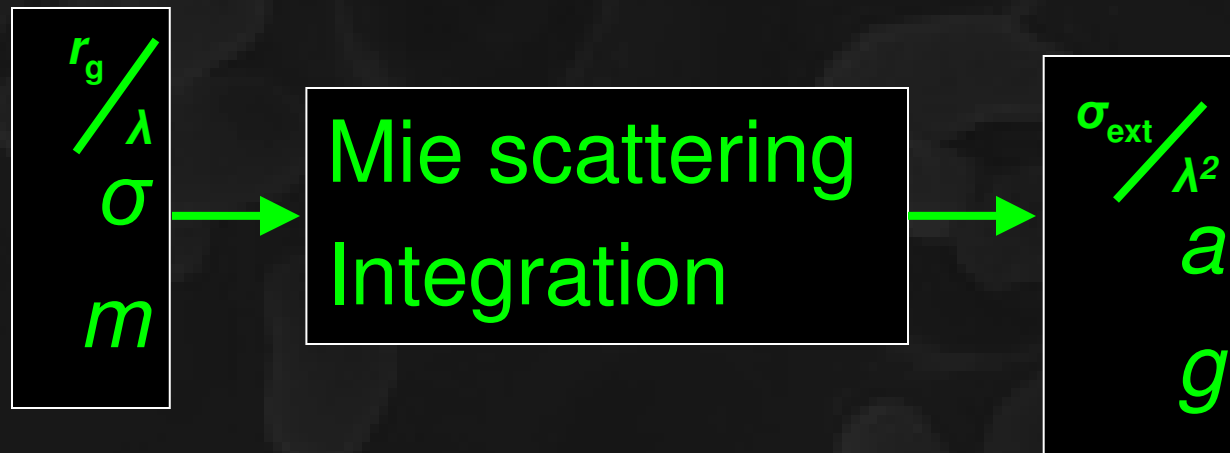


Mie scattering





Mie scattering

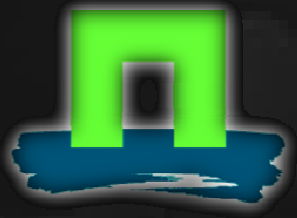


- One lookup-table per σ
- Only assumption: lognormal distribution



Implementation in TM5





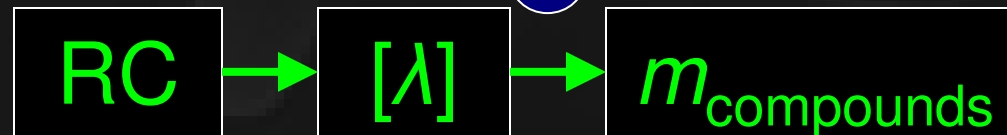
TM5 Init

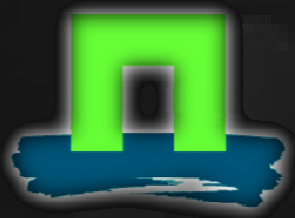


OPAC

ECHAM-HAM

Segelstein





TM5 Step



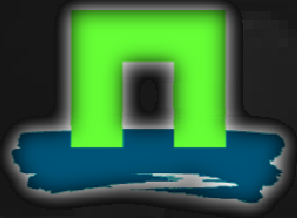
For each (mode, λ)

λ

mode

TM5

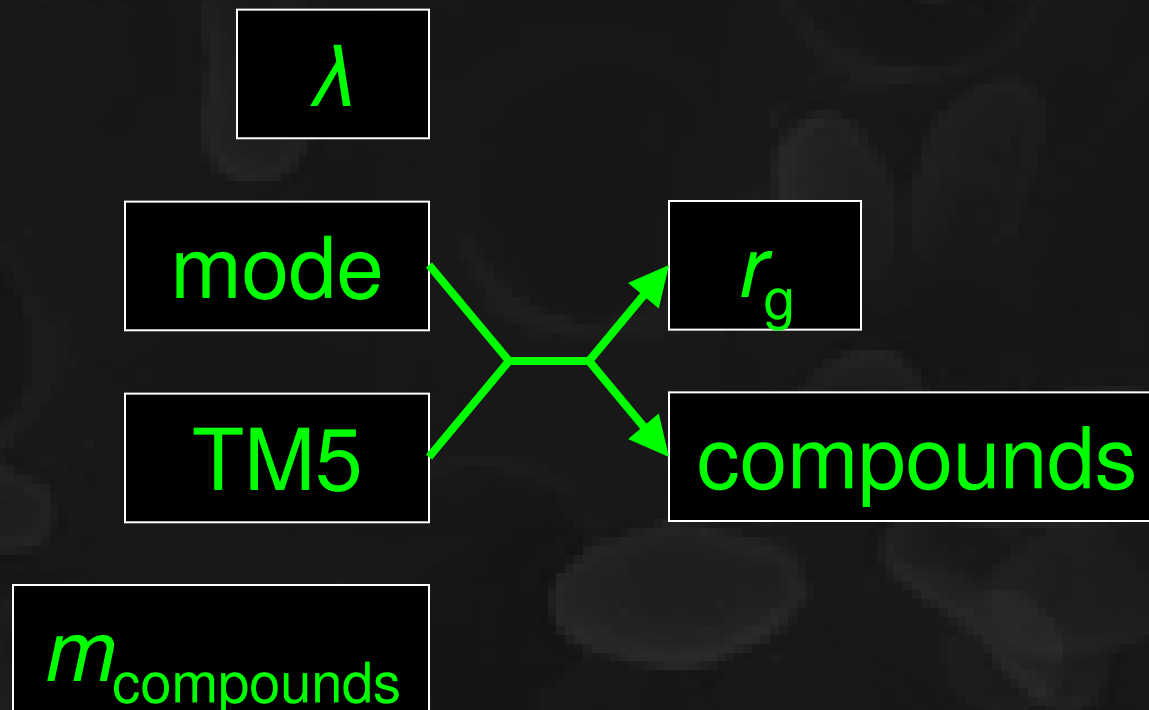
$m_{\text{compounds}}$

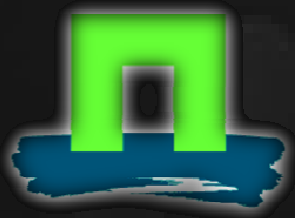


TM5 Step



For each (mode, λ)

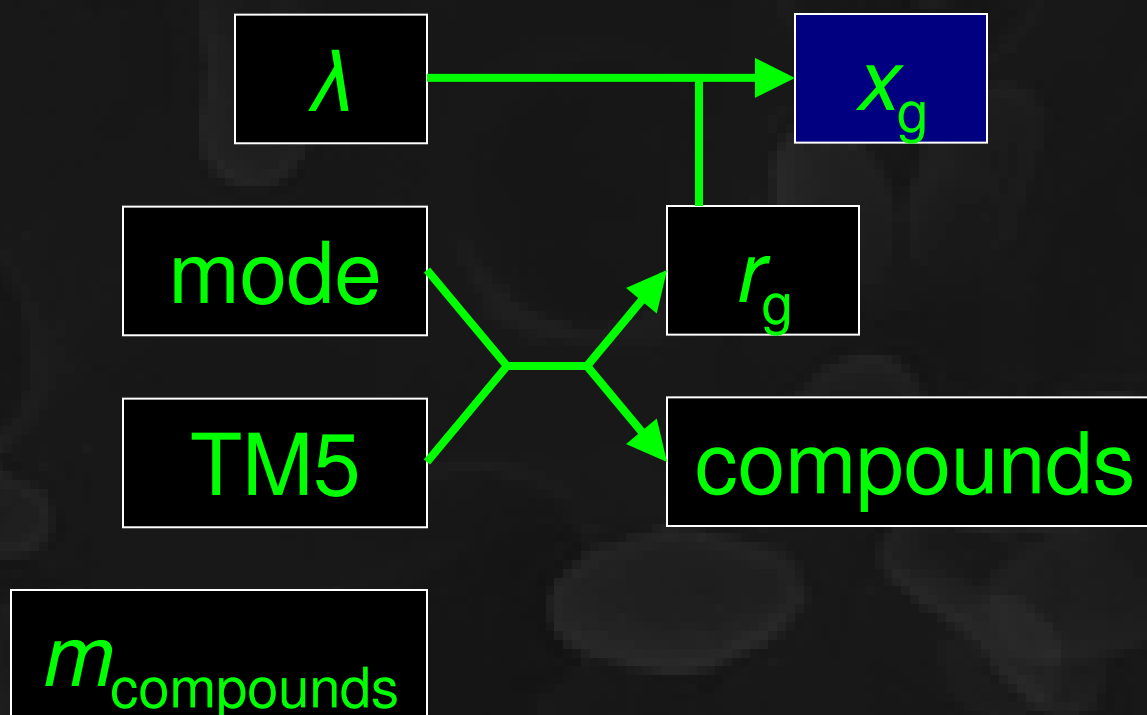


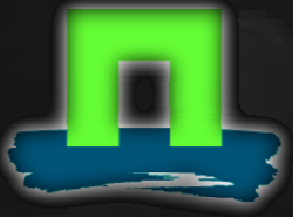


TM5 Step

For each (mode, λ)

$$X_g = r_g / \lambda$$

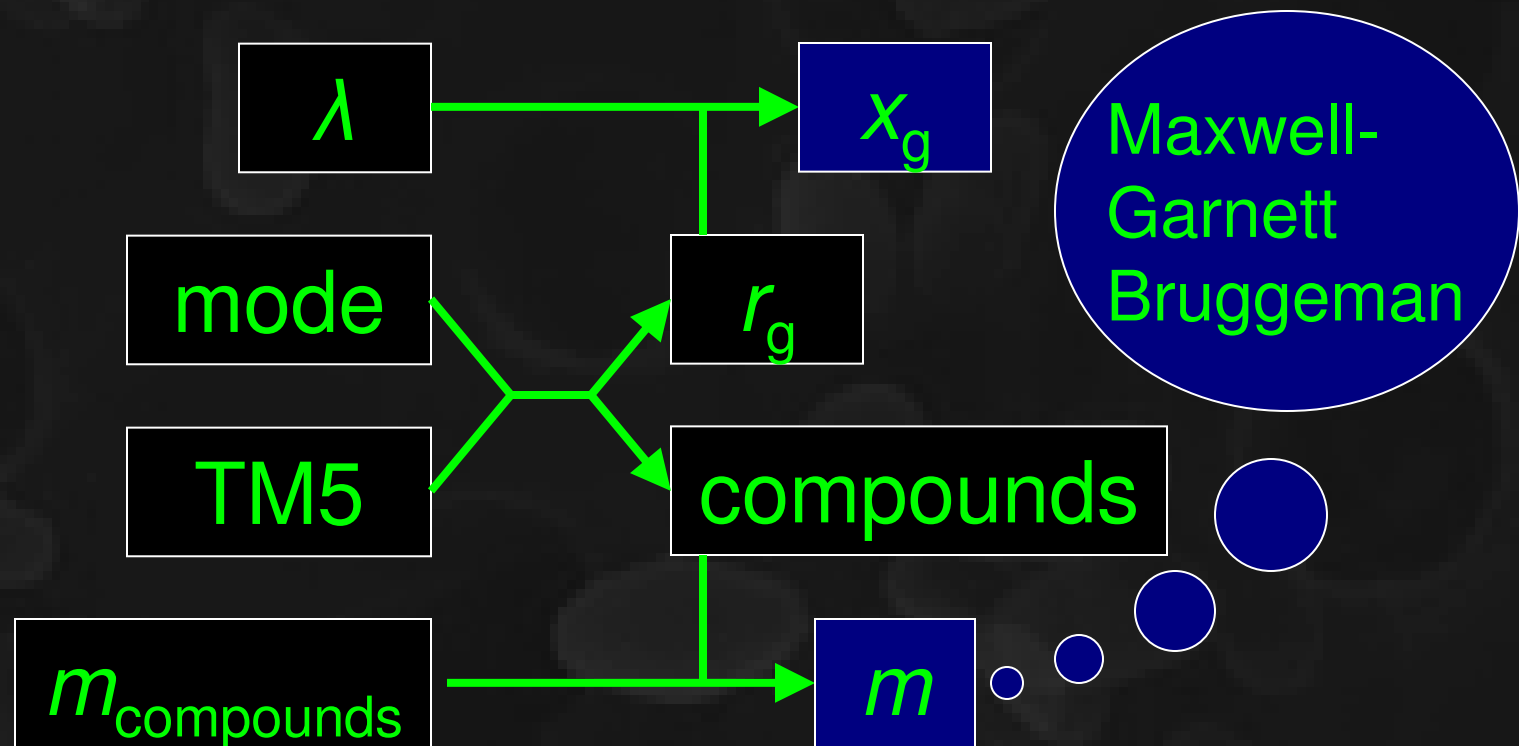


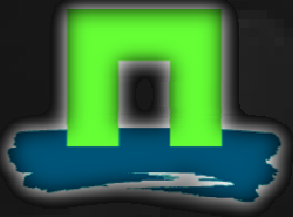


TM5 Step



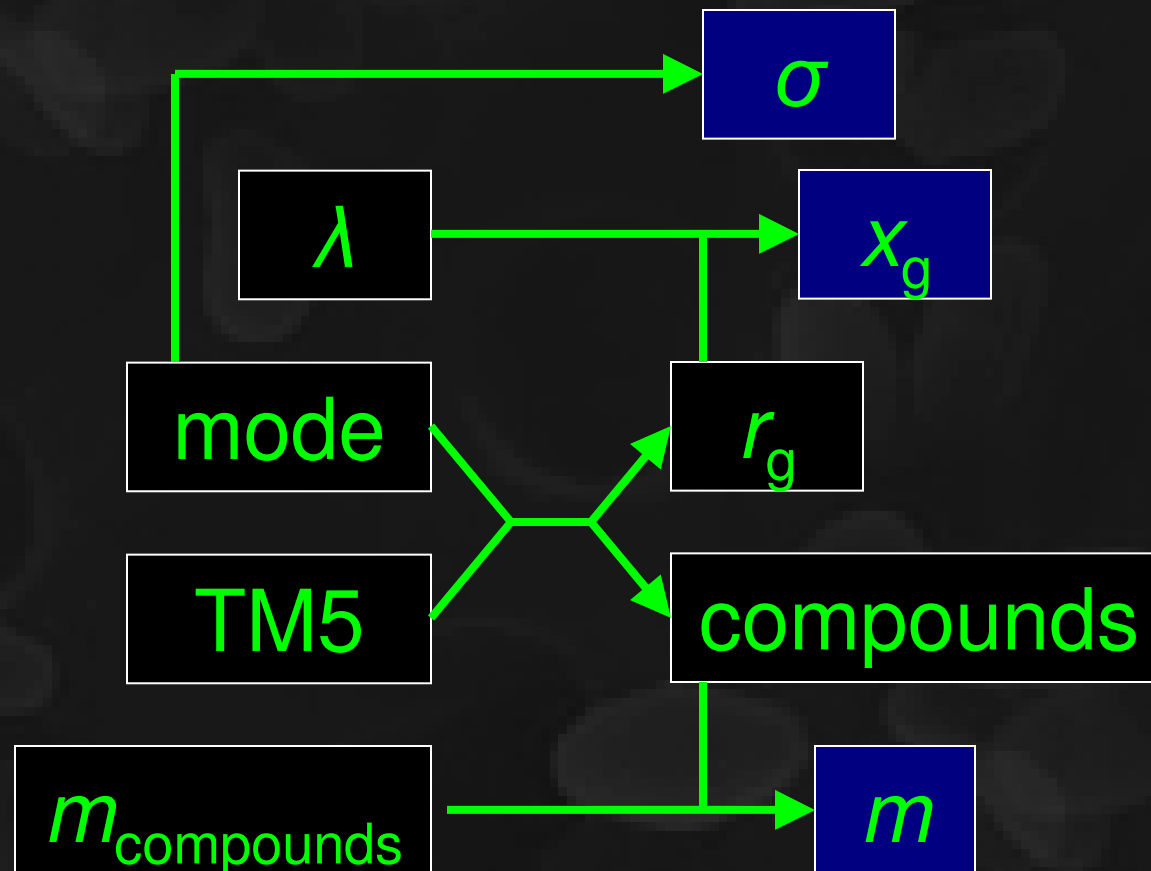
For each (mode, λ)

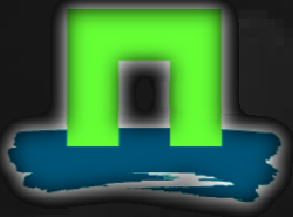




TM5 Step

For each (mode, λ)

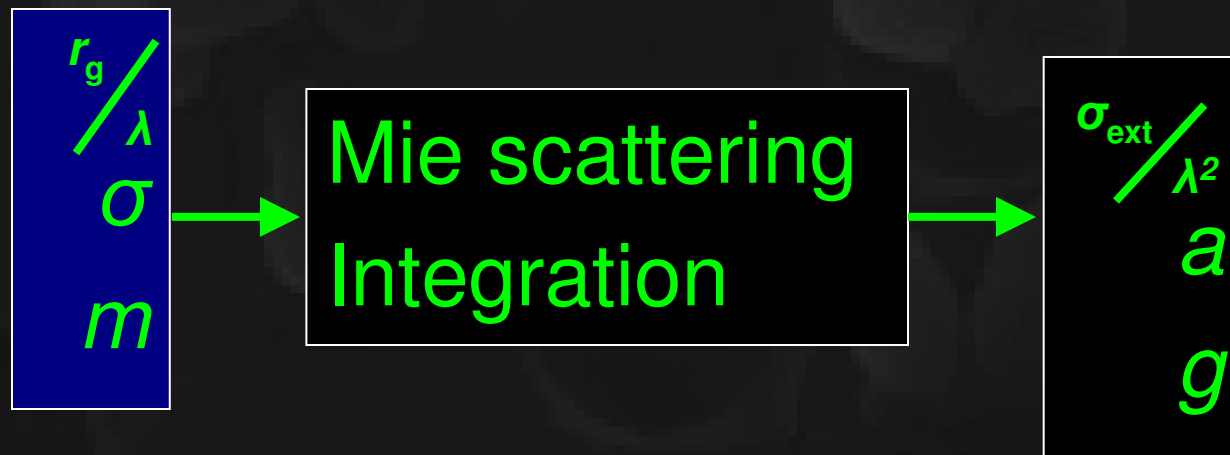




TM5 Step



For each (mode, λ)

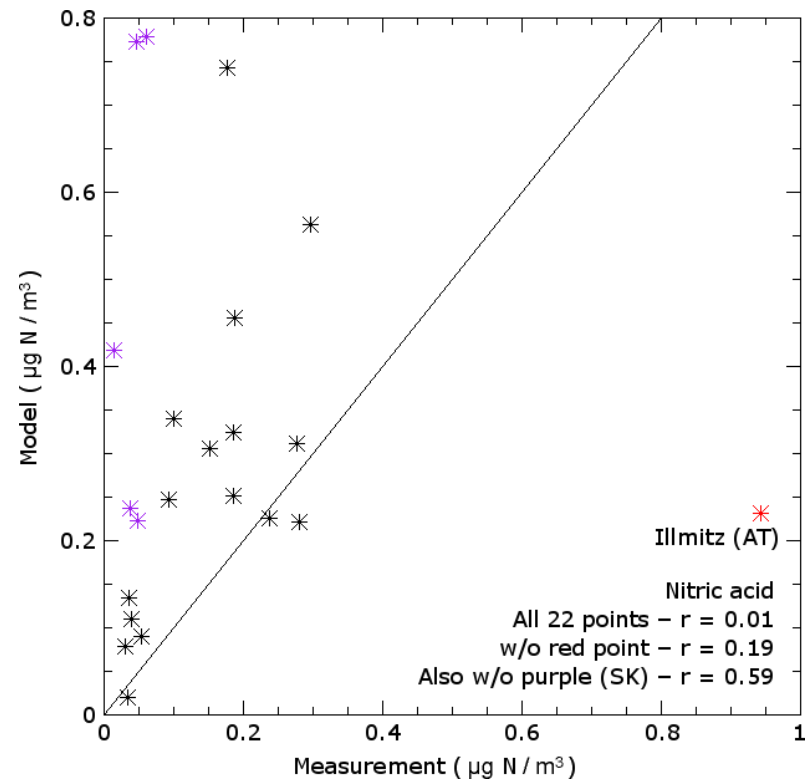
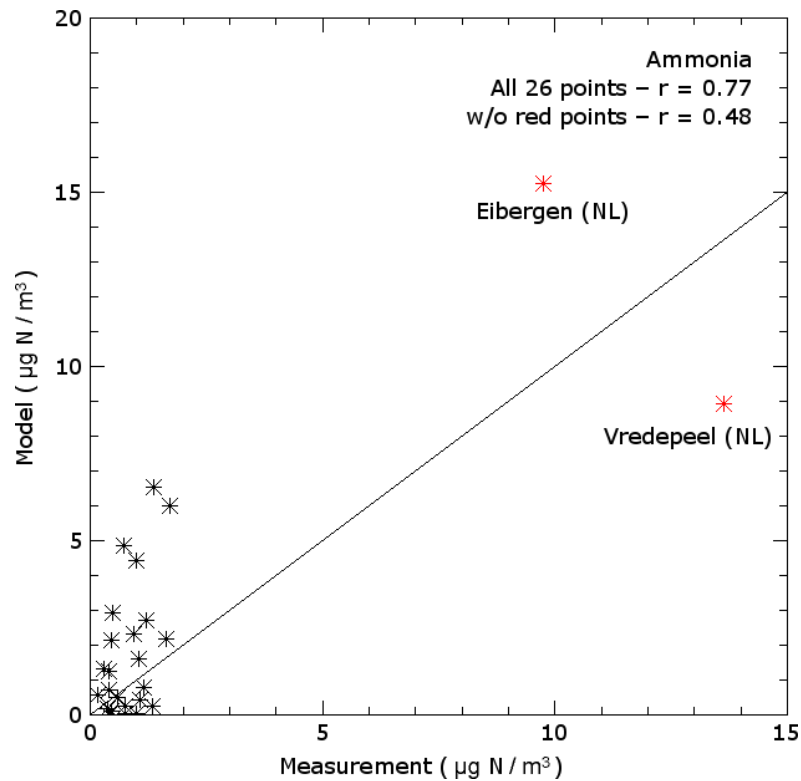


- We can acquire σ_{ext} because we have λ
- Count up all modes \rightarrow AOD
- Analyze $\text{AOD}(\lambda) \rightarrow \alpha$ (Ångström parameter)



Model validation

Ammonia and nitric acid

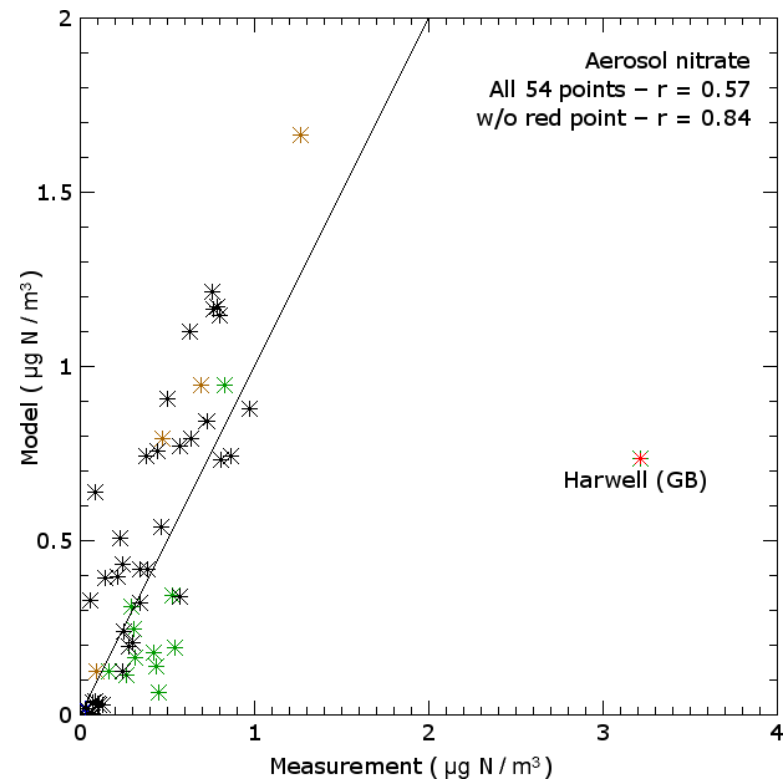
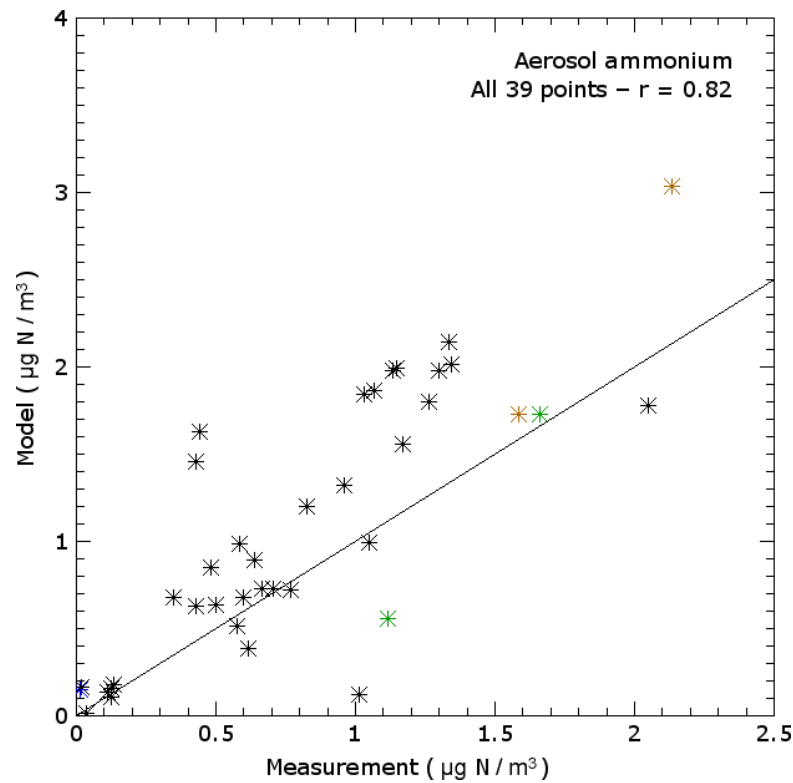


* Normal

* Outlier

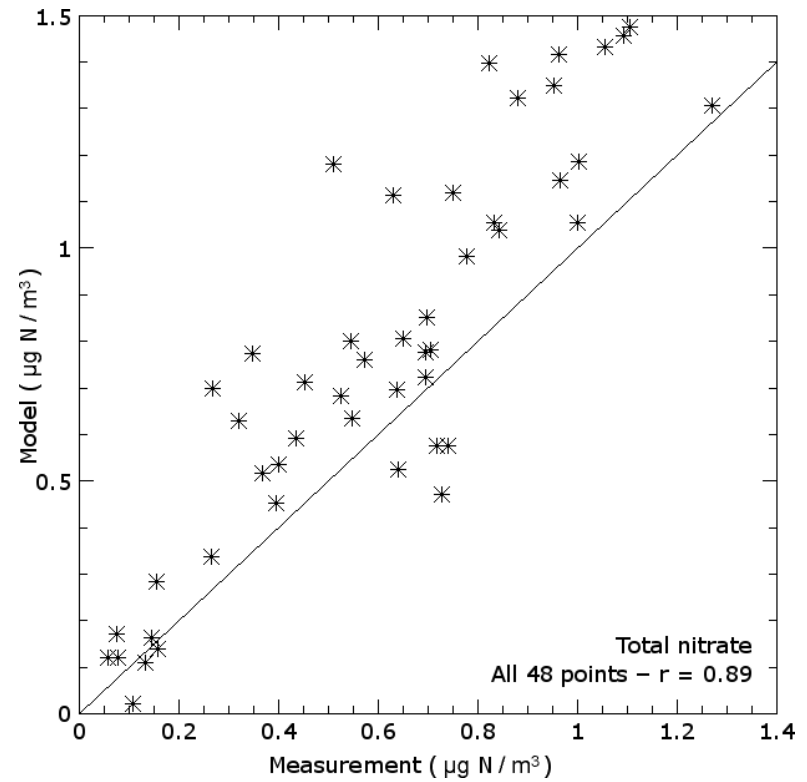
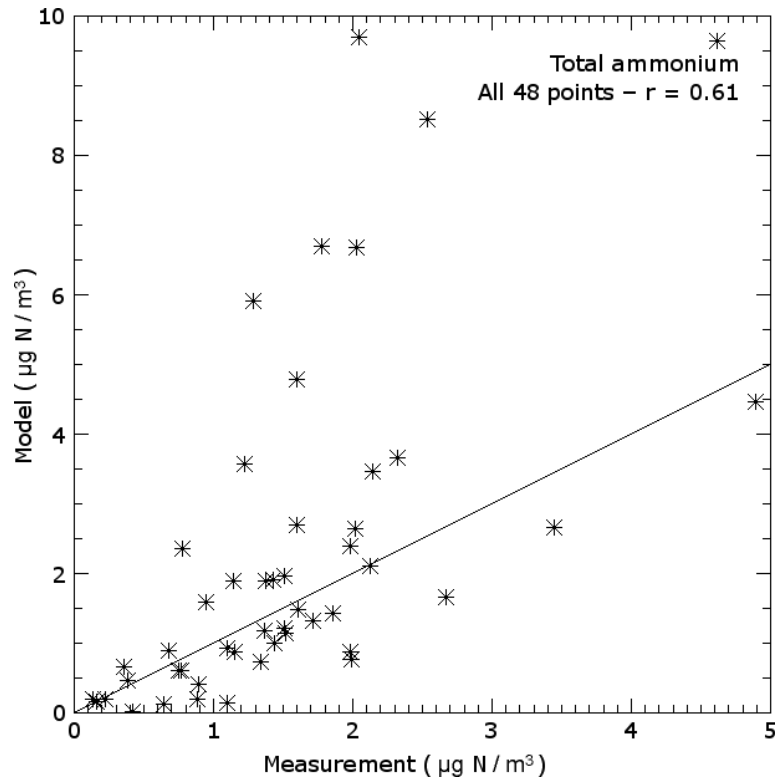
* Untrustworthy

Aerosol ammonium and nitrate

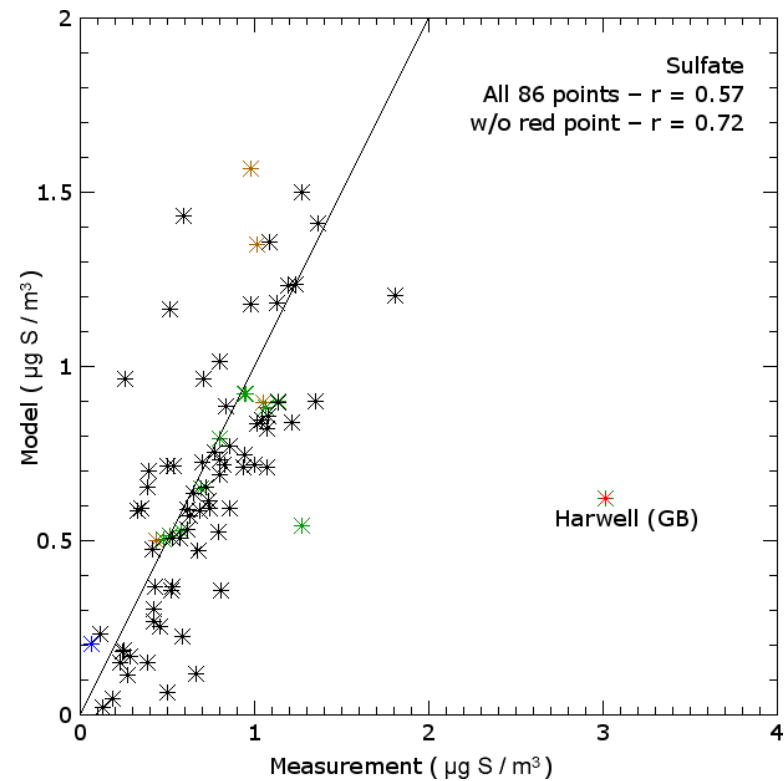
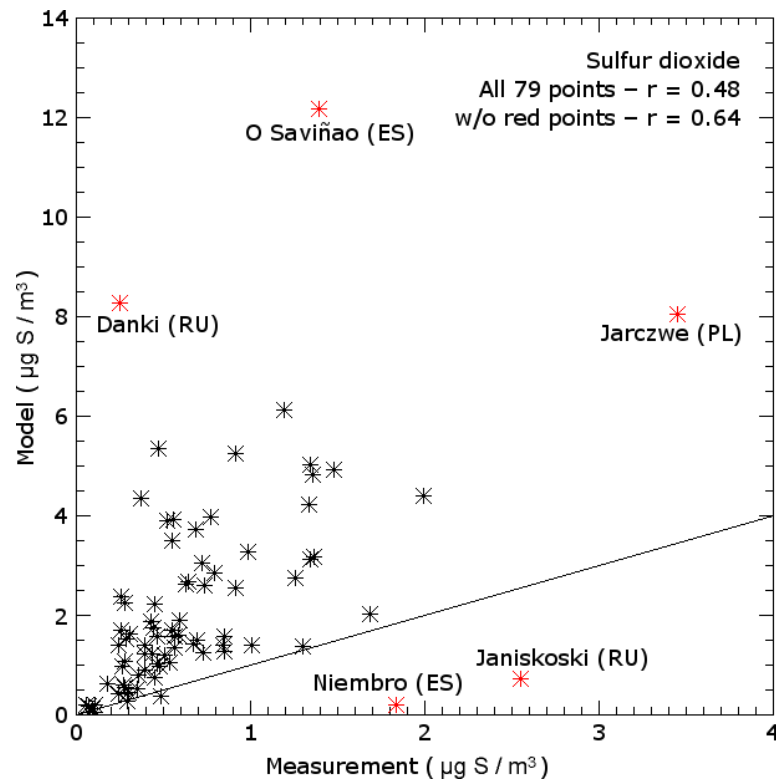


✱ All ✱ PM₁₀ ✱ PM_{2.5} ✱ PM₁ ✱ Outlier

Total ammonium and nitrate

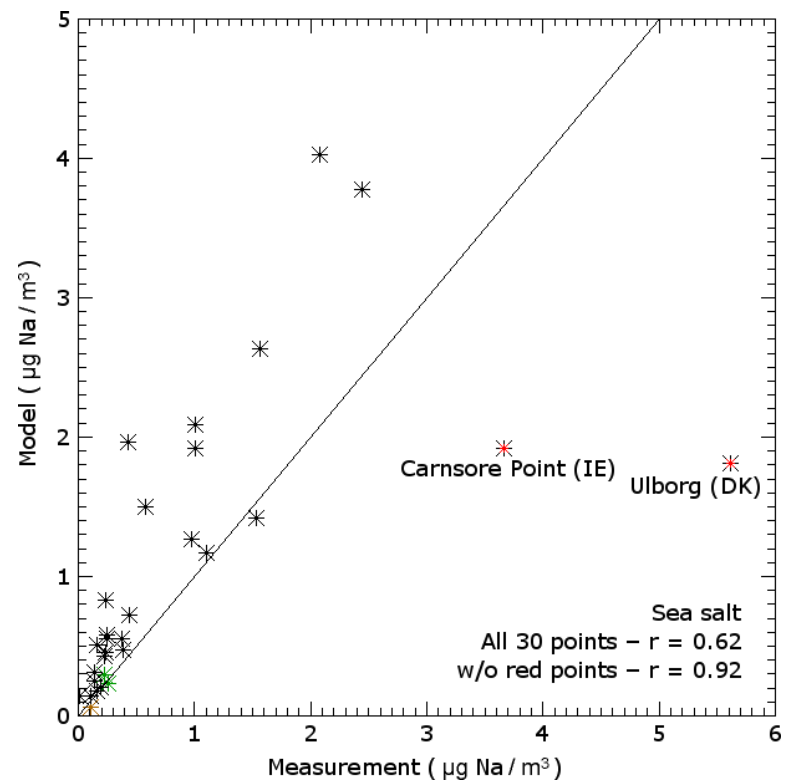
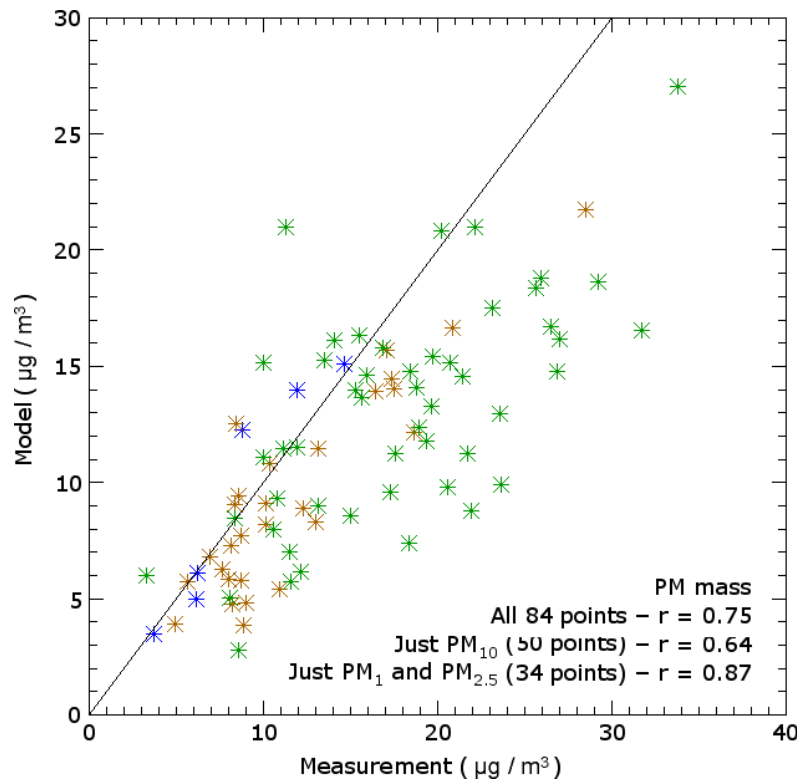


Sulfur dioxide and sulfate



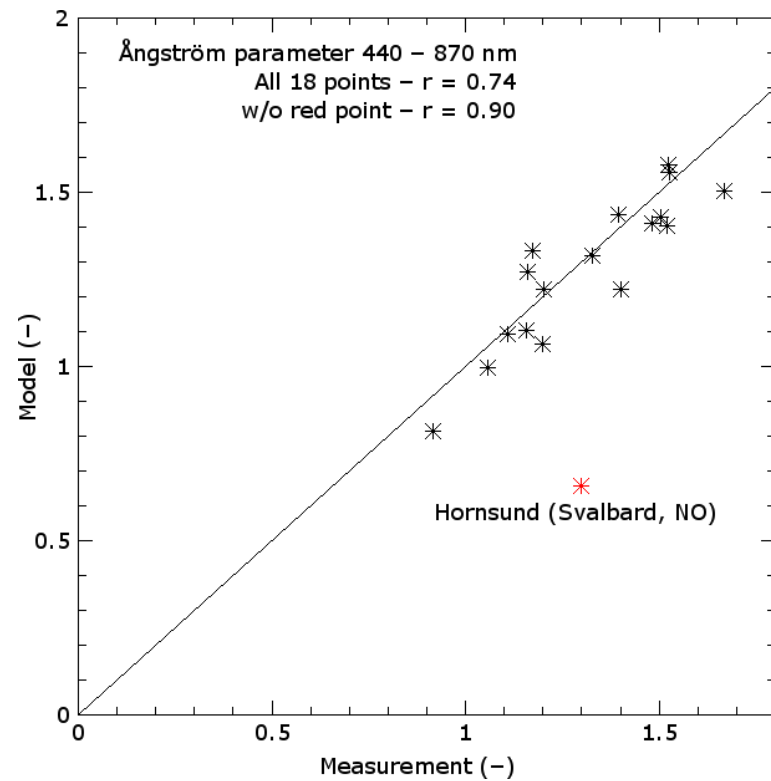
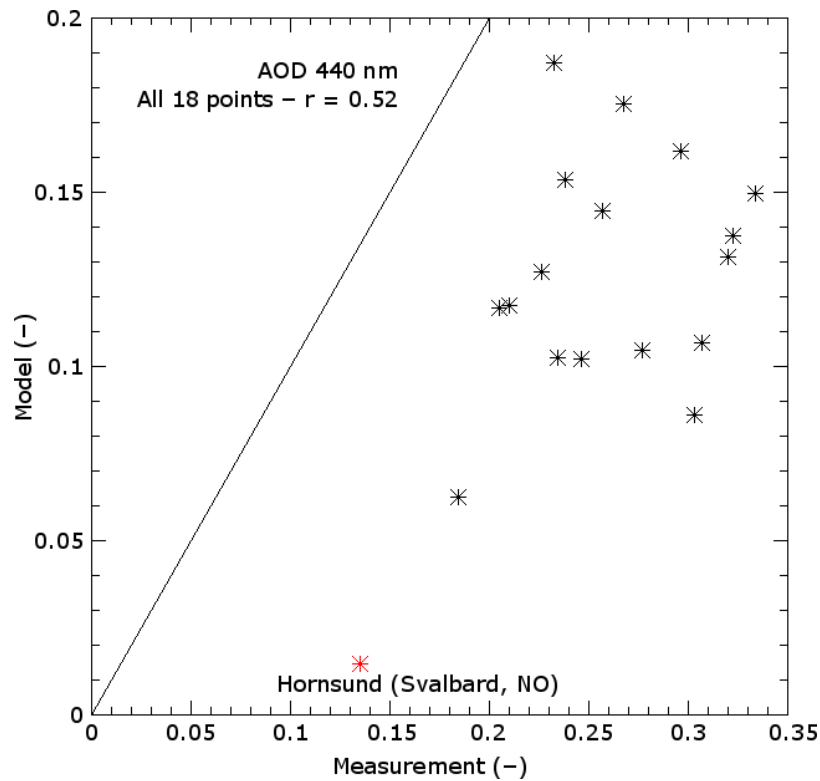
✱ All ✱ PM₁₀ ✱ PM_{2.5} ✱ PM₁ ✱ Outlier

Total PM and sea salt



All PM_{10} $\text{PM}_{2.5}$ PM_1 Outlier

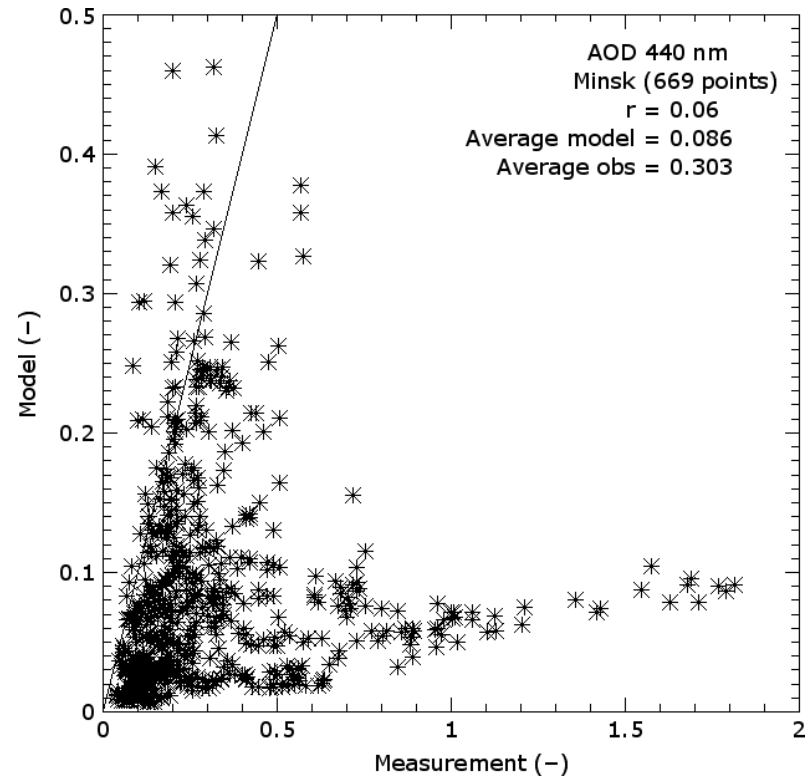
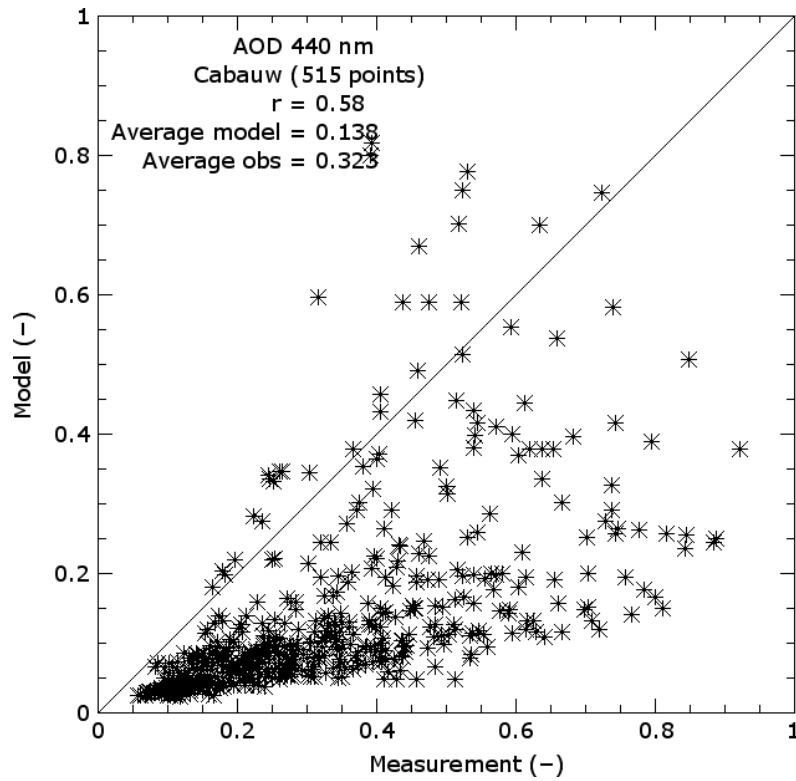
Aerosol optical depth



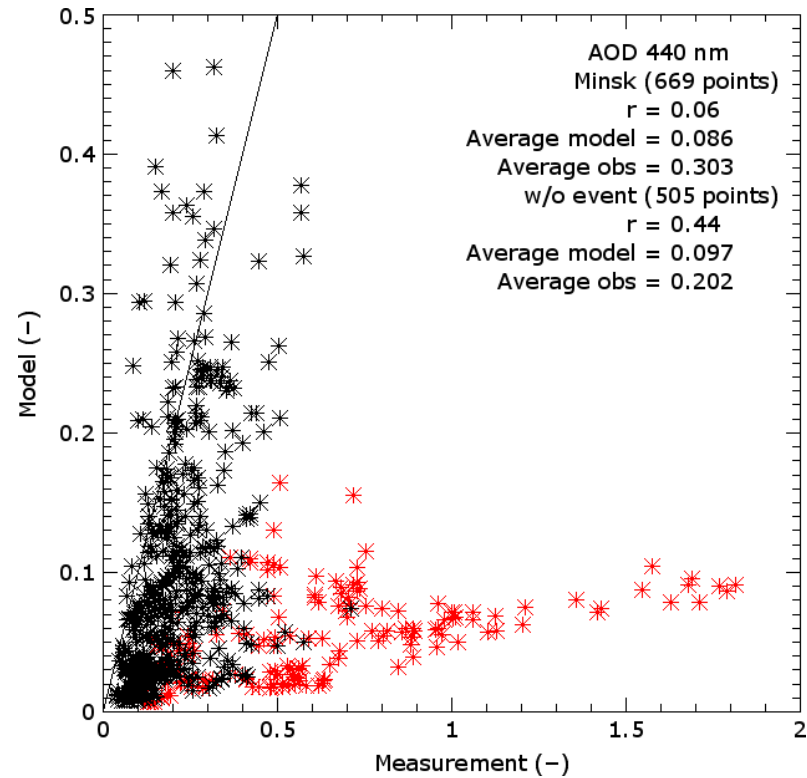
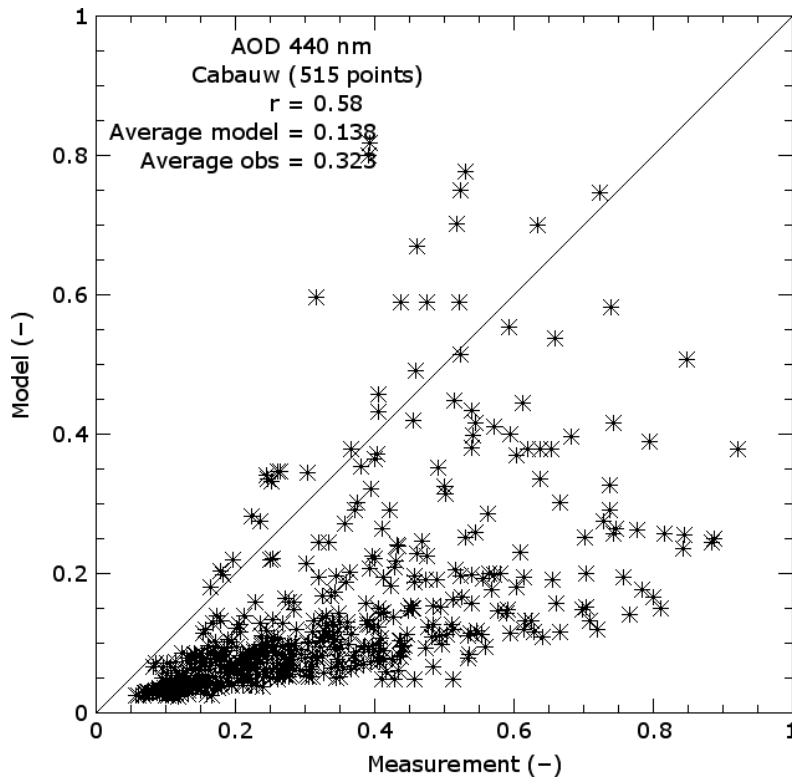
✱ Normal

✱ Outlier

Aerosol optical depth



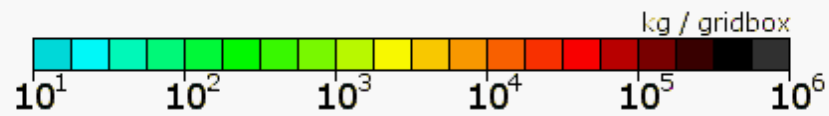
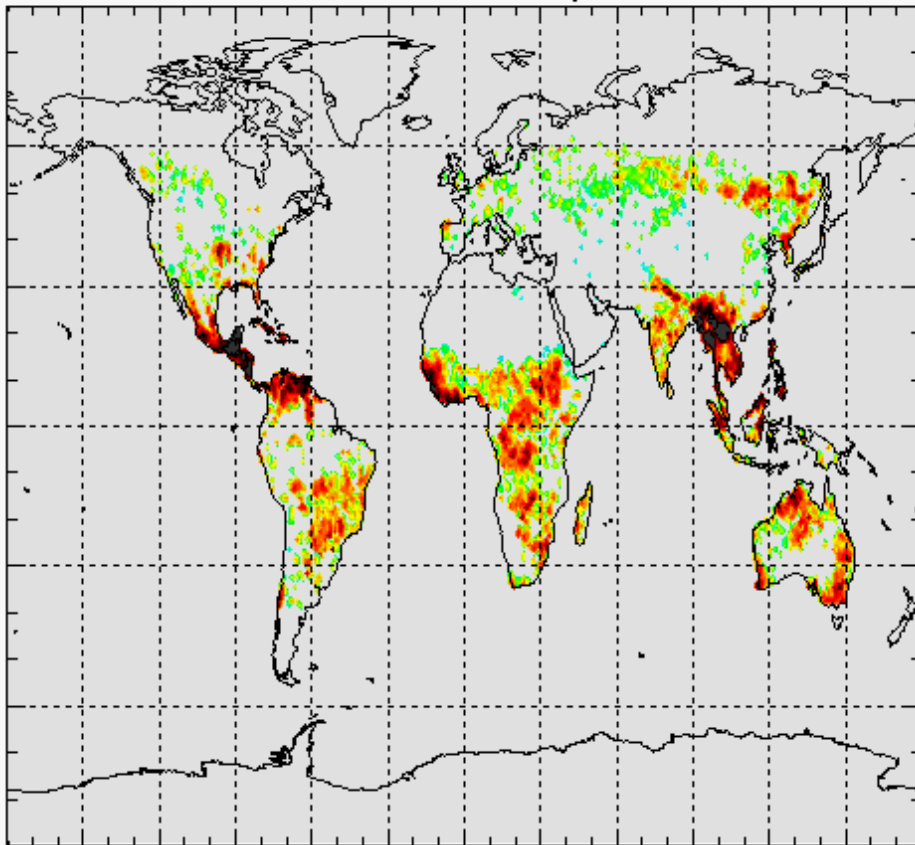
Aerosol optical depth



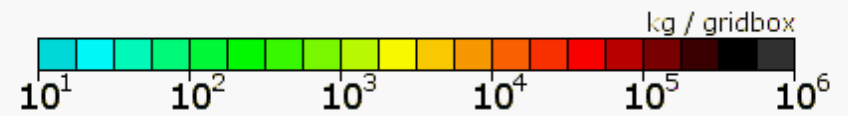
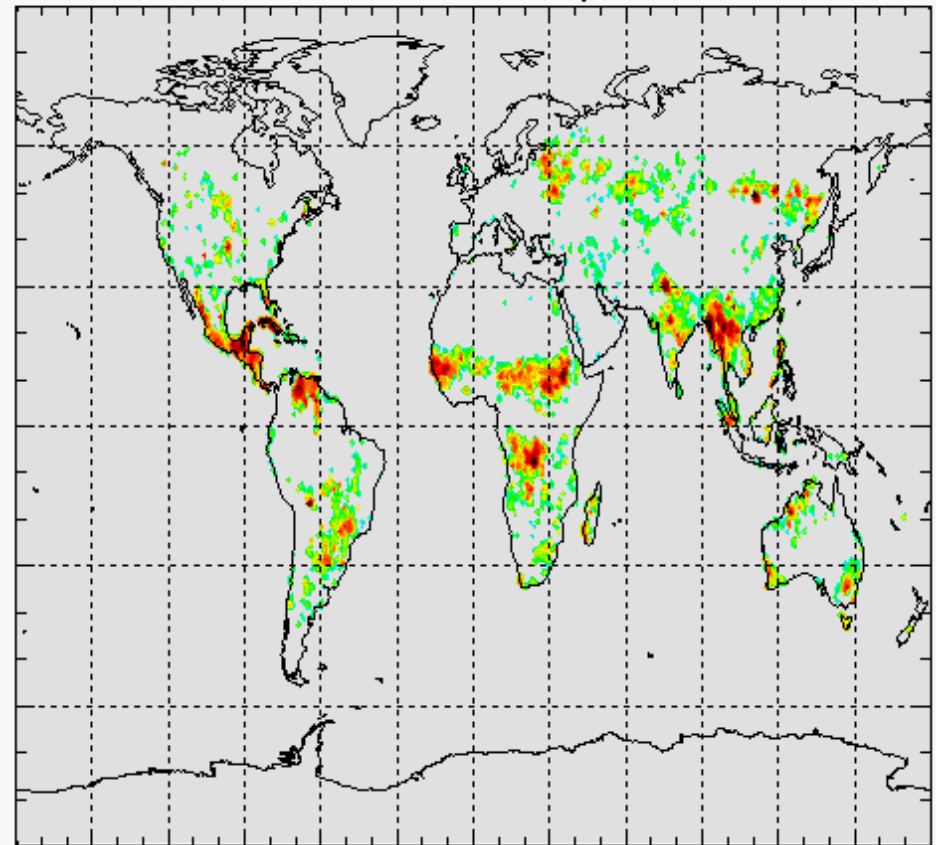
- Forest fires west-Russia May (?) 2006
- GFED 2006 aerosols

GFED 3 April 2006

Old inventory

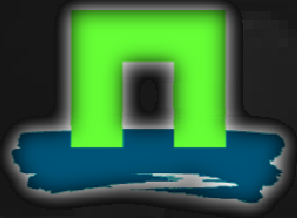


New inventory





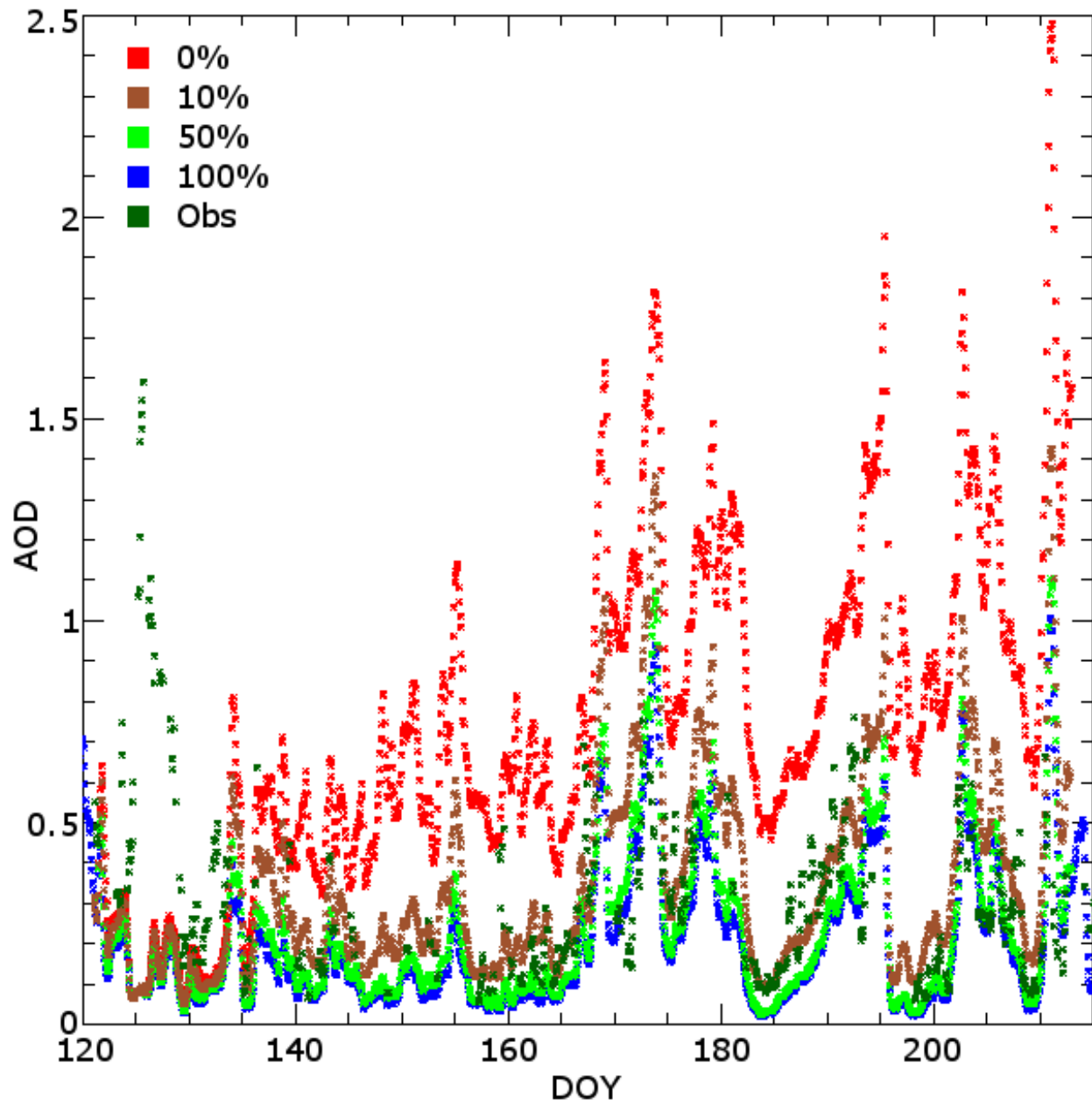
Wet deposition



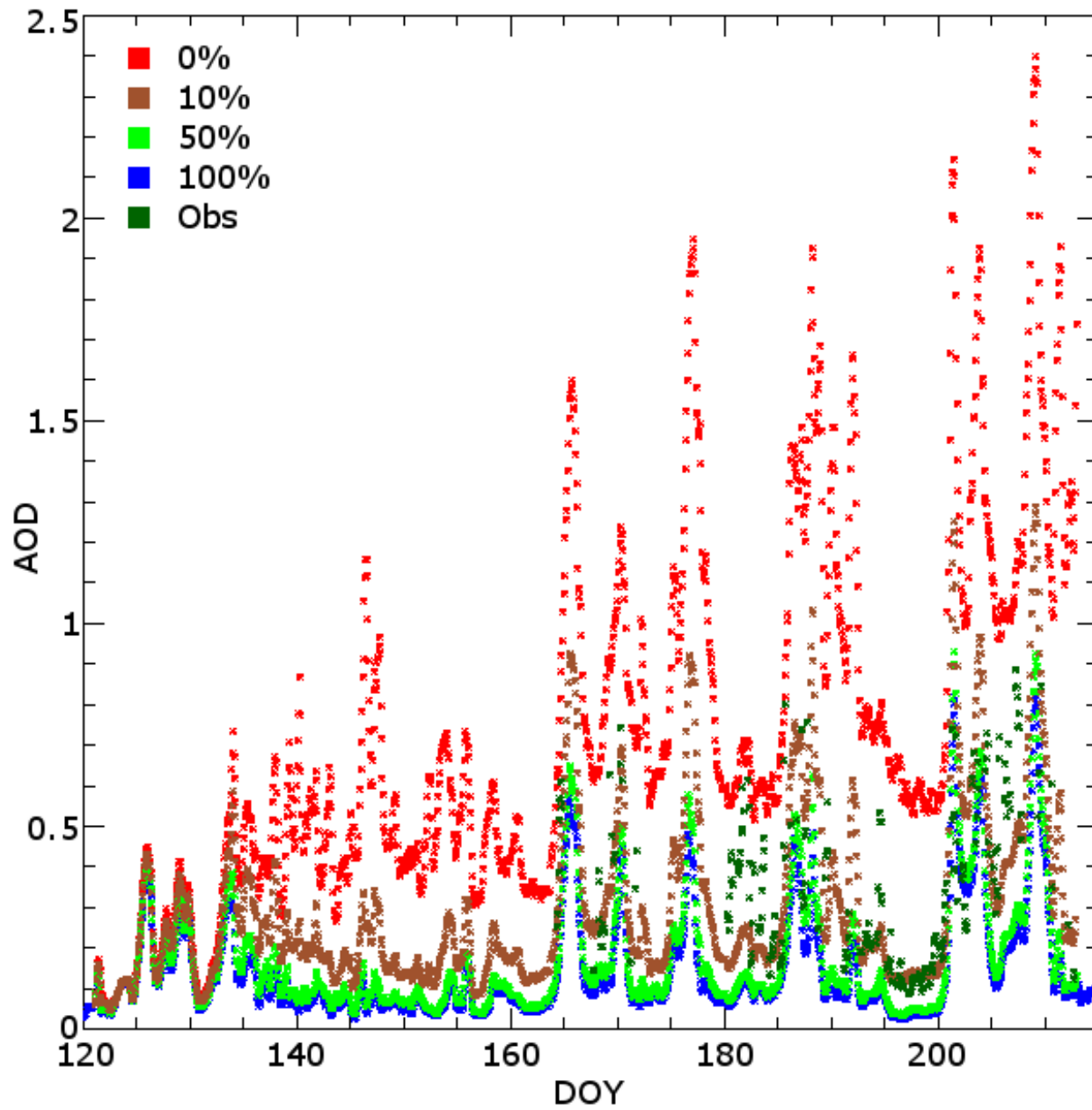
Set-up



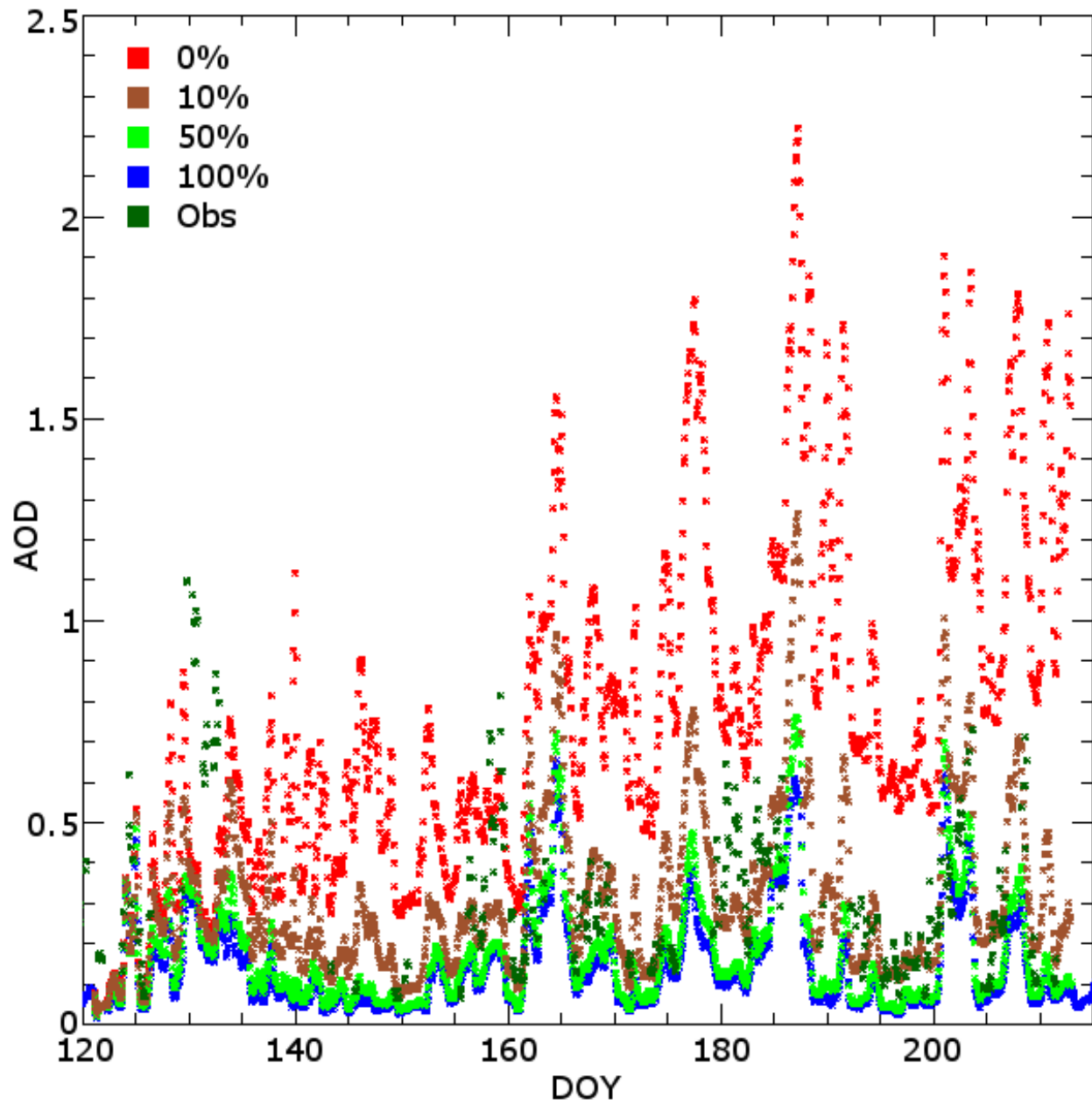
- Underestimation AOD
- Extra runs for May, June and July
- Less in-cloud scavenging M7 tracers



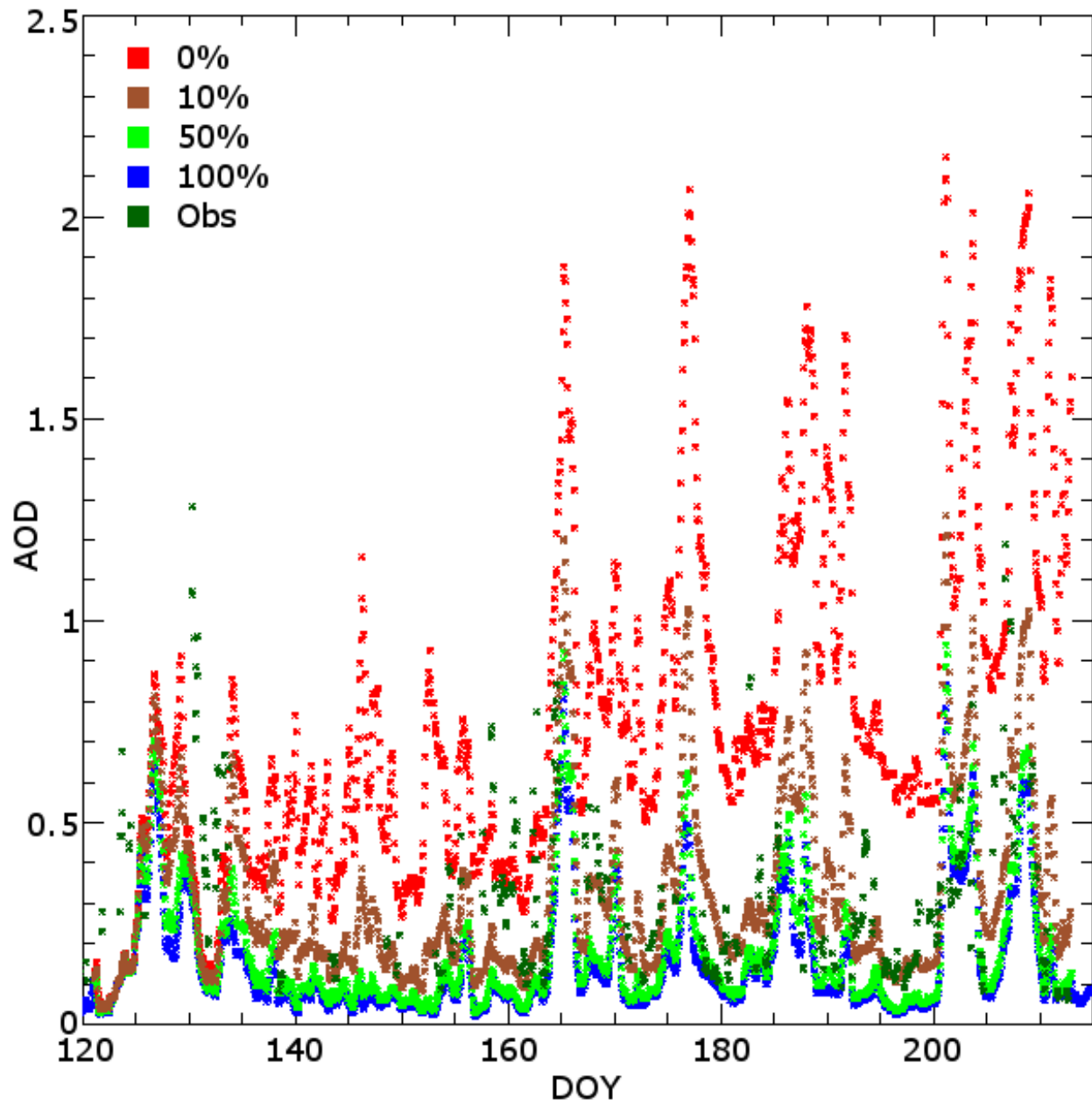
Belisk



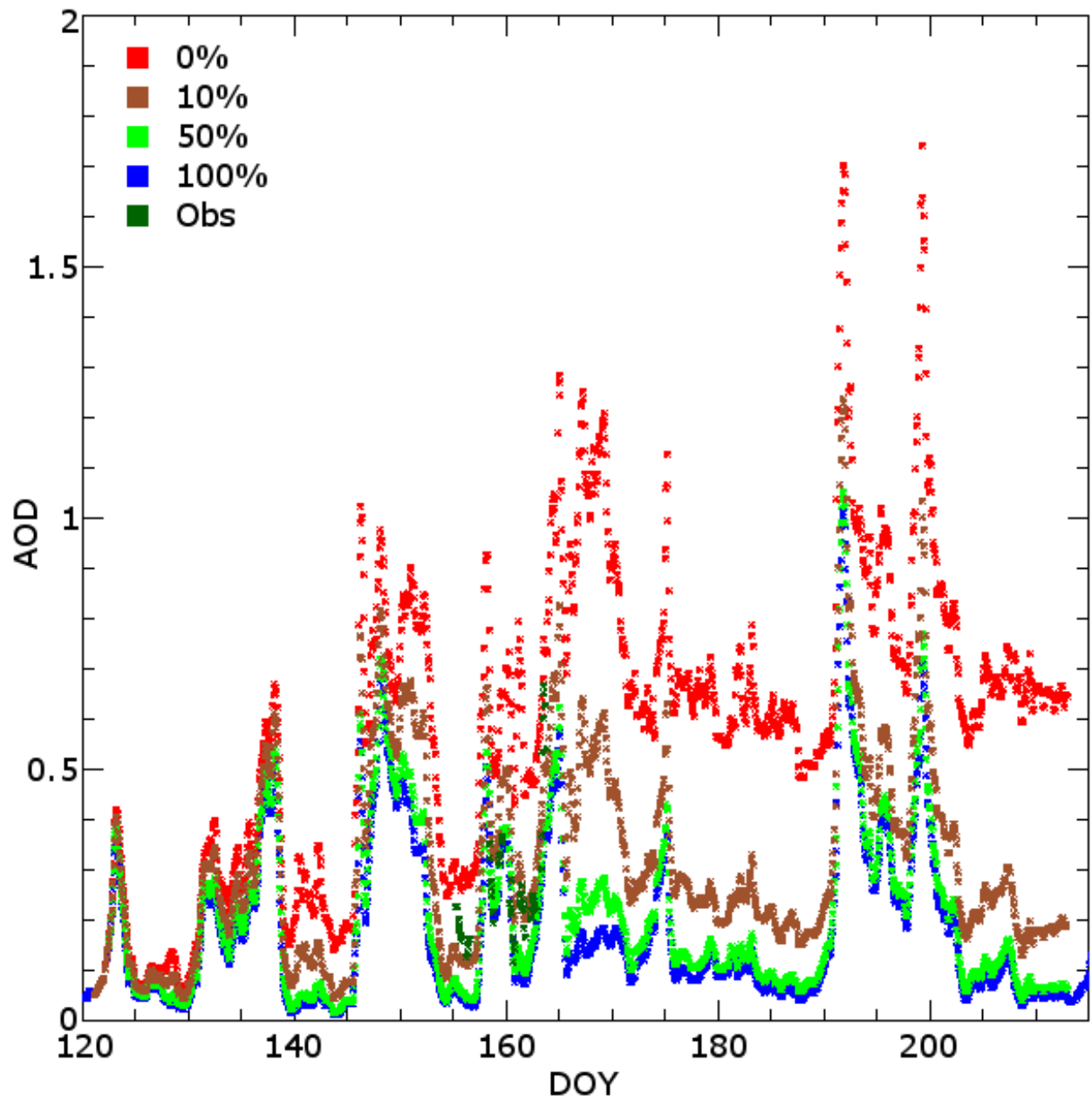
Cabauw



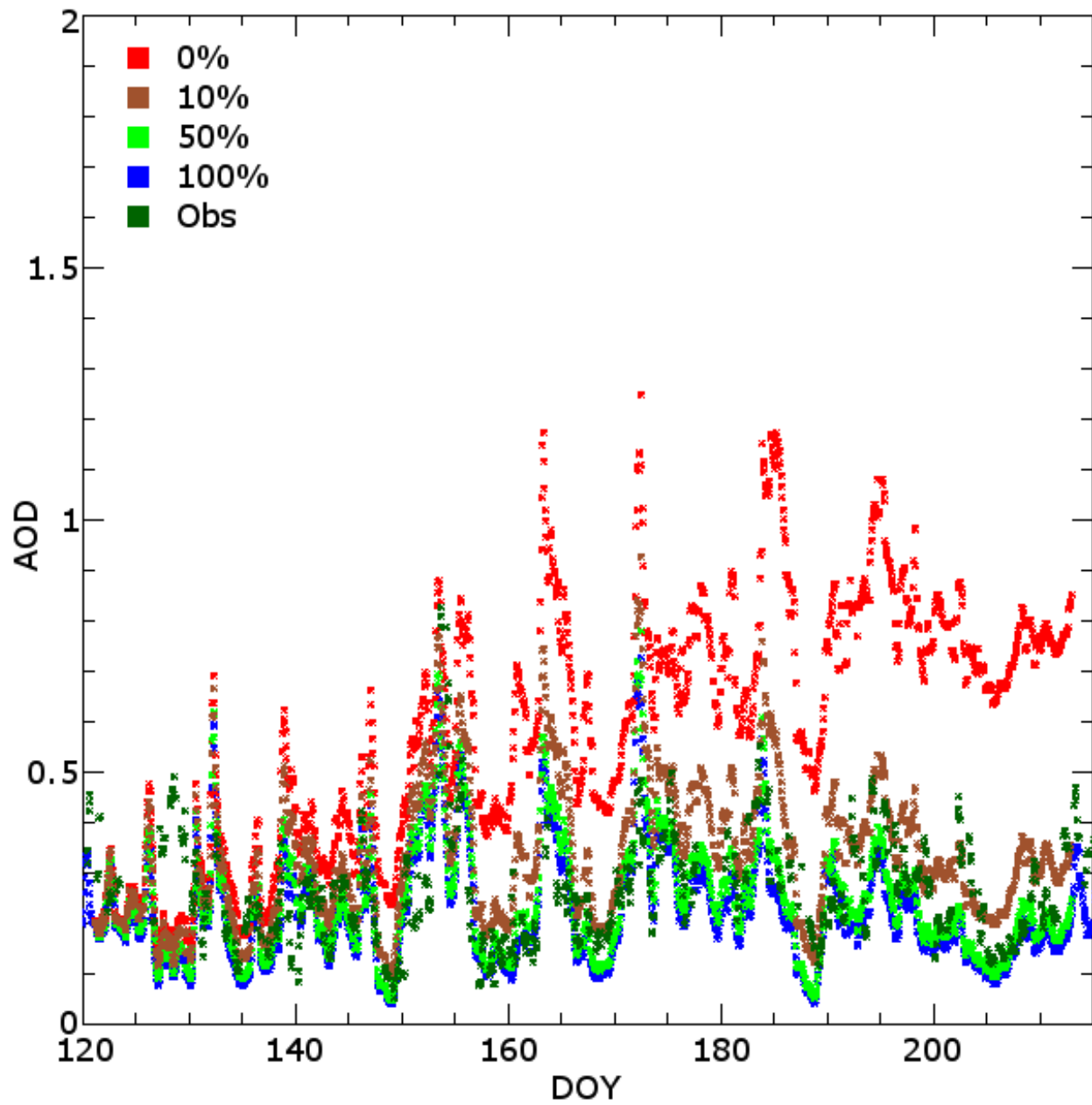
Chilbolton



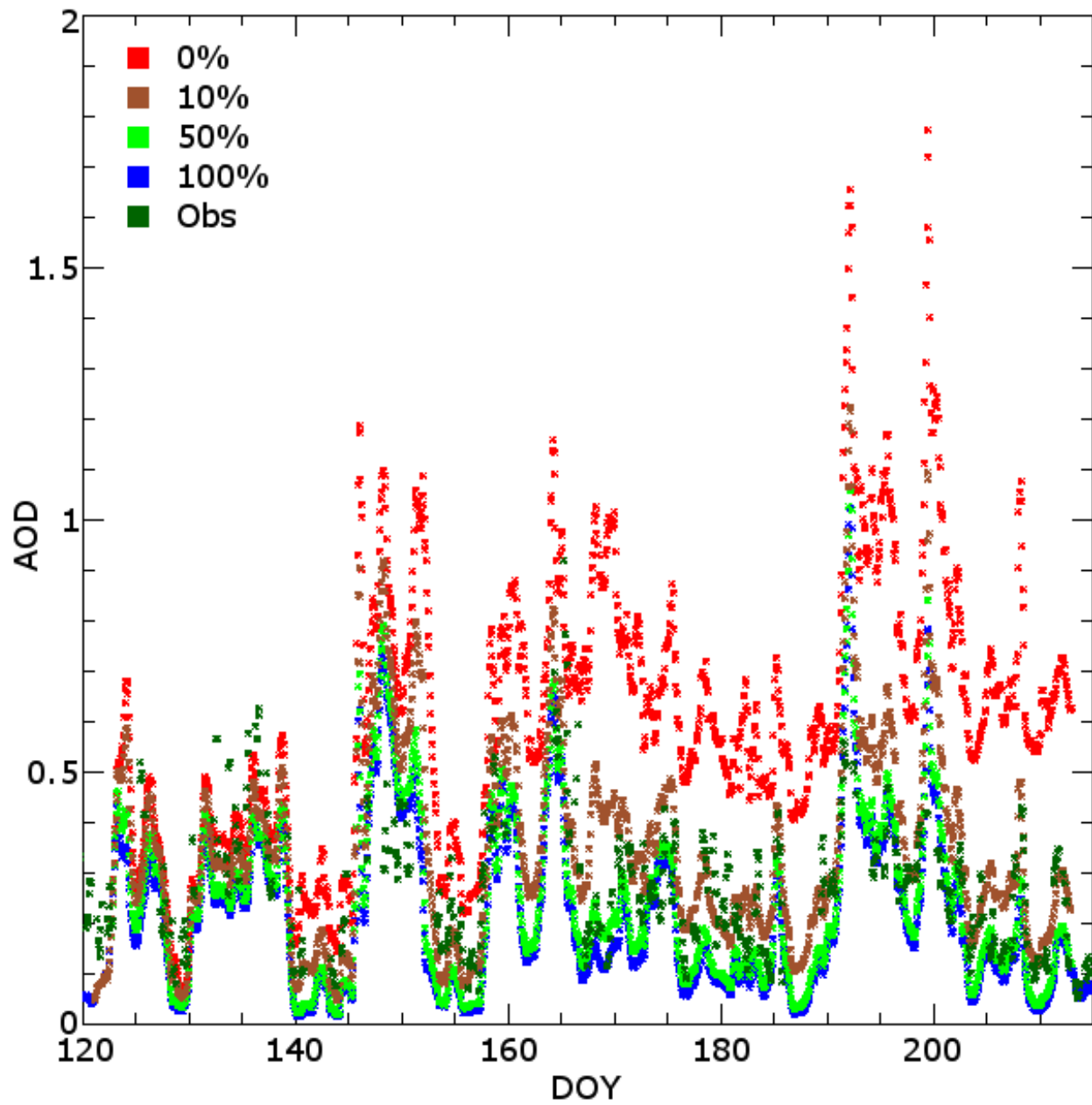
Dunkerque



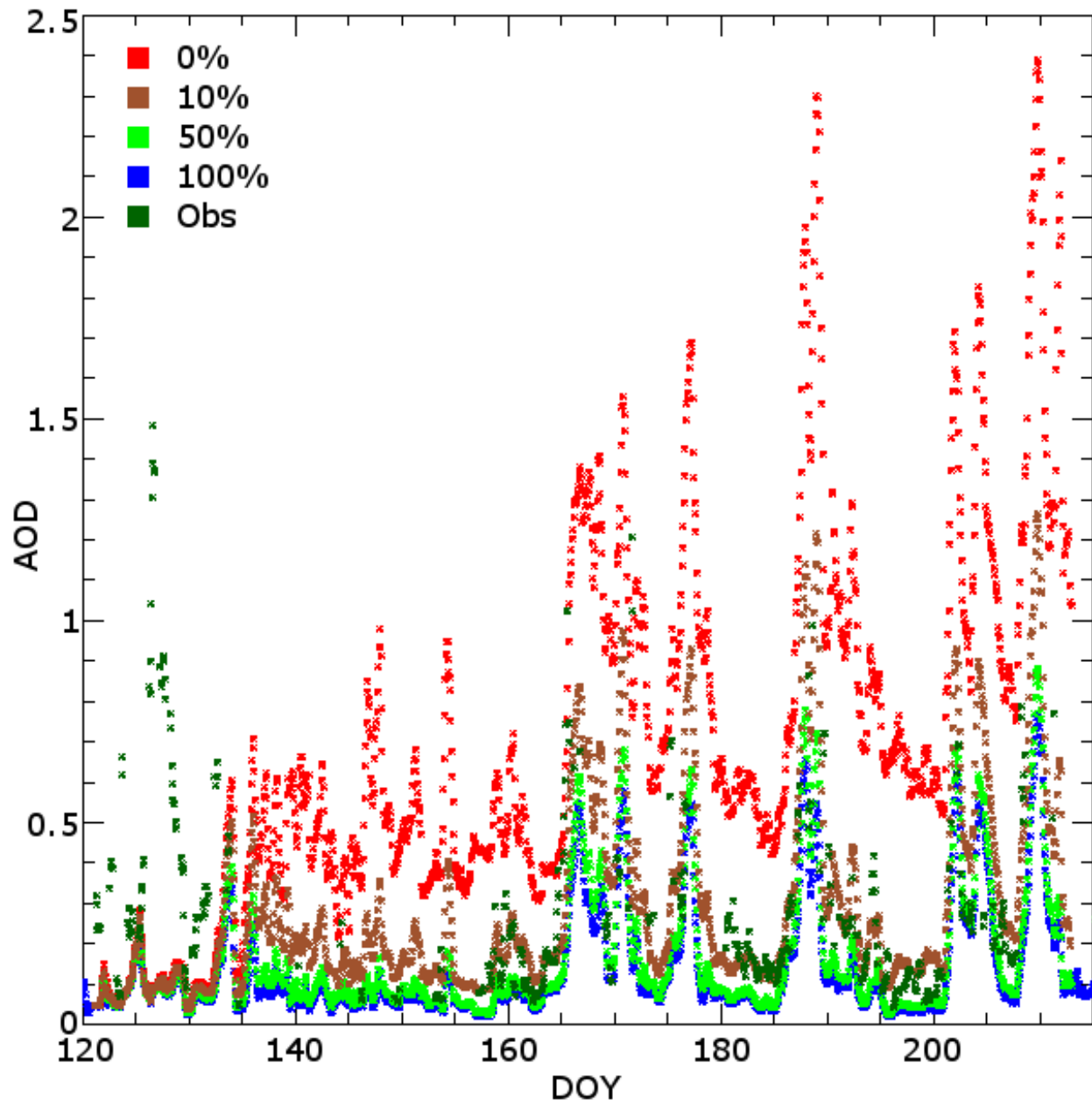
El Arenosillo



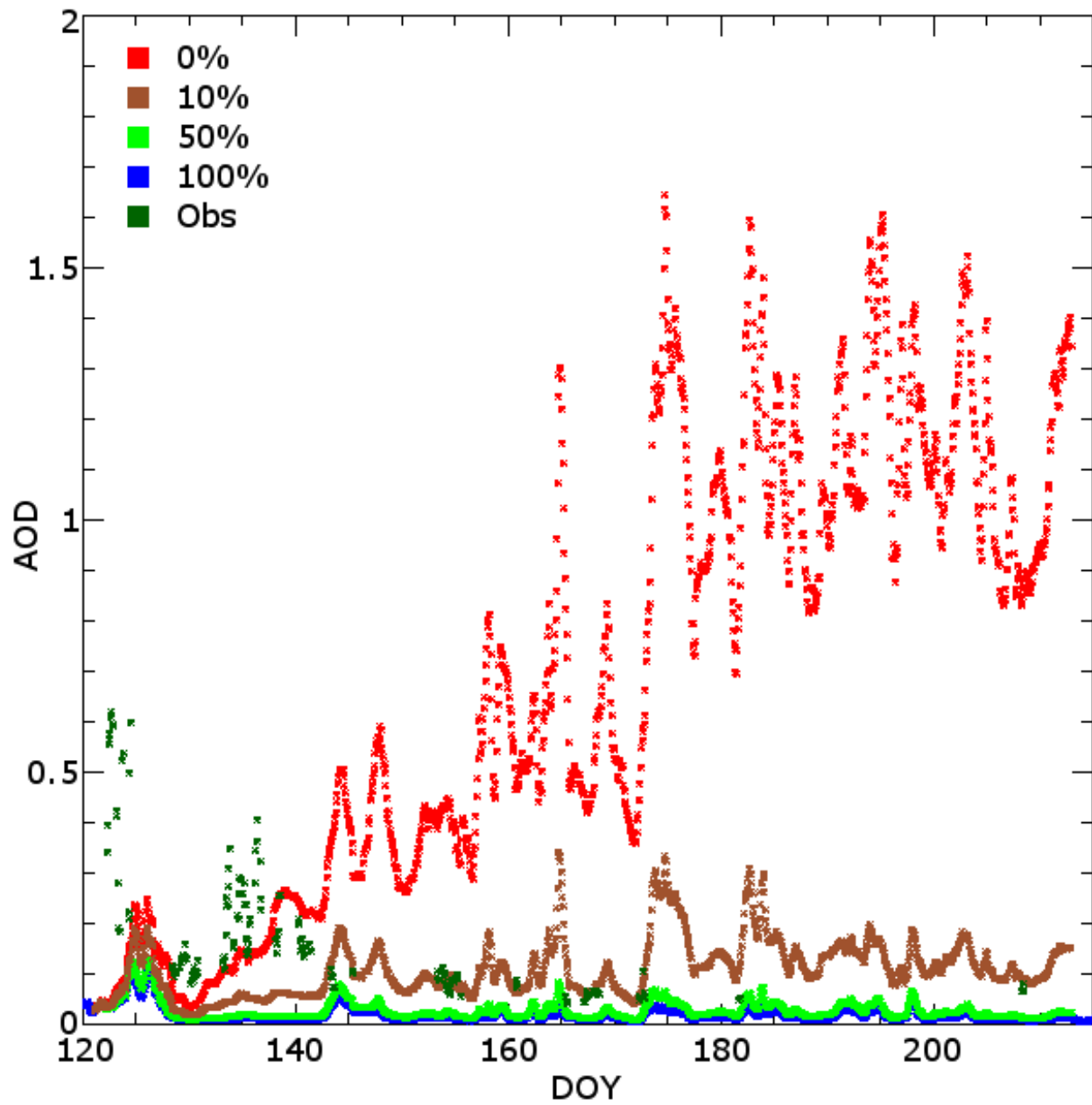
Fortn Crete



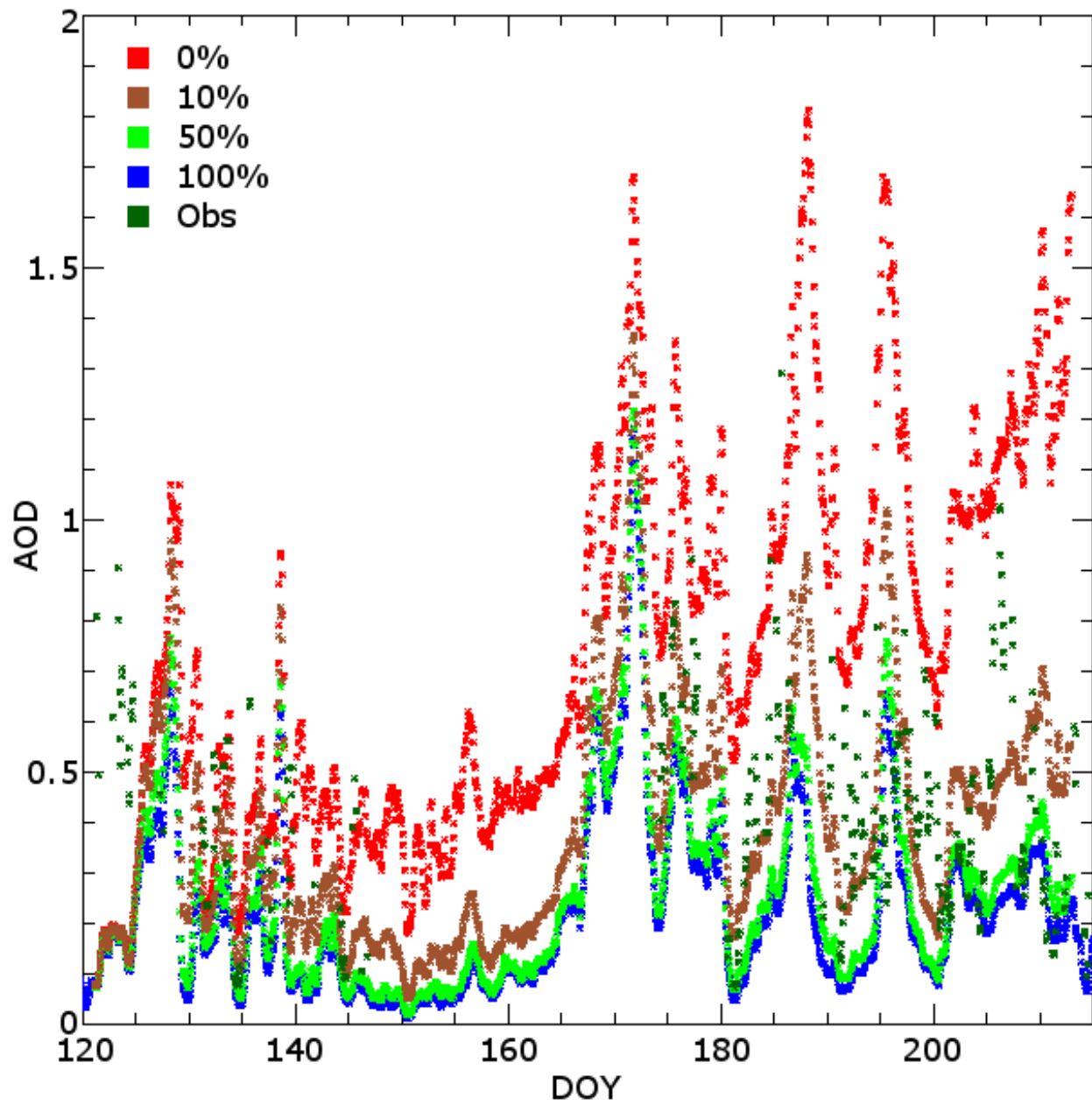
Granada



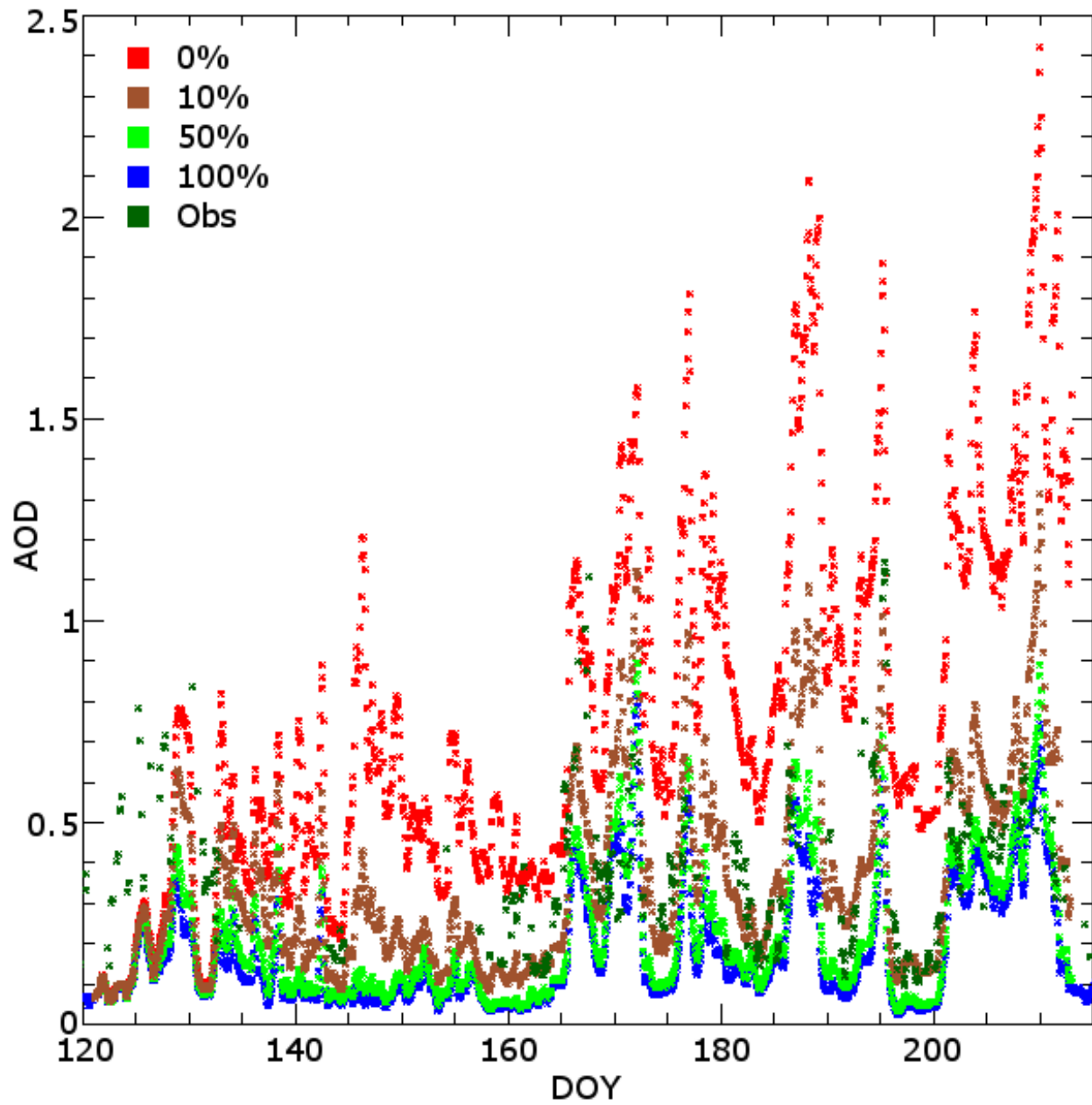
Hamburg



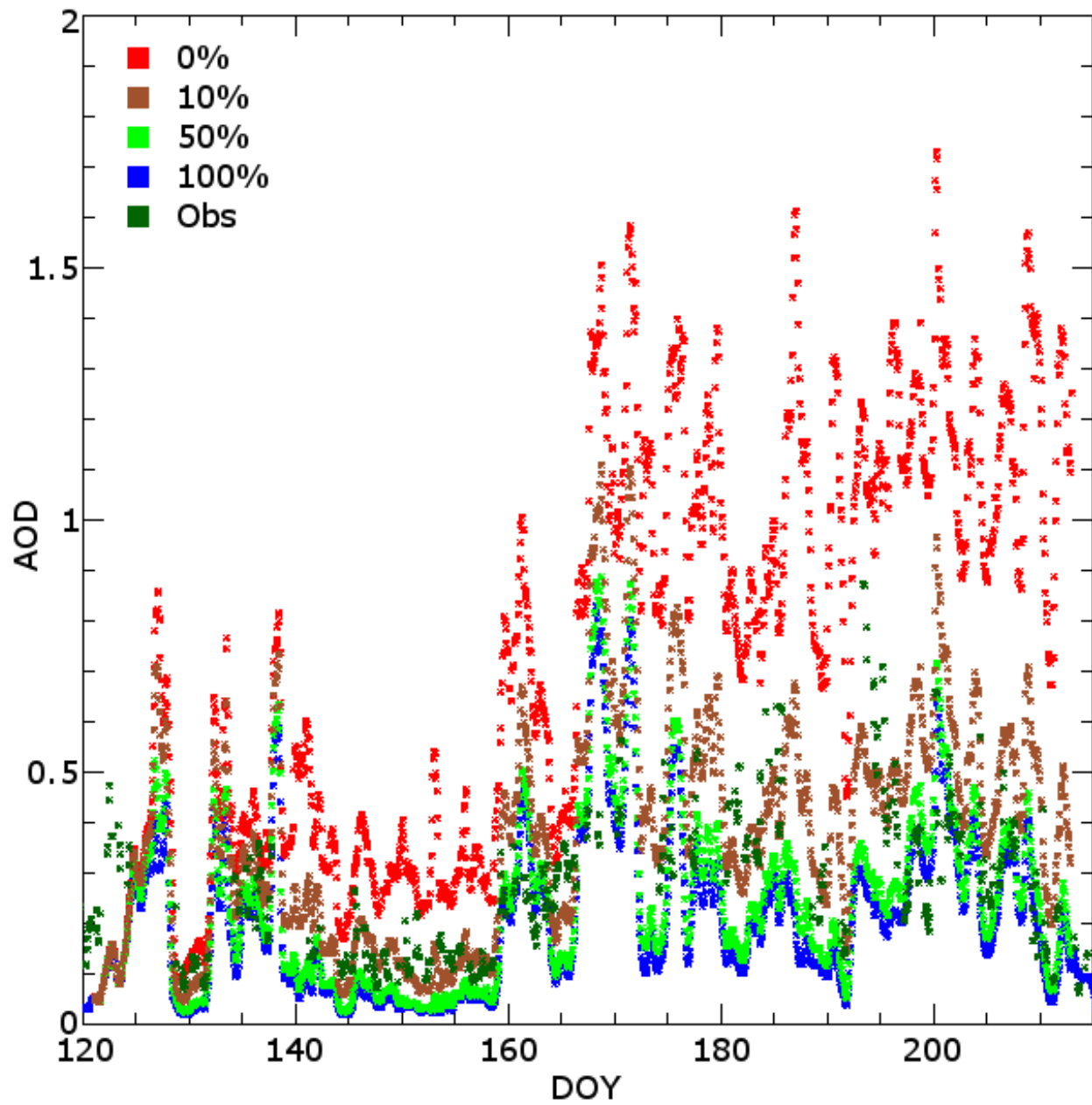
Hornsund



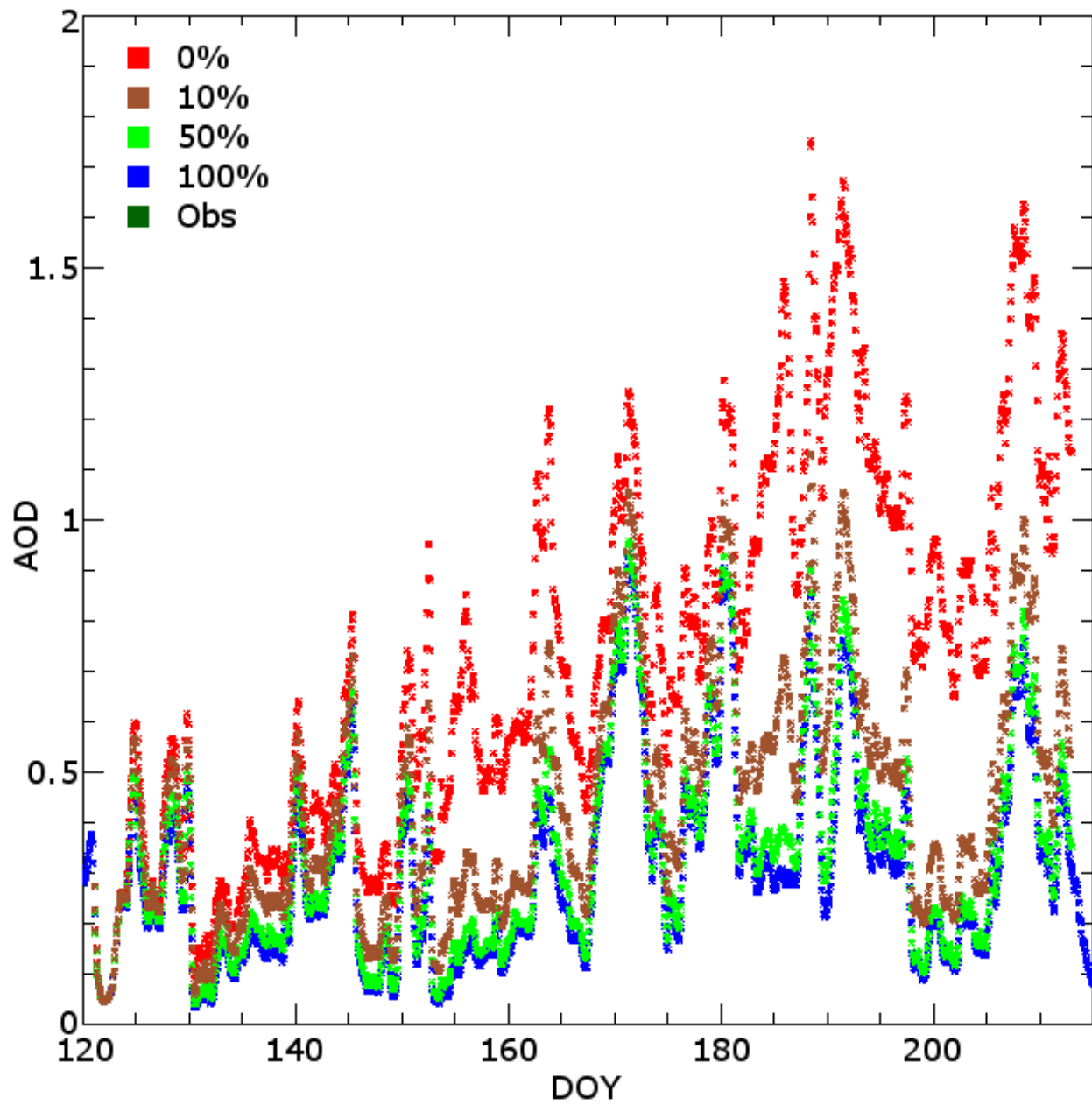
Ispra



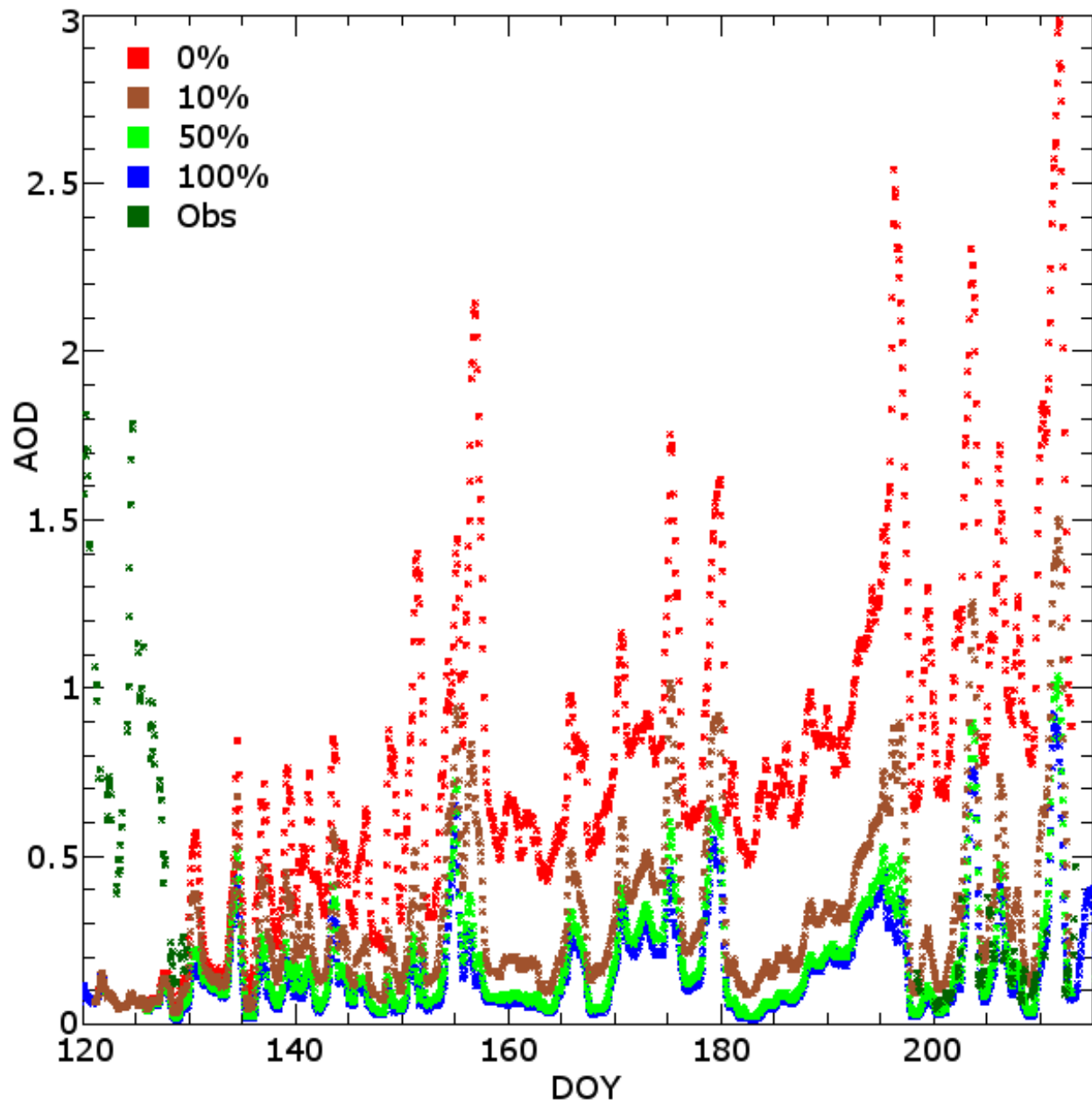
Karlsruhe



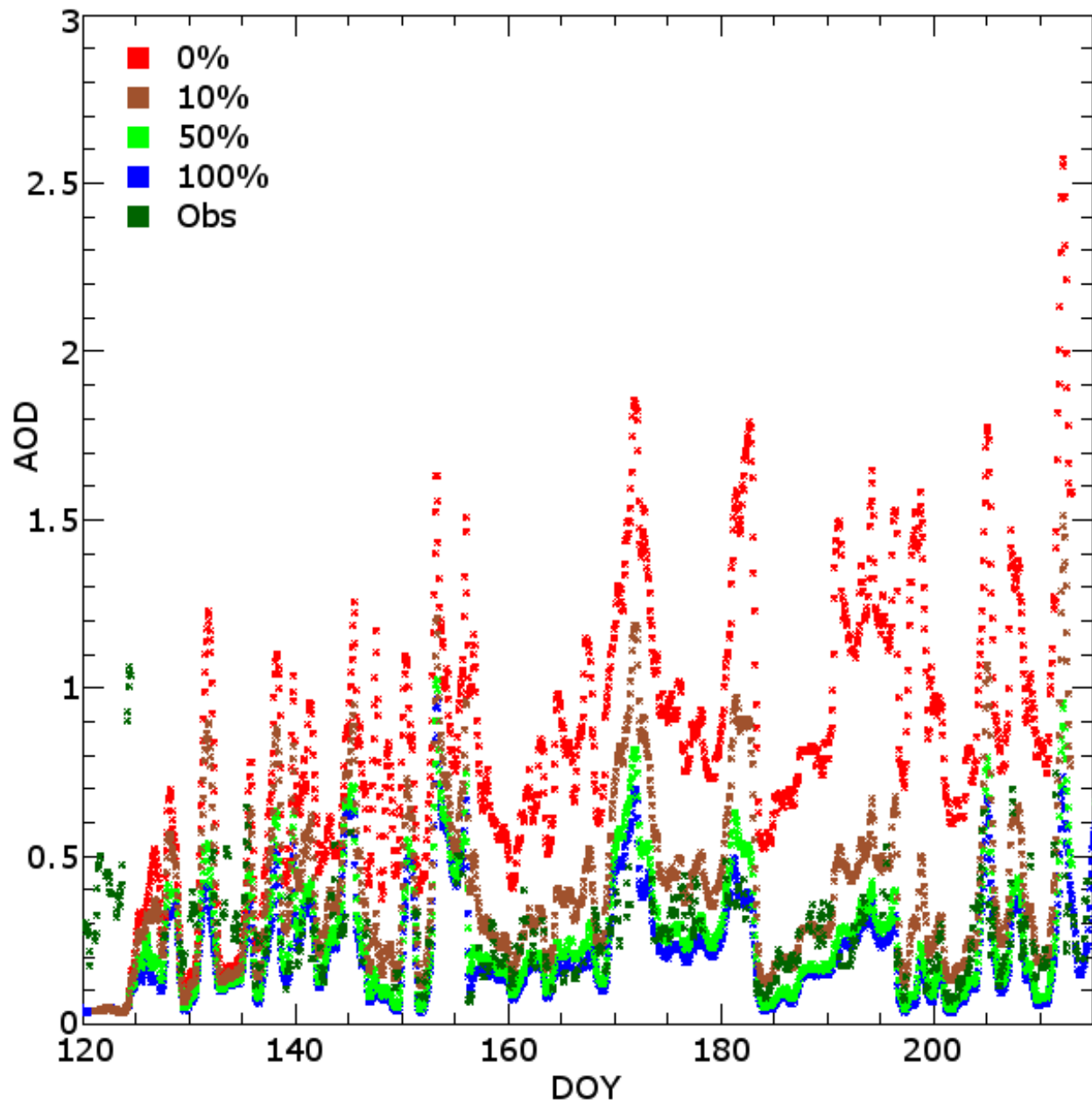
Le Fauga



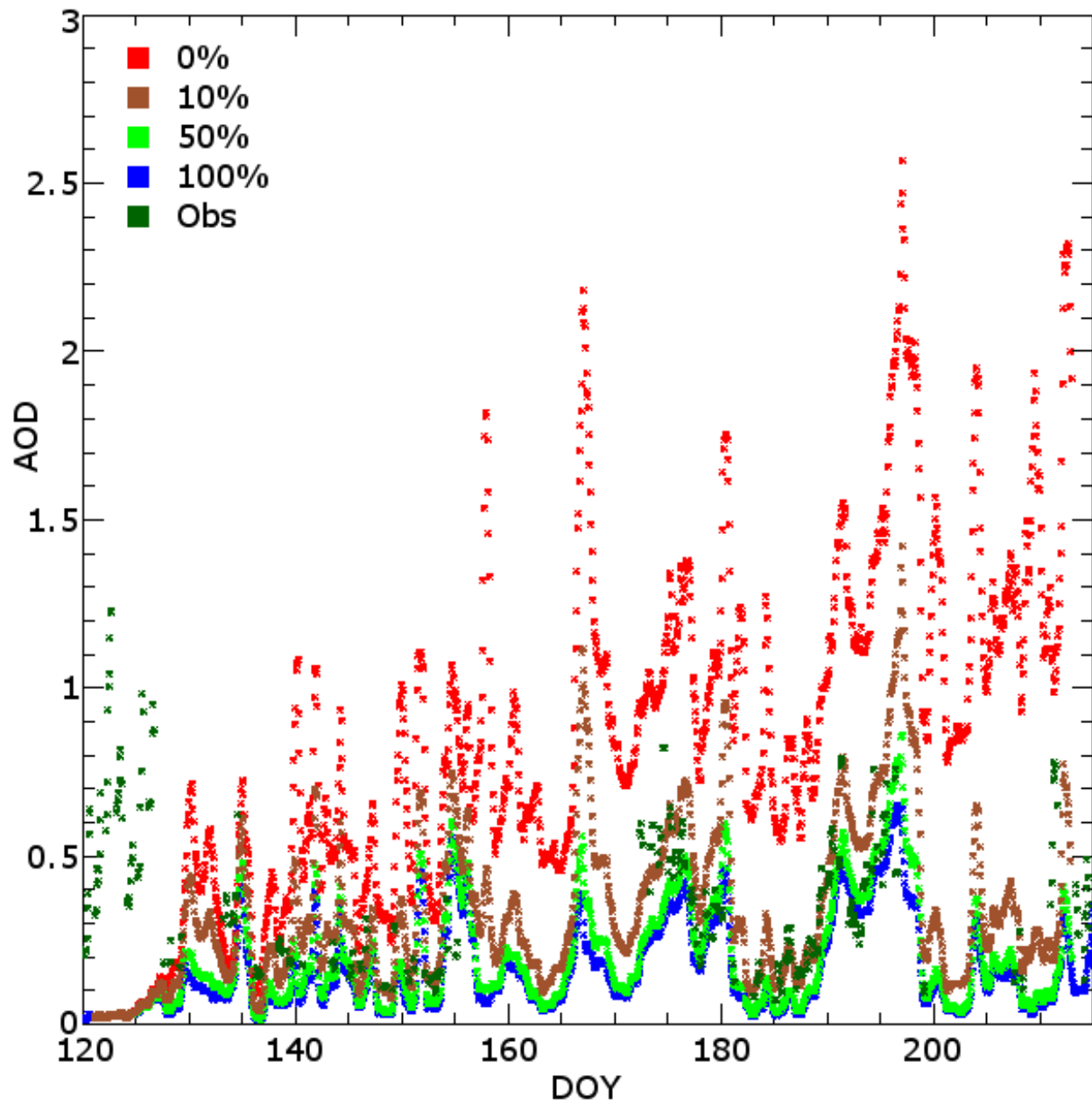
Messina



Minsk

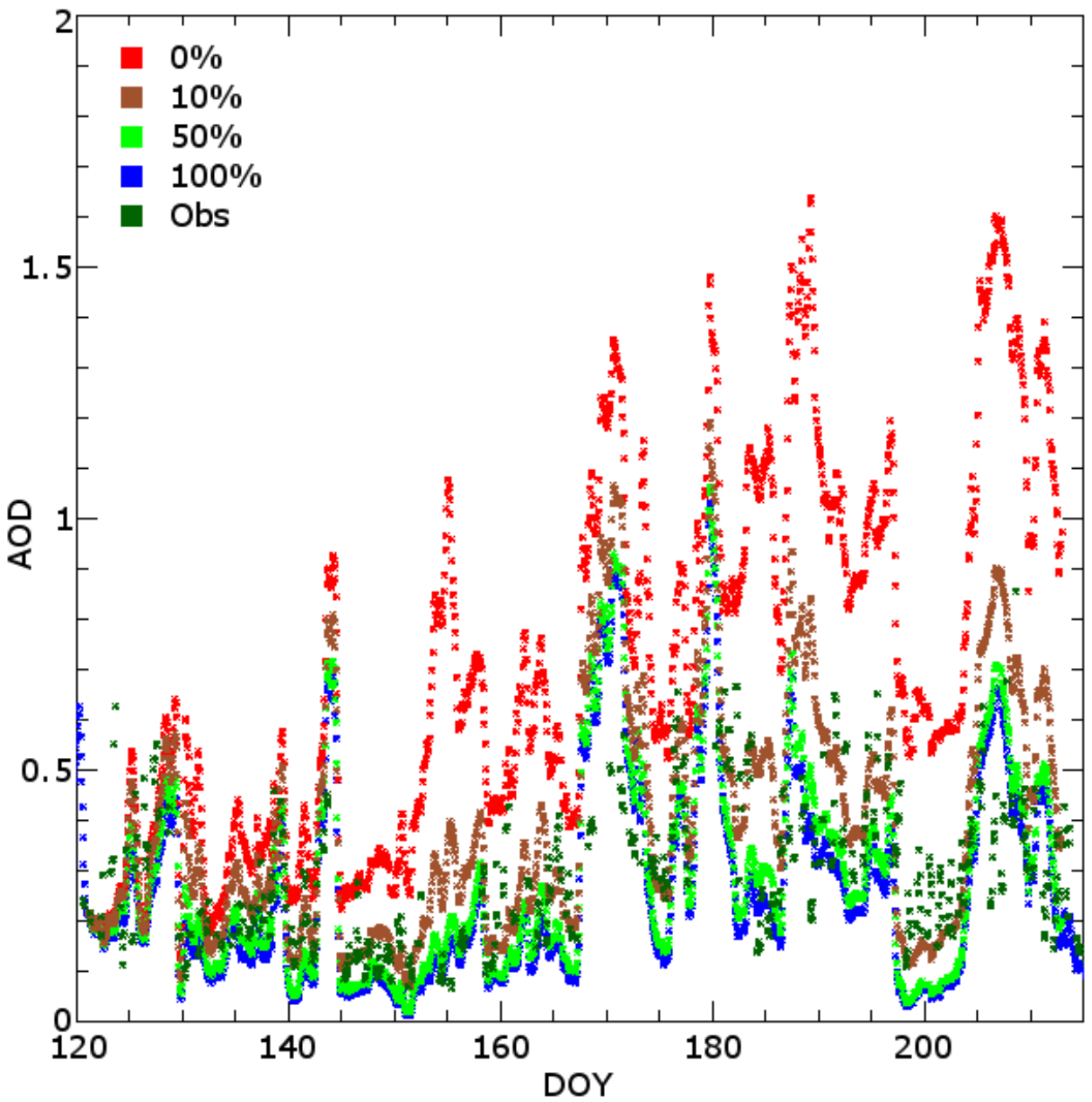


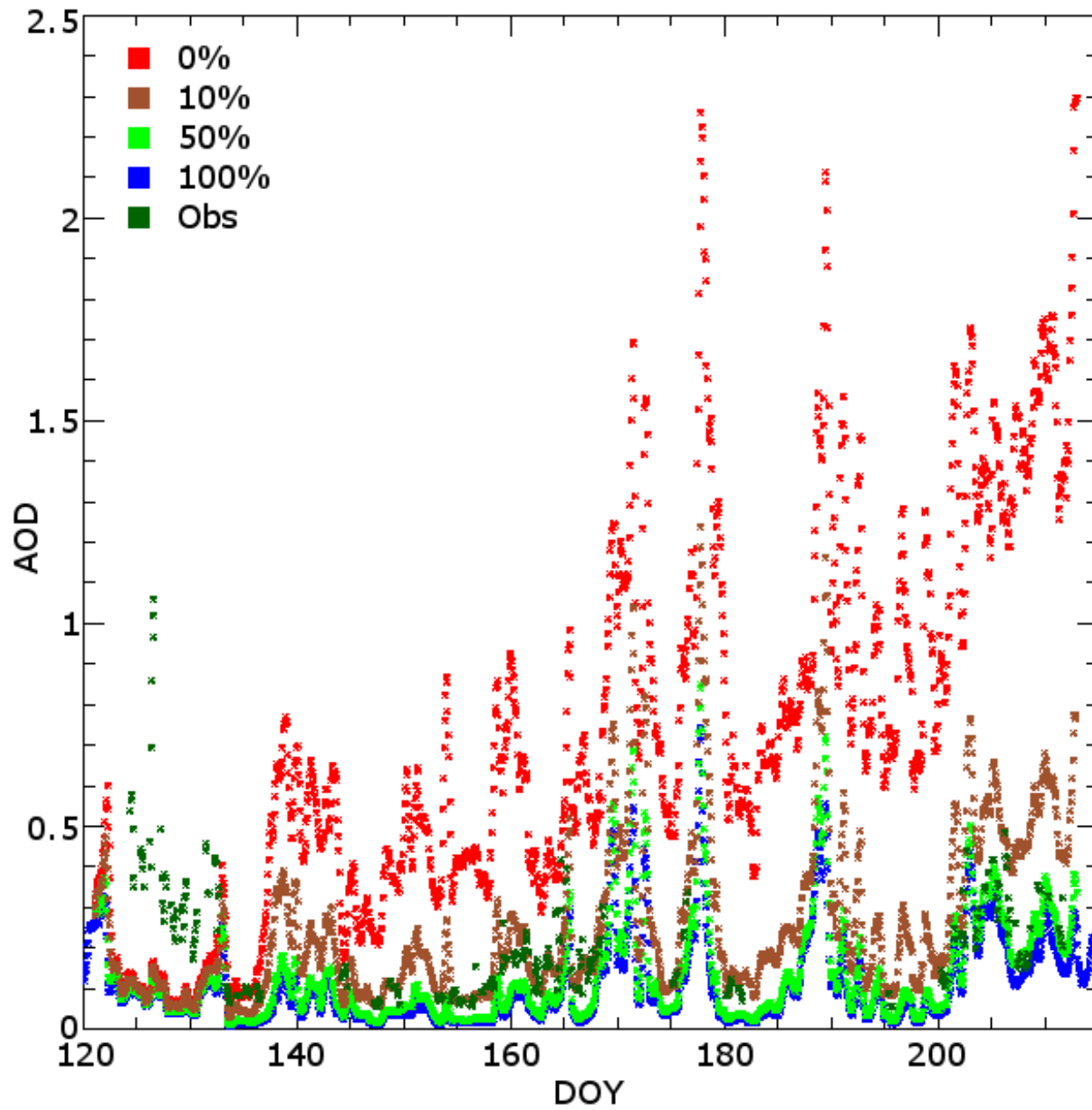
Moldova



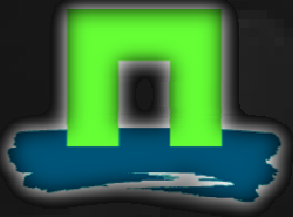
MOSCOW MSU MO

Rome Tor Vergata





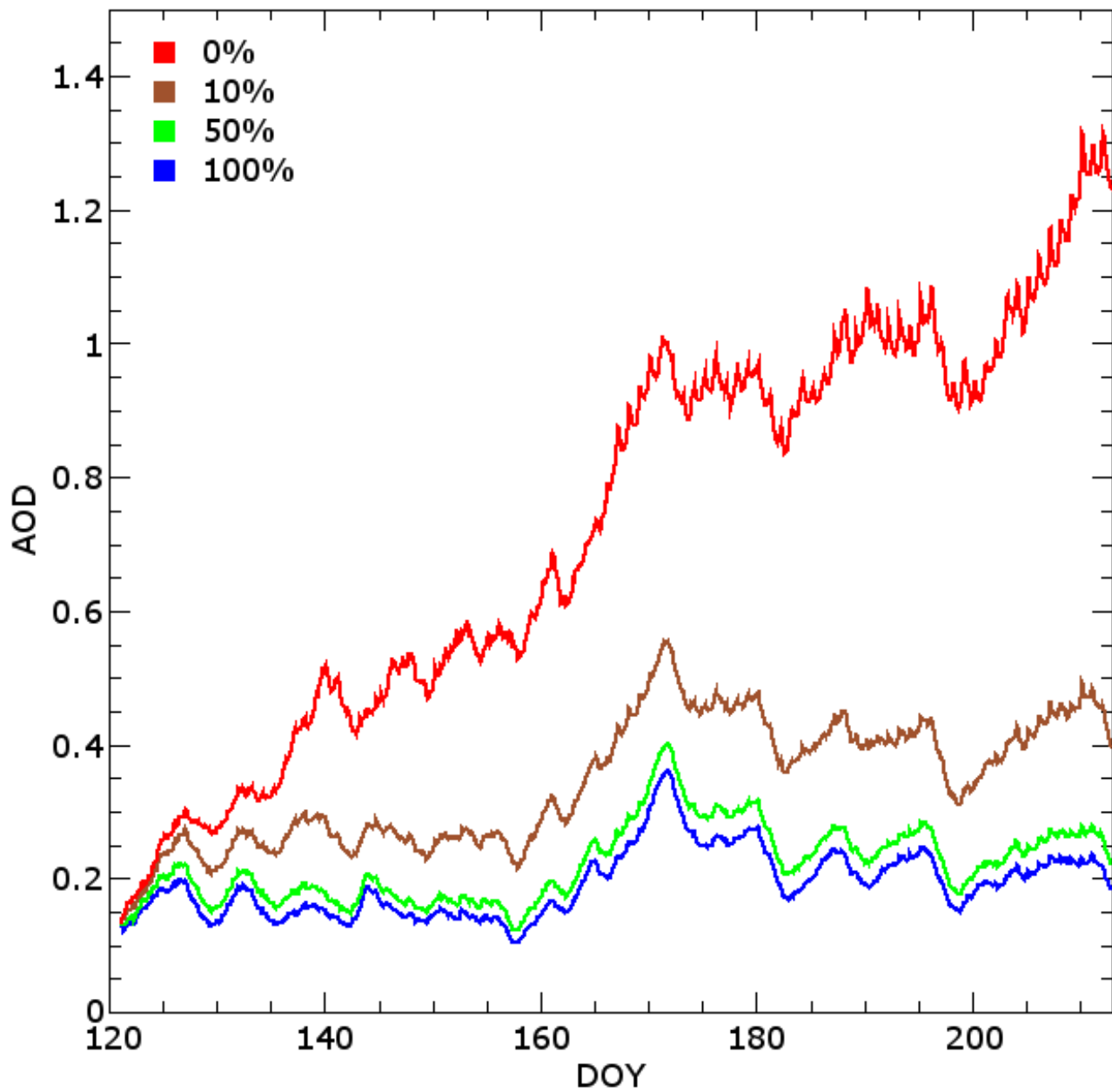
IHMS



Analysis

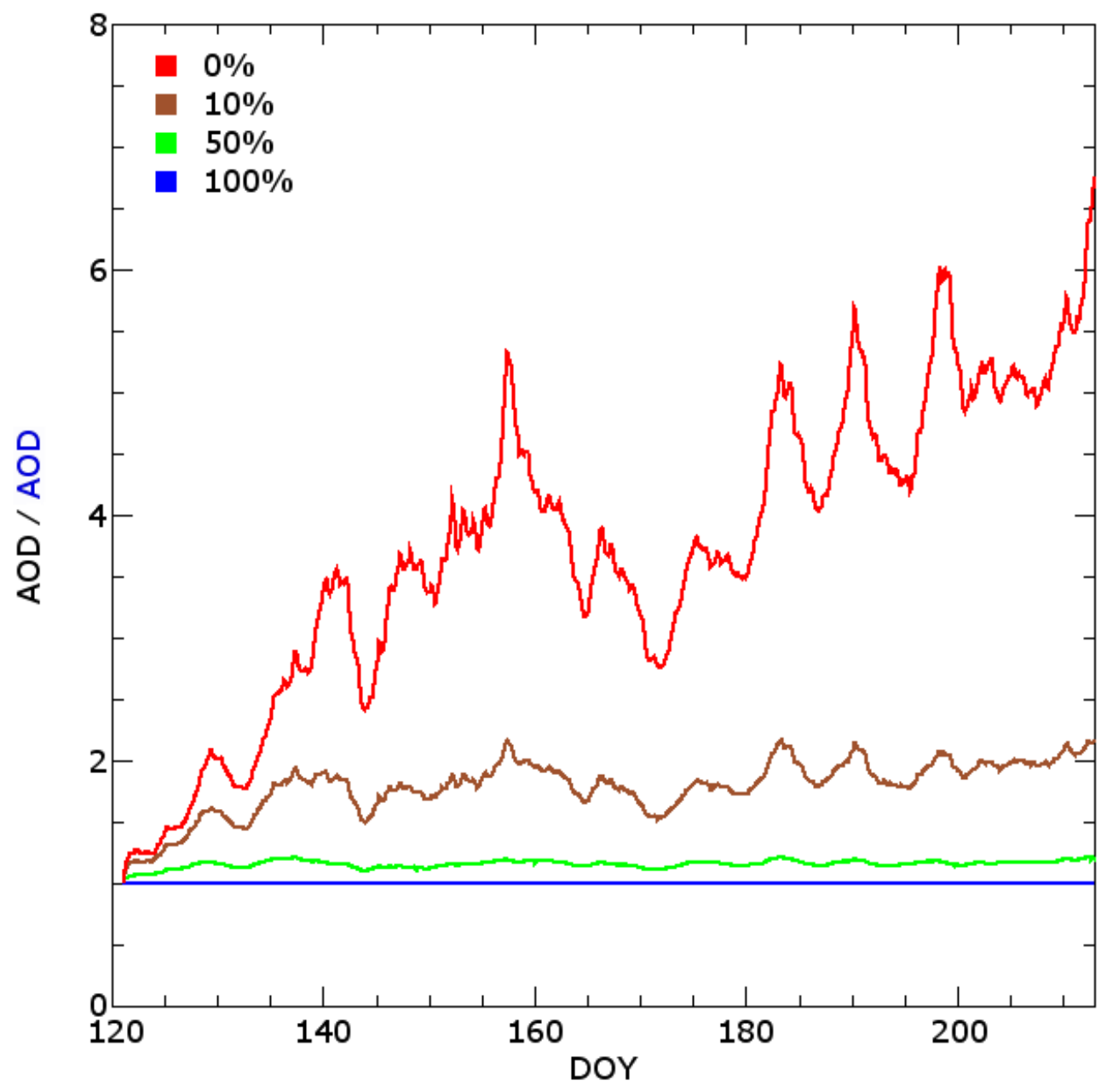


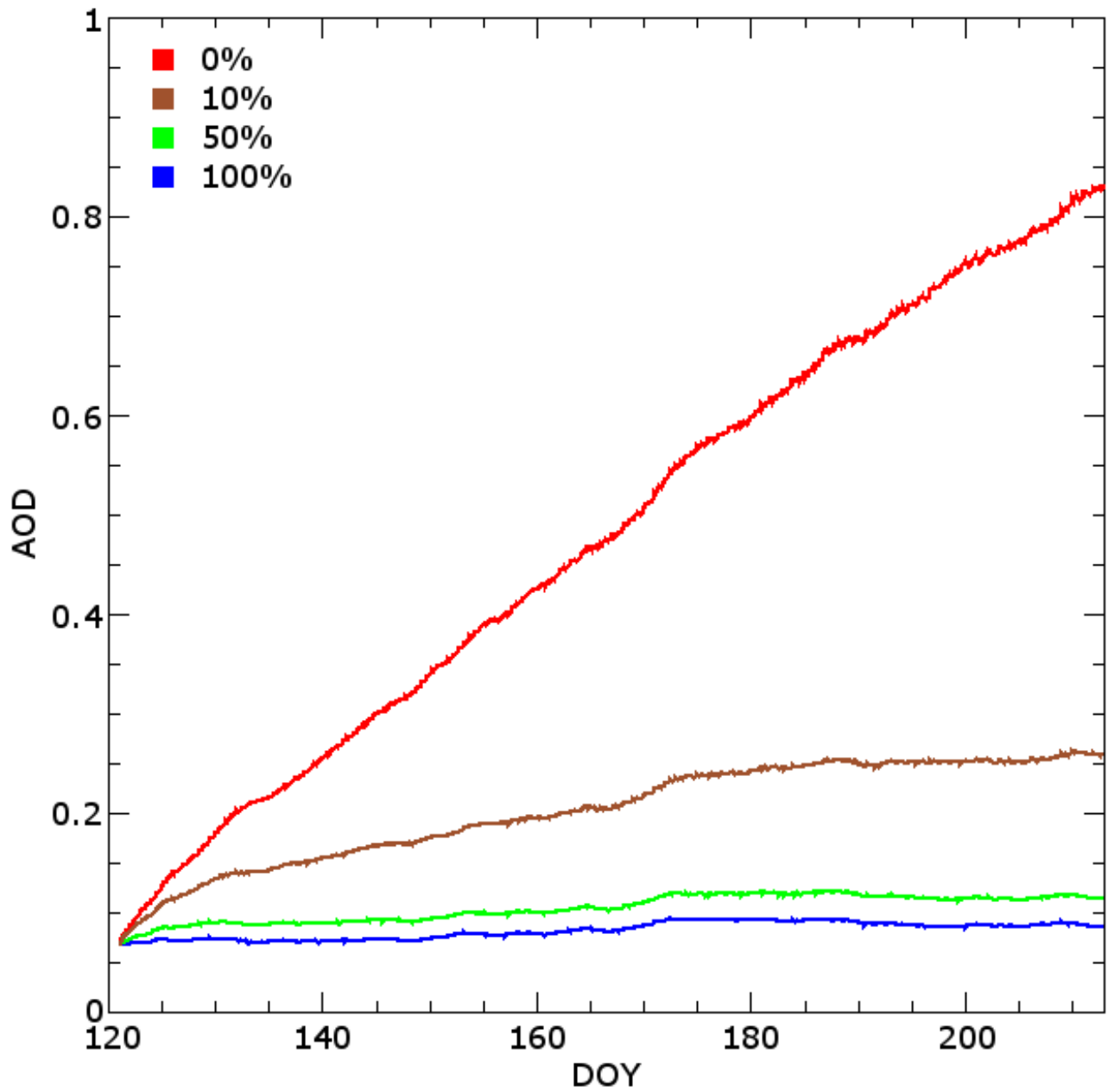
- Spin up
- 10% run
 - Results
 - Ground concentrations



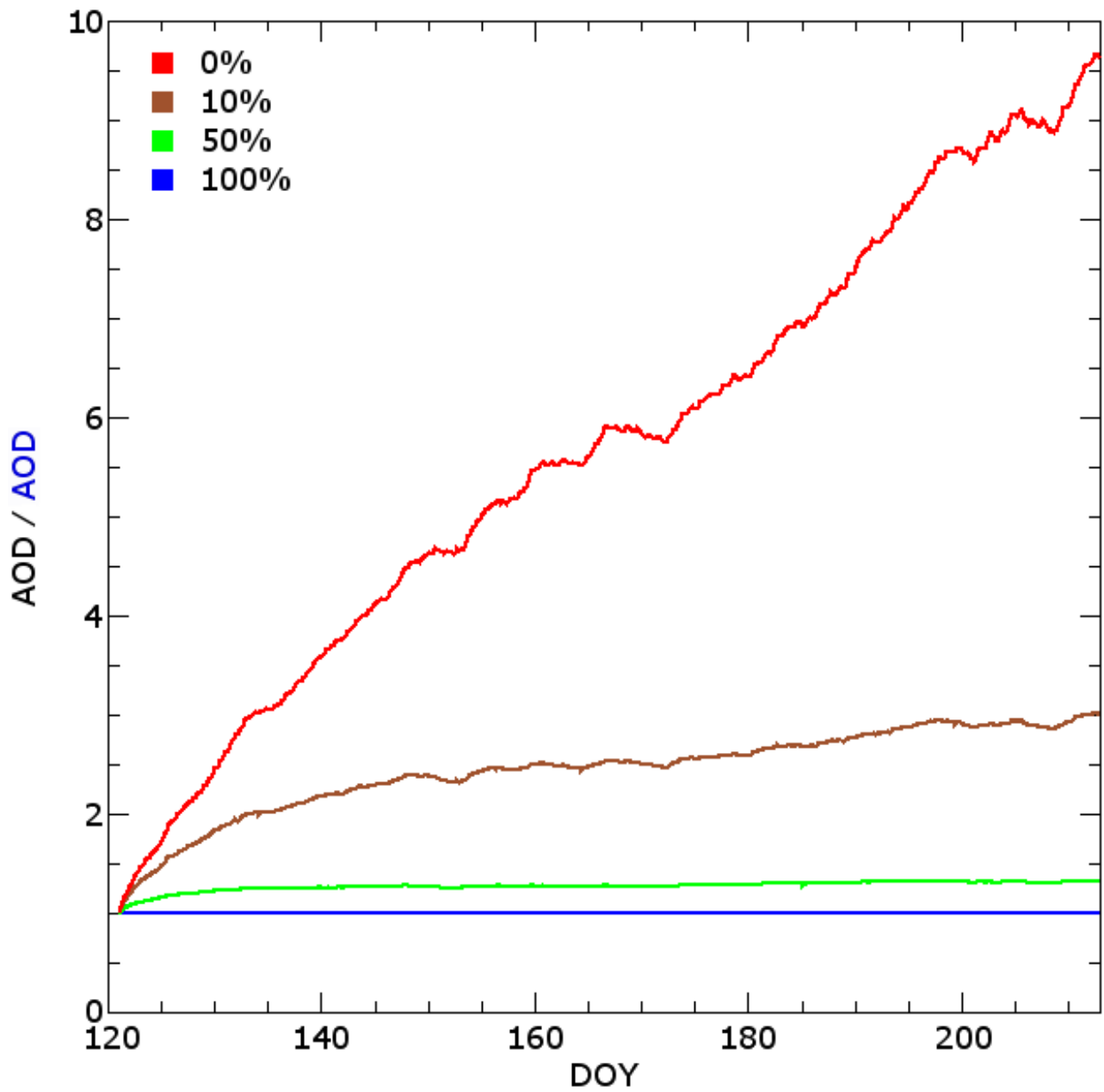
Average Europe

Average Europe

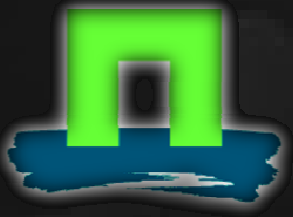




Average World



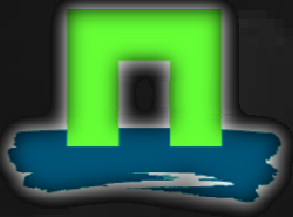
Average World



AOD



Station	Factor	Corr	Station	Factor	Corr
Belsk	1.338	0.594	Ispra	1.016	0.216
Cabauw	0.930	0.609	Karlsruhe	1.002	0.680
Chilbolton	0.986	0.558	Le fauga	1.275	0.555
Dunkerque	0.934	0.483	Messina	NA	NA
El arenosillo	1.100	0.776	Minsk	2.017	0.399
Forth Crete	1.337	0.635	Moldova	1.514	0.567
Granada	1.201	0.687	Moscow	1.196	0.637
Hamburg	1.083	0.669	Rome	1.340	0.477
Hornsund	1.169	-0.133	SMHI	1.345	0.784

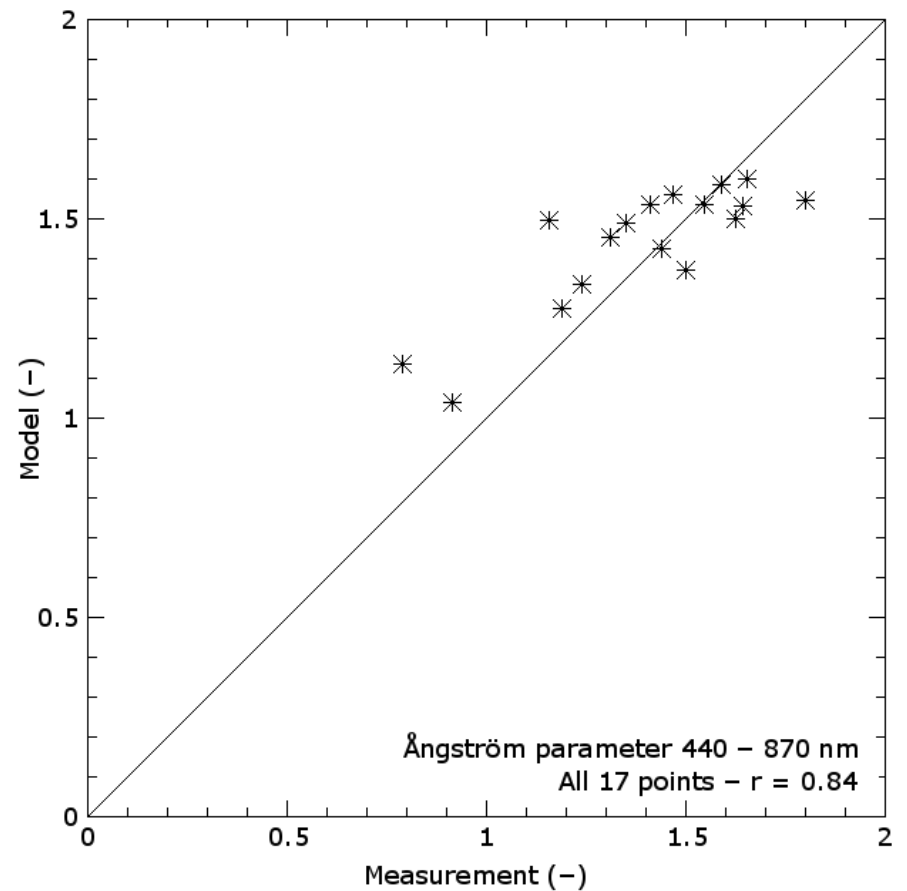
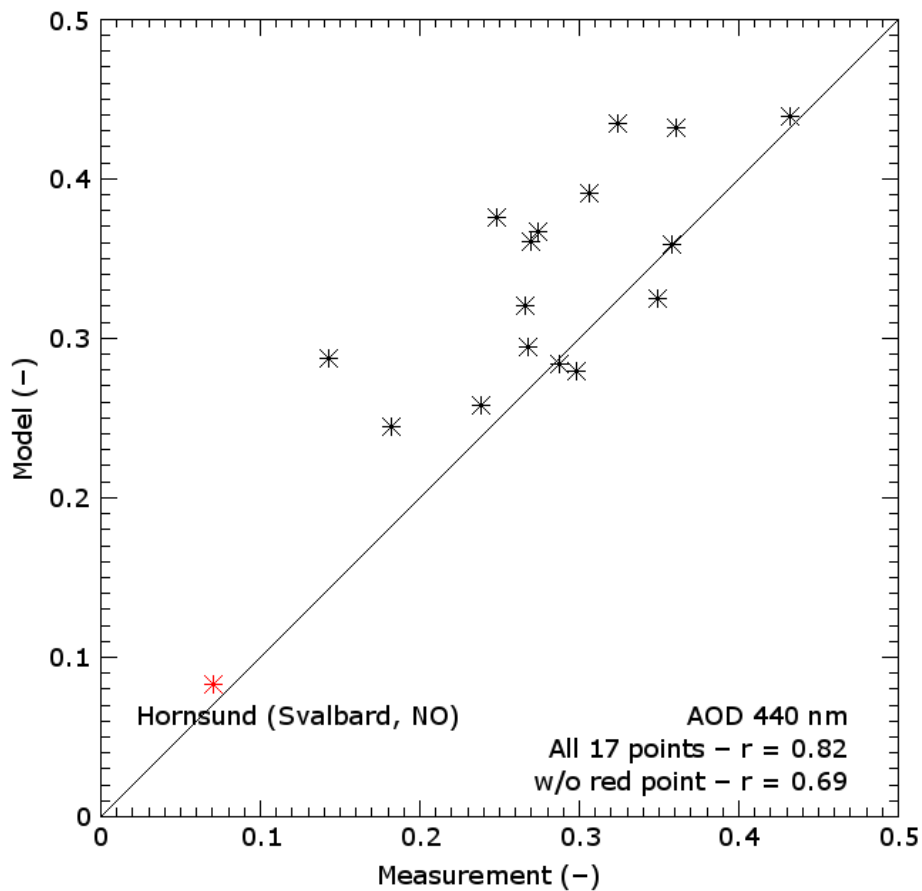


Ångström parameter

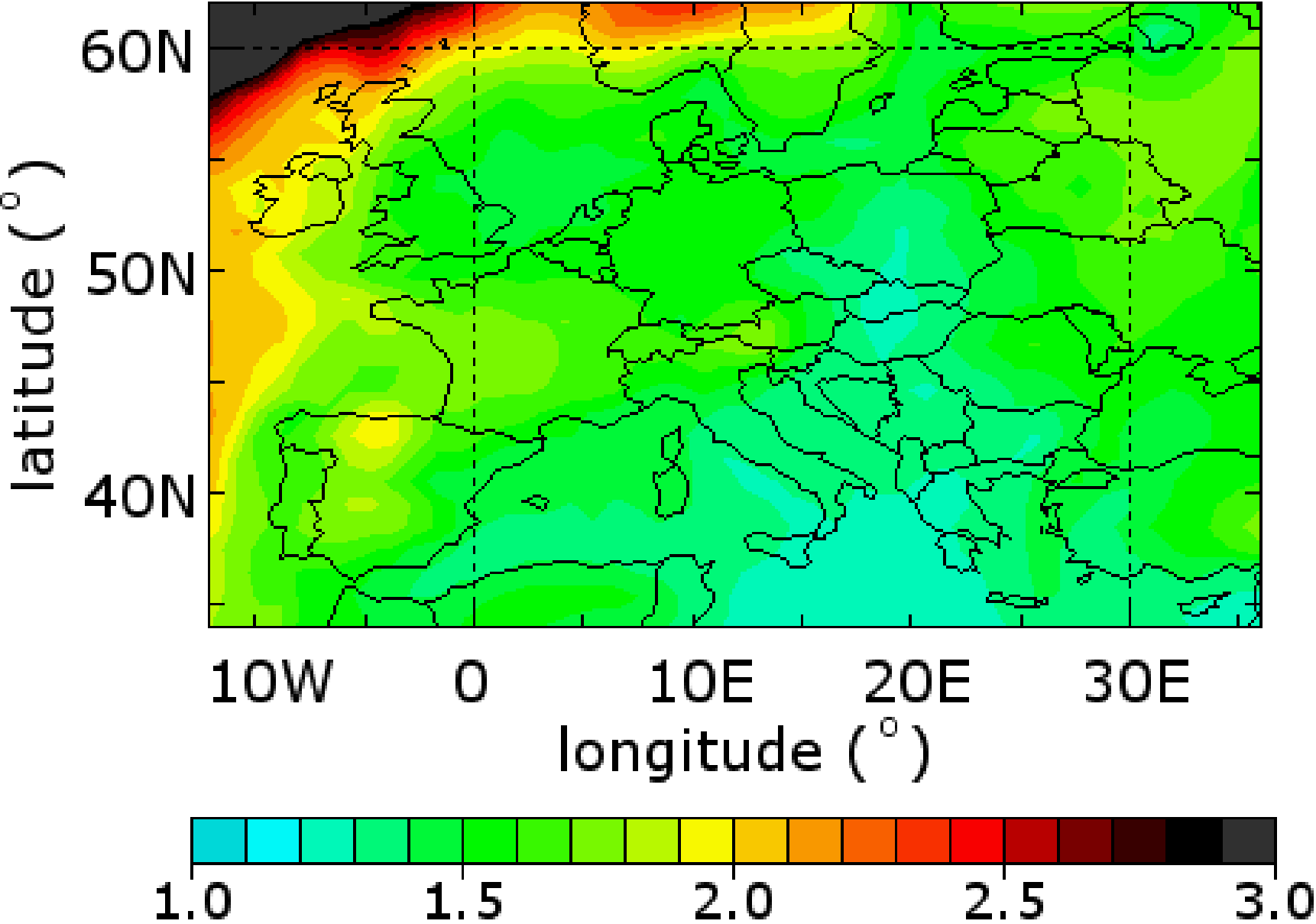


Station	Factor	Corr	Station	Factor	Corr
Belsk	0.996	0.280	Ispra	0.932	0.447
Cabauw	1.088	0.455	Karlsruhe	0.992	0.519
Chilbolton	1.108	0.599	Le fauga	0.913	0.760
Dunkerque	1.102	0.458	Messina	NA	NA
El arenosillo	1.135	0.790	Minsk	0.923	0.545
Forth Crete	1.073	0.799	Moldova	0.859	0.168
Granada	1.440	0.704	Moscow	0.967	0.246
Hamburg	1.062	0.052	Rome	0.991	0.897
Hornsund	1.077	-0.226	SMHI	1.296	0.327

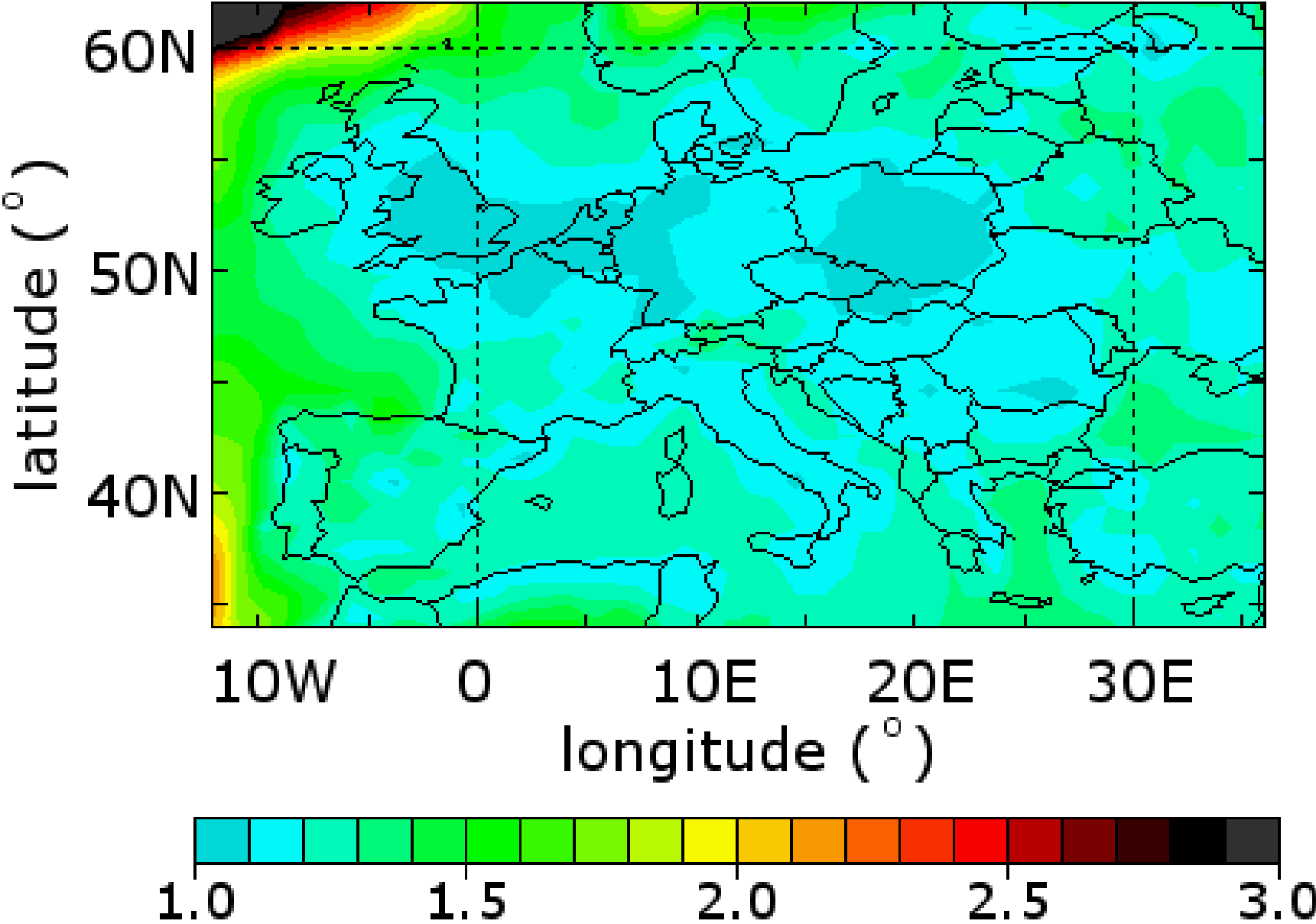
AOD and Ångström parameter



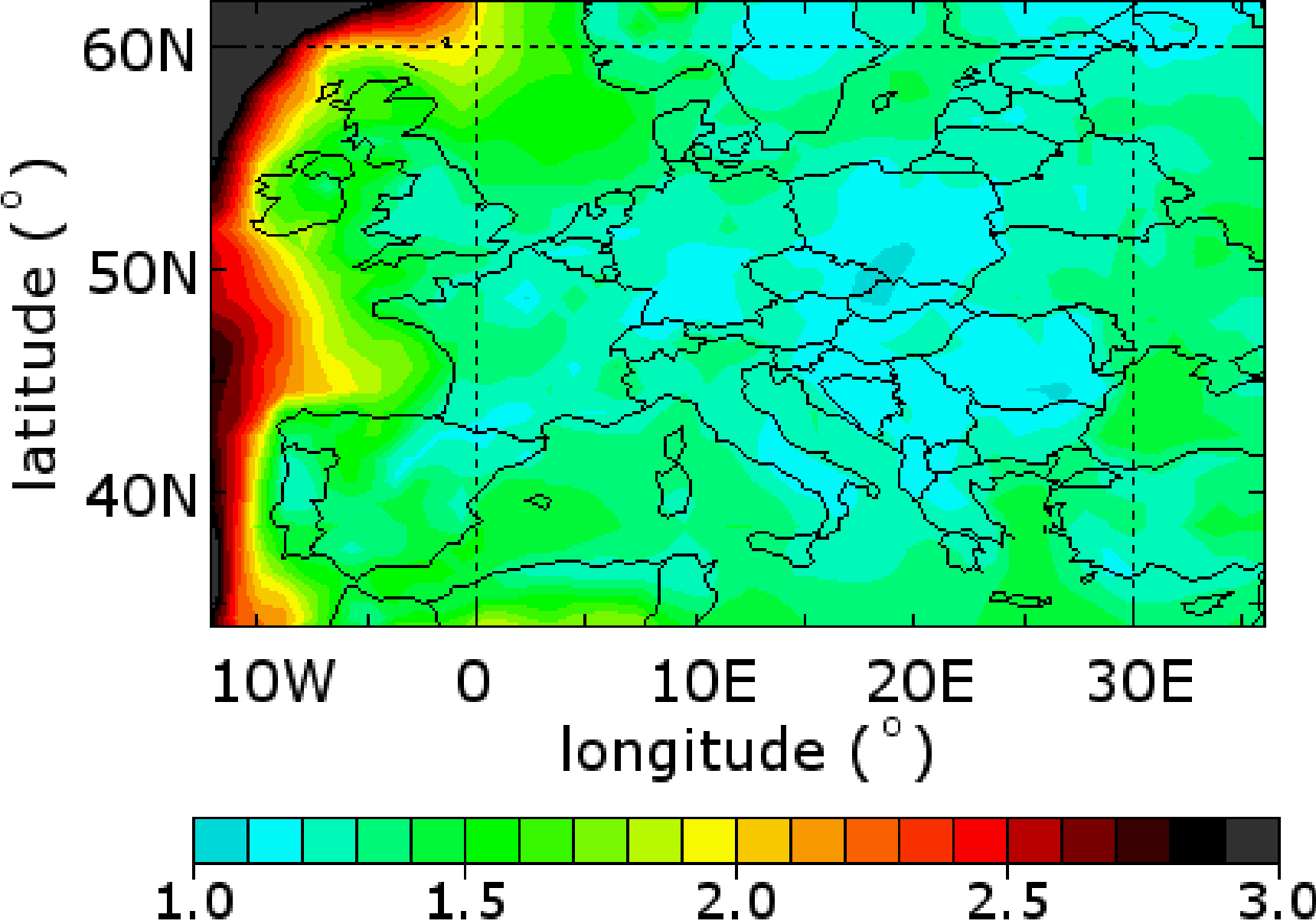
Sulfate change – July 2006



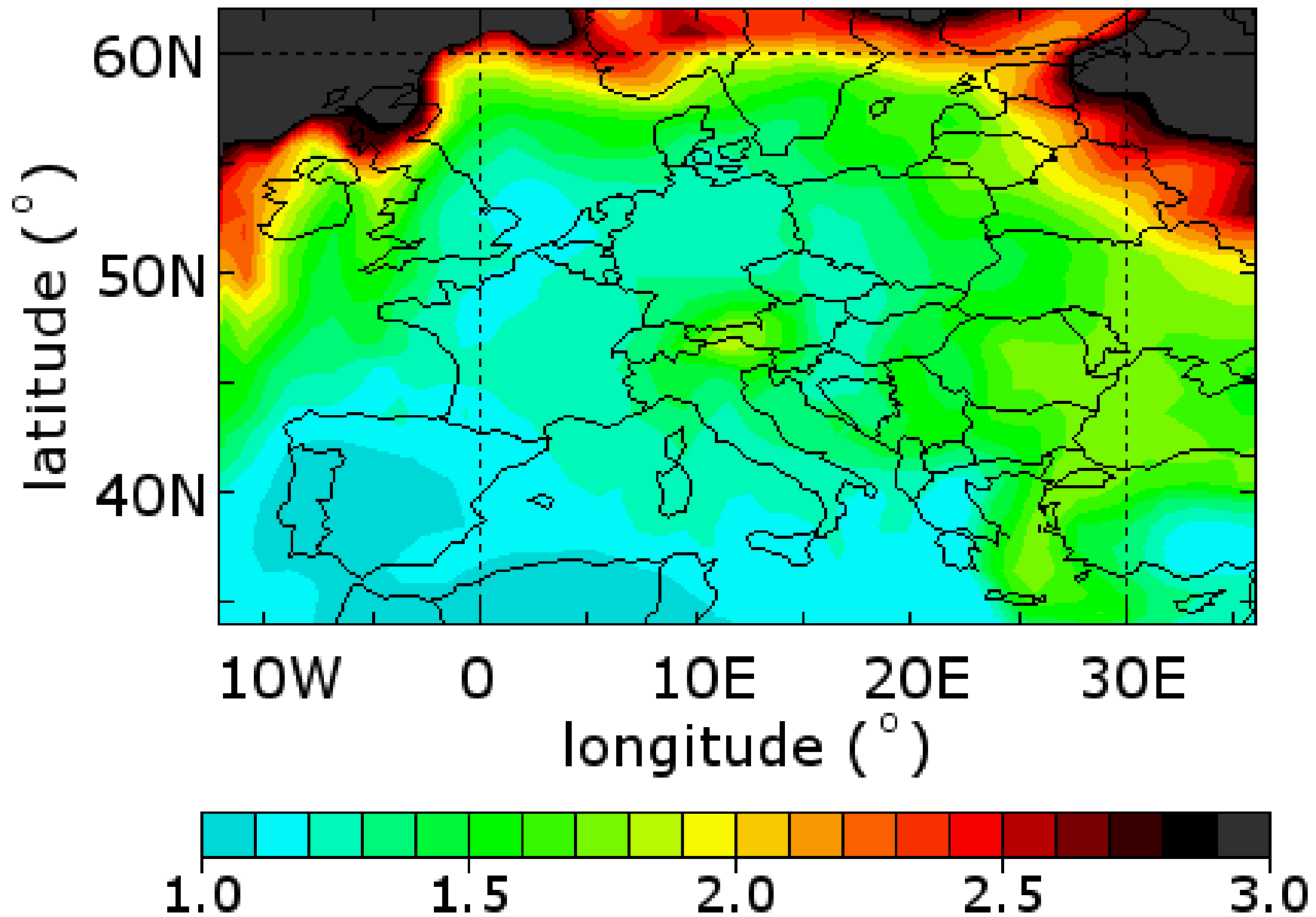
Black carbon change – July 2006



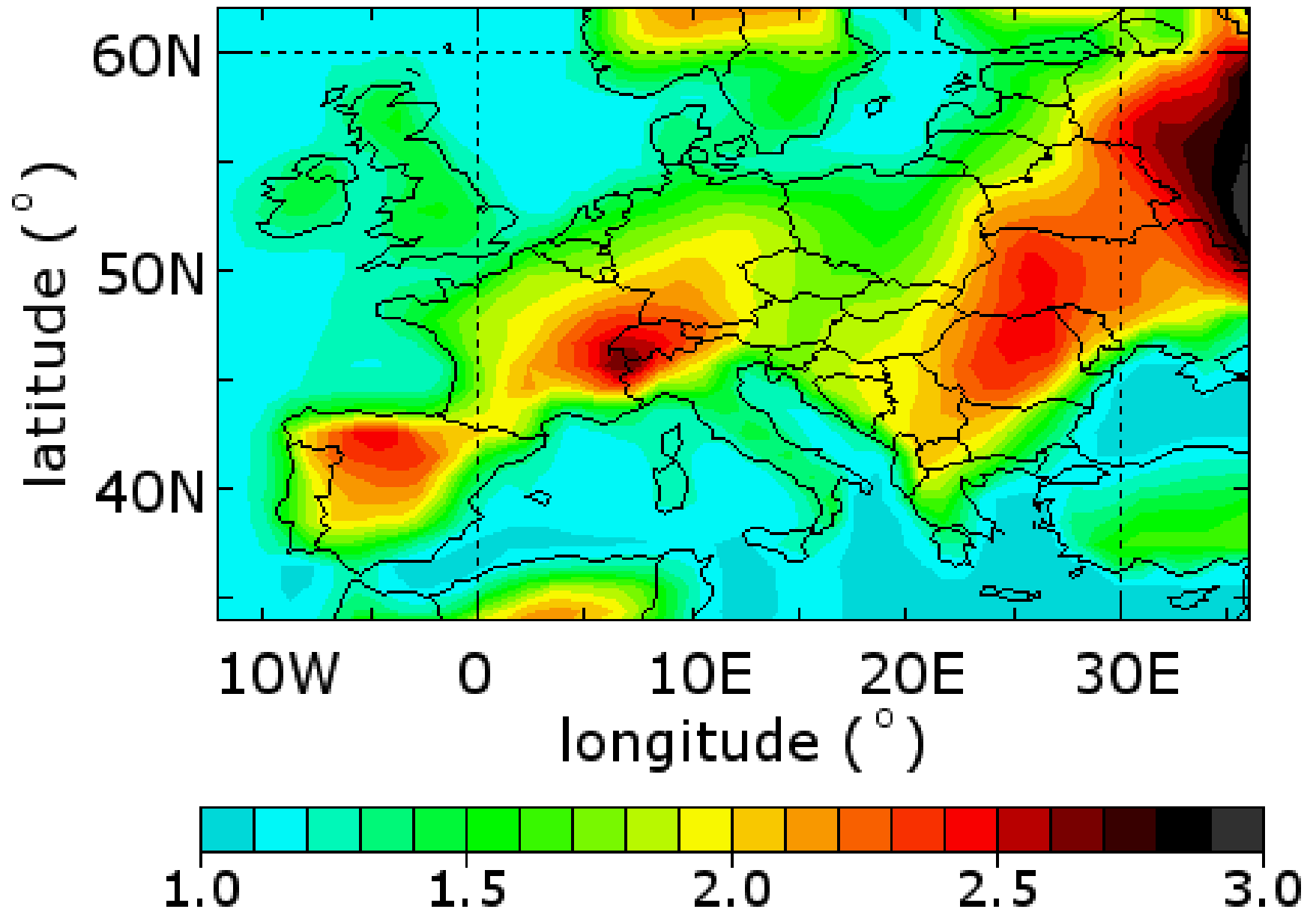
Organic matter change – July 2006

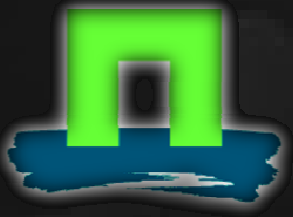


Mineral dust change – July 2006



Sea salt change – July 2006

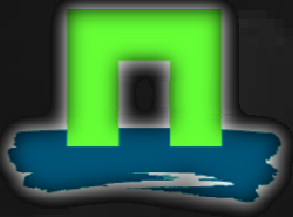




Conclusion



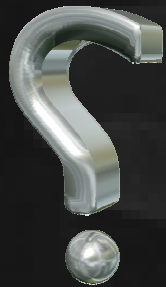
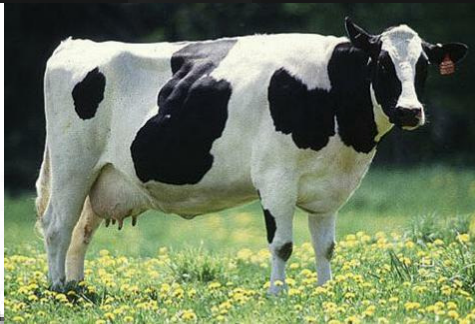
- M7, EQSAM and Optics
- Validation – Not all points were wrong
- Wet deposition – First results



Thank you



- M7, EQSAM and Optics
- Validation – Not all points were wrong
- Wet deposition – First results



Questions

