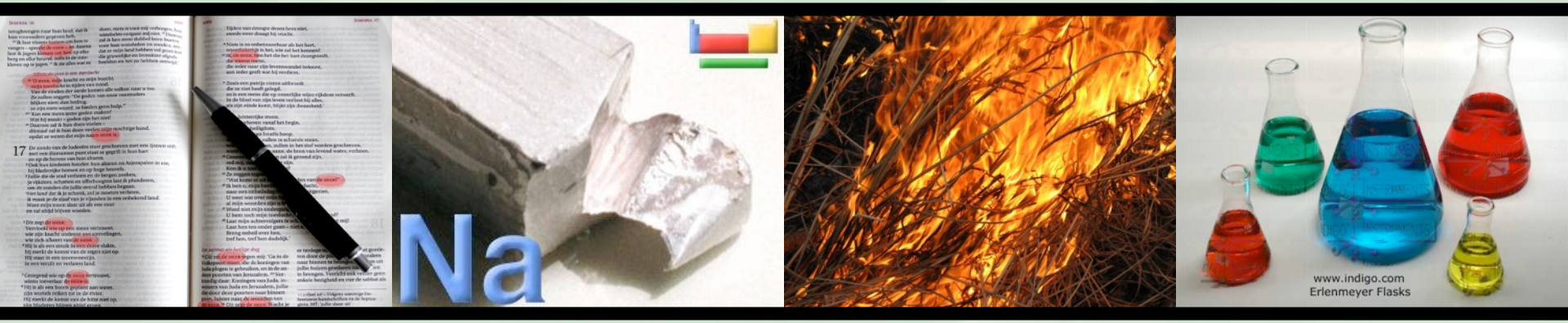
European aerosol budget 2006

TM meeting June 2010



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Outline

- Paper – European aerosol budget 2006
  - Sea salt issue
  - Budget
  - Flux diagram
  - Wet deposition (old)
  - Forest fires
- Generic chemistry

Sea salt issue

```
real,    parameter :: xmna=22.990
real,    parameter :: xmcl=35.453
real,    parameter :: xmnacl=xmna+xmcl
```

- Molar mass suggests NaCl (39.3% Na)

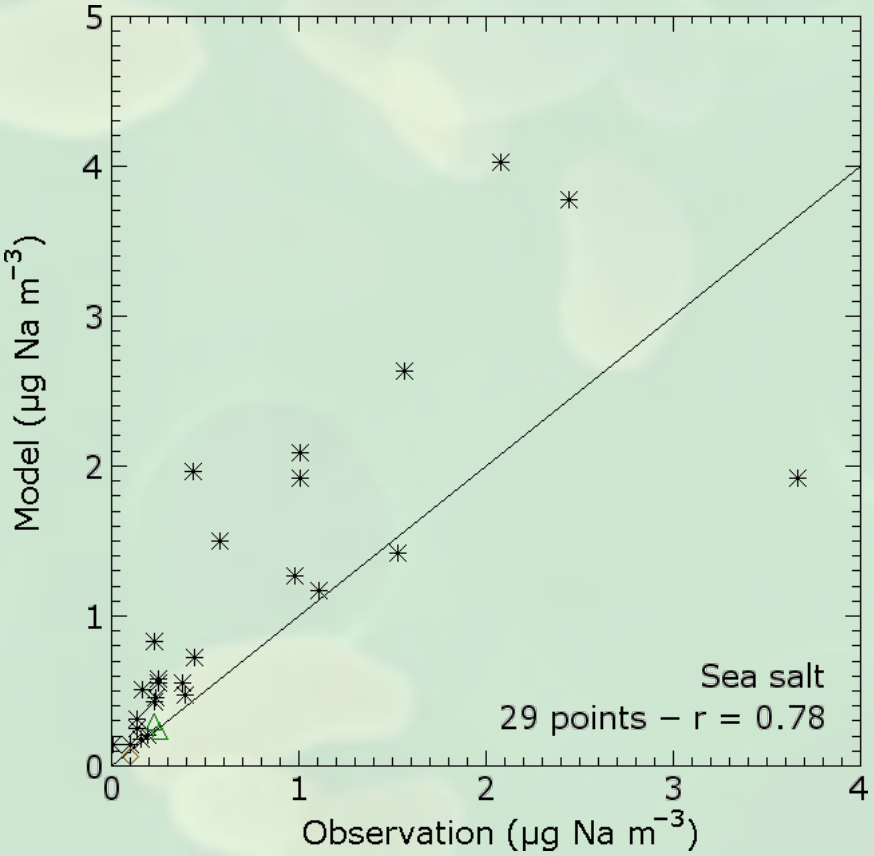
Sea salt issue

```
real,    parameter :: xmna=22.990
real,    parameter :: xmcl=35.453
real,    parameter :: xmnacl=xmna+xmcl
! Sea salt is 30.6% sodium (Millero, 2004)
```

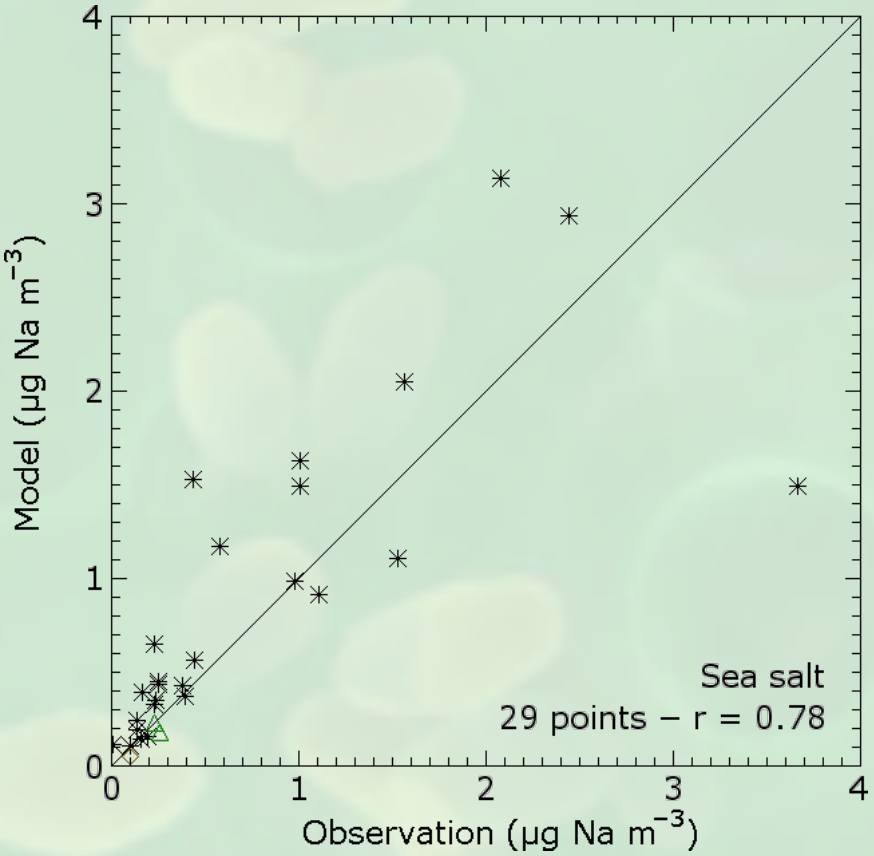
- Molar mass suggests NaCl (39.3% Na)
- Sea salt is 30.6% sodium (Millero, 2004)
- Only important for interpretation
- Results improve ☺

Sea salt issue

Old



New



Budget

- Domain
  - Horizontal: 12°W – 36°E, 34°N – 62°N
  - Boundary layer / Free atmosphere (850 hPa)
- Masses N, S and Na

Budget boundary layer

	Tracer	NO_y	SO_x	NH_3	HNO_3	NH_4^+	NO_3^-	SO_4^{2-}	BC	POM	DU	SS
	B	12.1	18.4	3.2	5.3	7.0	2.0	7.0	2.4	6.8	64.4	8.4
	L	0.6	0.7	0.2	0.6	1.7	1.5	2.0	1.6	1.6	1.5	0.3
Sinks	C	3804	487	18								
	A		564	1535	473							
	D	1154	5038	3378	1430			39	26	55	11701	8062
	W		863	405	860	604	254	502	142	403	4071	1869
	H	421	552	46	329	346	79	410	112	310		
	V	1567	1780	622	207	585	141	330	268	773		1176
Sources	E	6943	9051	6004				232	547	1541	3931	10663
	C		234		3298			487				
	A					1535	473	564				
	H										7853	446
	V										4033	

Budget boundary layer

	Tracer	NH_4^+	NO_3^-	SO_4^{2-}	BC	POM	DU	SS
Sinks	D			39	26	55	11701	8062
	W	604	254	502	142	403	4071	1869
	H	346	79	410	112	310		
	V	585	141	330	268	773		1176

Budget free atmosphere

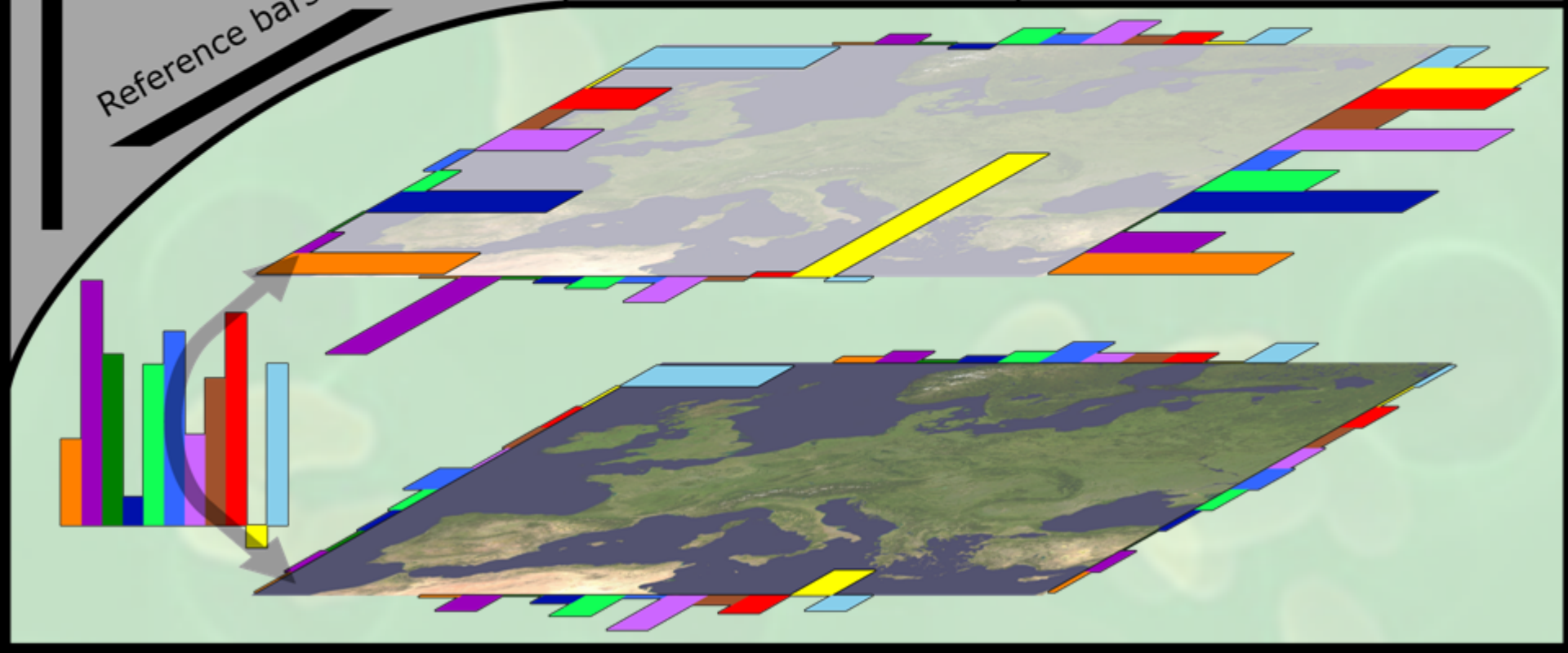
	Tracer	NO_y	SO_x	NH_3	HNO_3	NH_4^+	NO_3^-	SO_4^{2-}	BC	POM	DU	SS
	B	38.5	16.9	0.6	21.3	7.5	0.6	13.8	2.1	8.7	339.4	10.7
	L	7.6	1.5	0.4	5.8	2.5	1.6	2.9	2.9	4.0	6.1	2.0
Sinks	C	1384	878	6								
	A		555	496	6							
	D											
	W		864	101	850	576	90	984	149	536	16161	1926
	H	454	1908	20	488	505	59	778	121	259		
	V										4033	
Sources	E	275	2320					0	2	20		
	C		102		1119			878				
	A					496	6	555				
	H										20179	754
	V	1567	1780	622	222	585	141	330	268	773		1176

Budget free atmosphere

	Tracer	NH_4^+	NO_3^-	SO_4^{2-}	BC	POM	DU	SS
Sinks	D							
	W	576	90	984	149	536	16161	1926
	H	505	59	778	121	259		
	V						4033	

Flux diagram

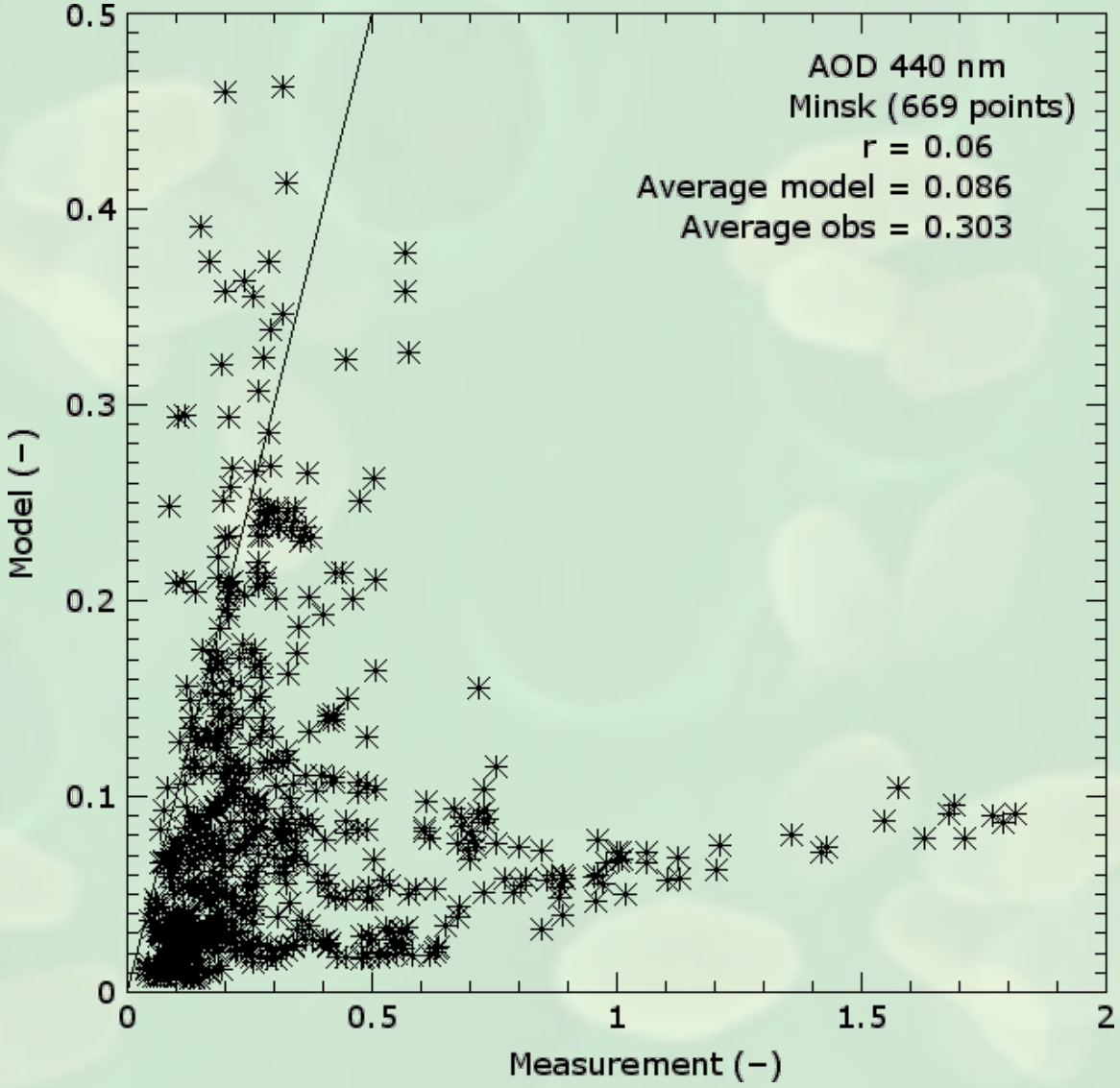
Nitrogen oxides (5)	Nitric acid (2)	Black carbon (0.5)
Sulphur oxides (2)	Ammonium (1)	Organic matter (1)
Ammonia (1)	Nitrate (0.2)	Mineral dust (50)
	Sulphate (1)	Sea salt (2)



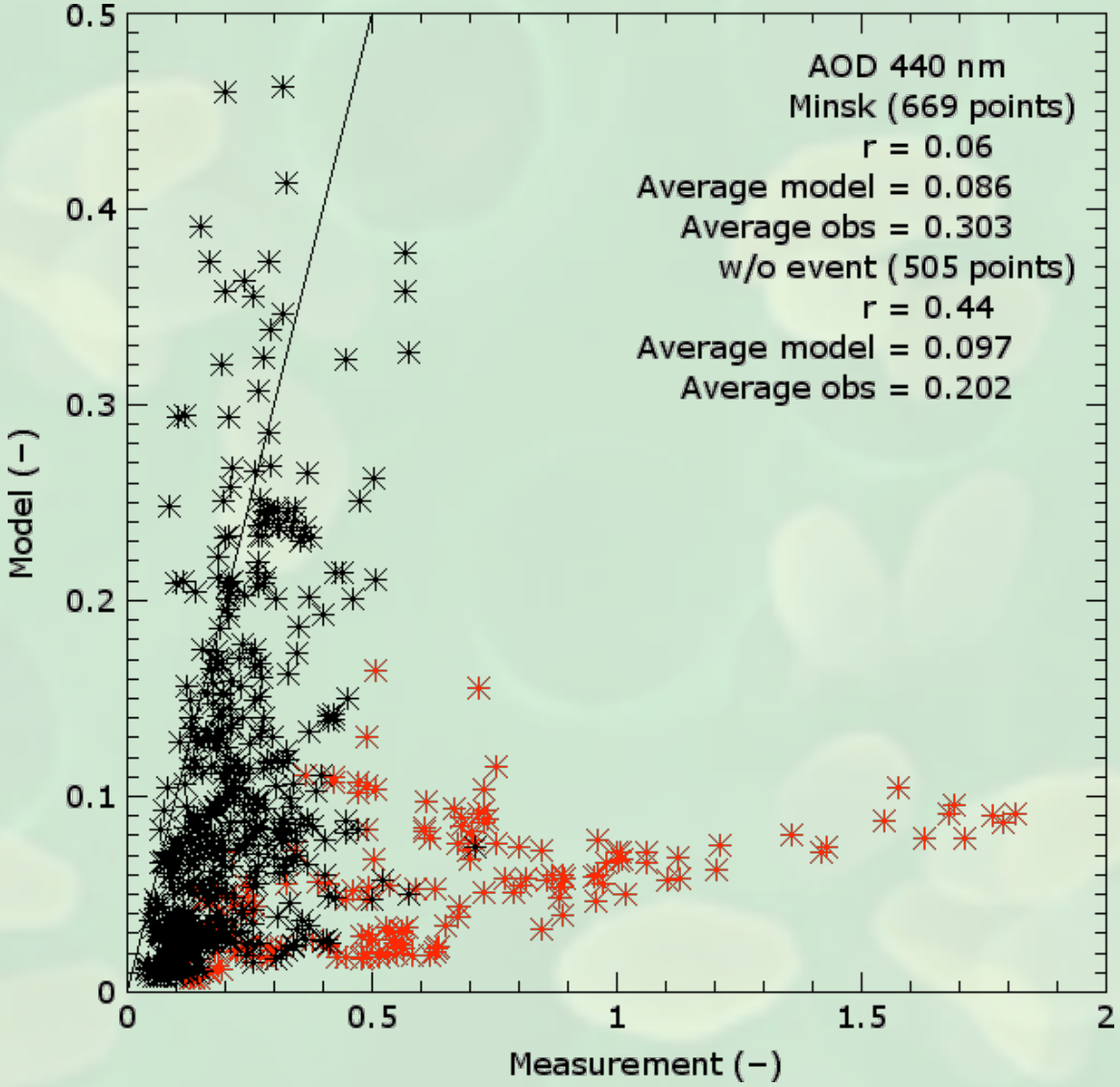
Wet deposition (old)

- Huge down-scaling to fit data (factor ~5)
- Scaling is no final solution

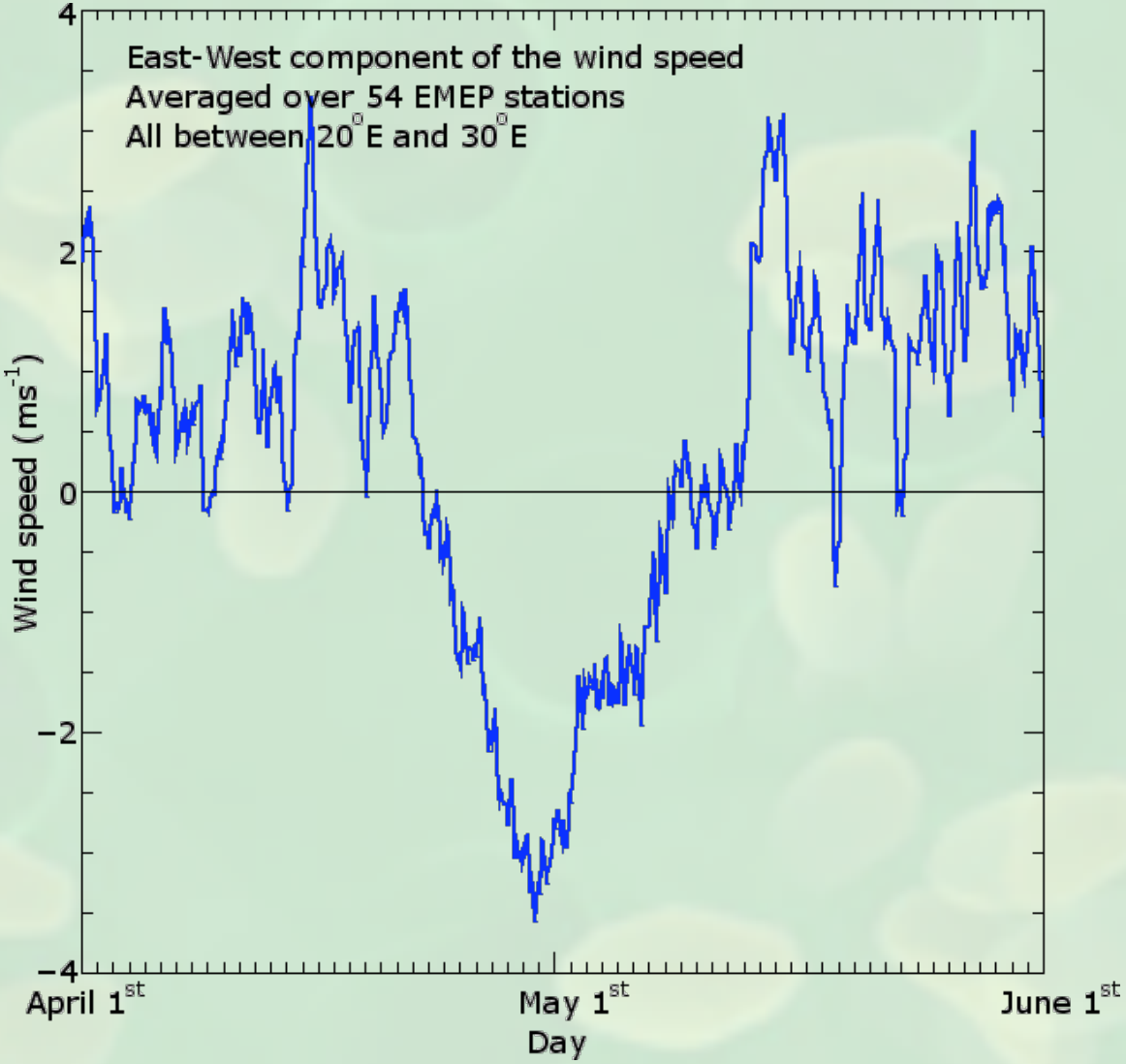
Forest fires



Forest fires

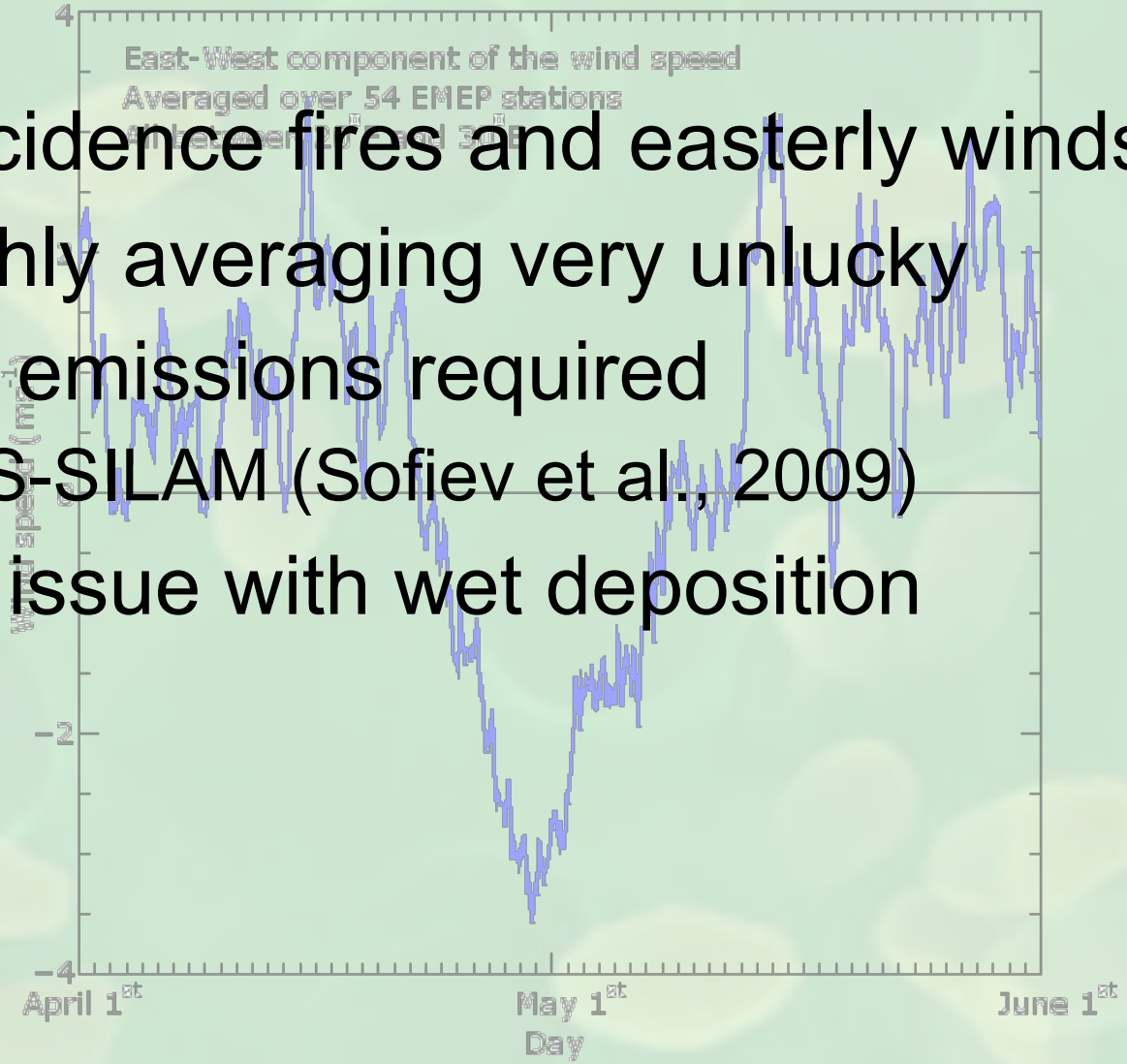


Forest fires



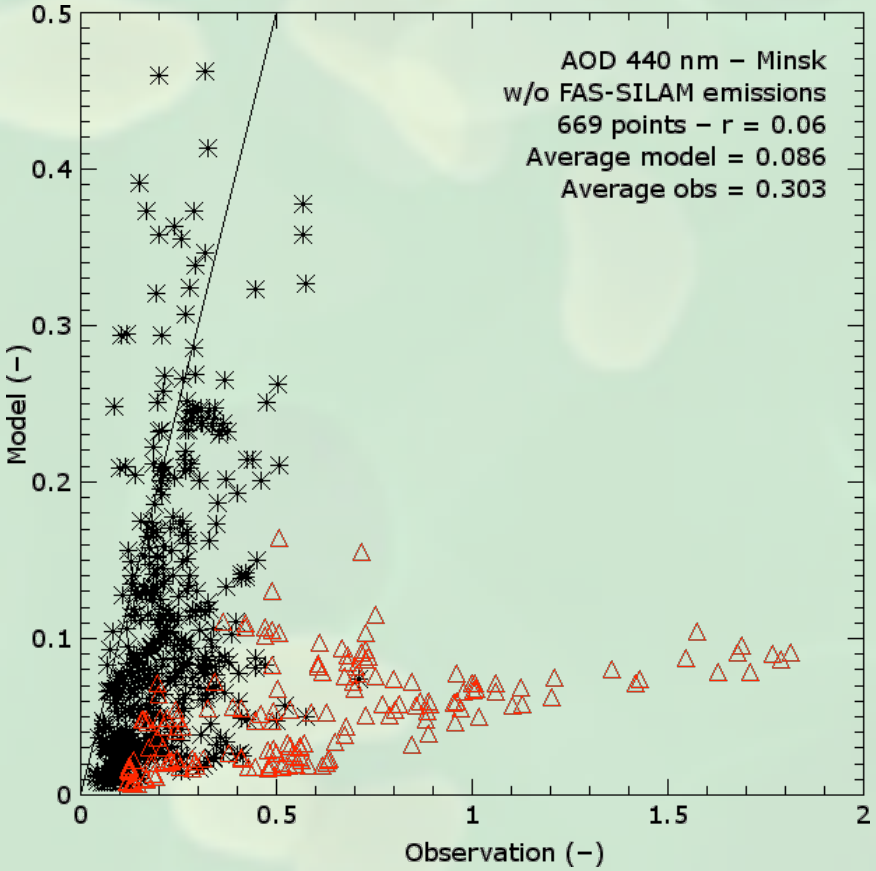
Forest fires

- Coincidence fires and easterly winds
- Monthly averaging very unlucky
- Daily emissions required
  - FAS-SILAM (Sofiev et al., 2009)
- Little issue with wet deposition



Improvement – Minsk

Old



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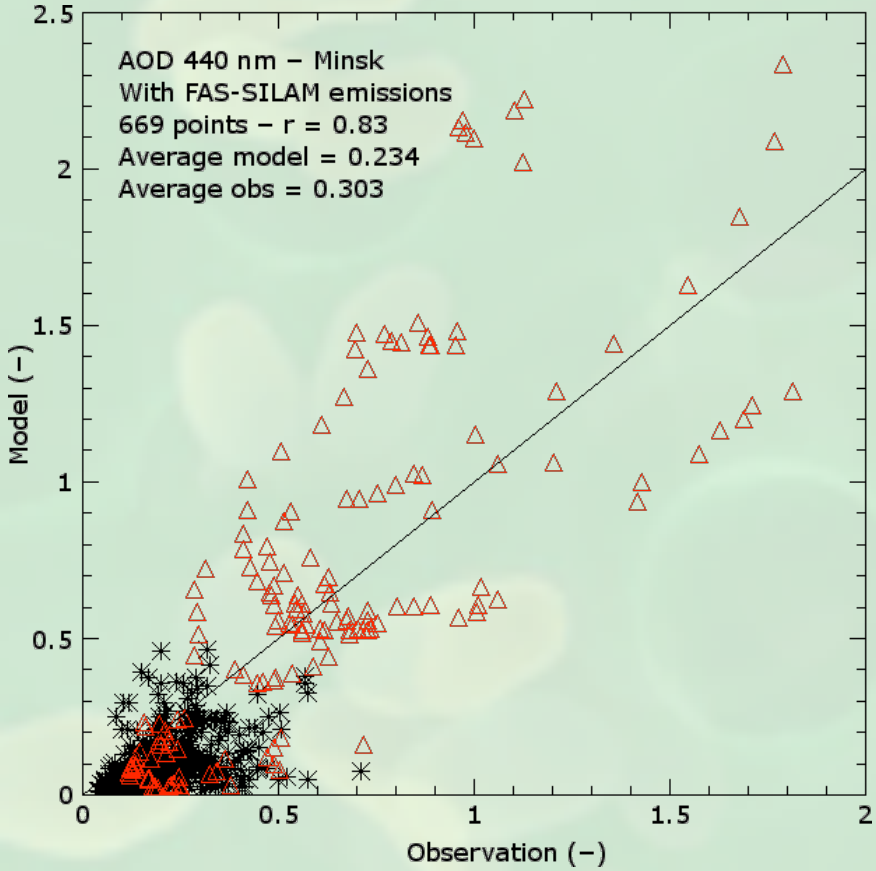
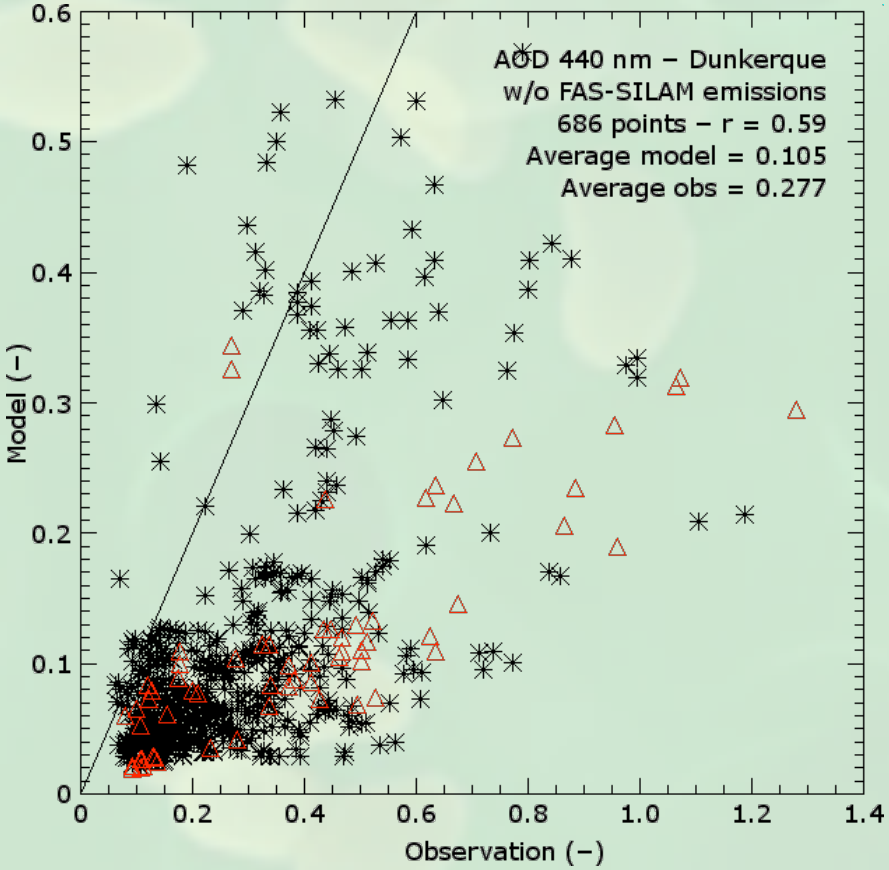


Reference – Dunkerque

Old



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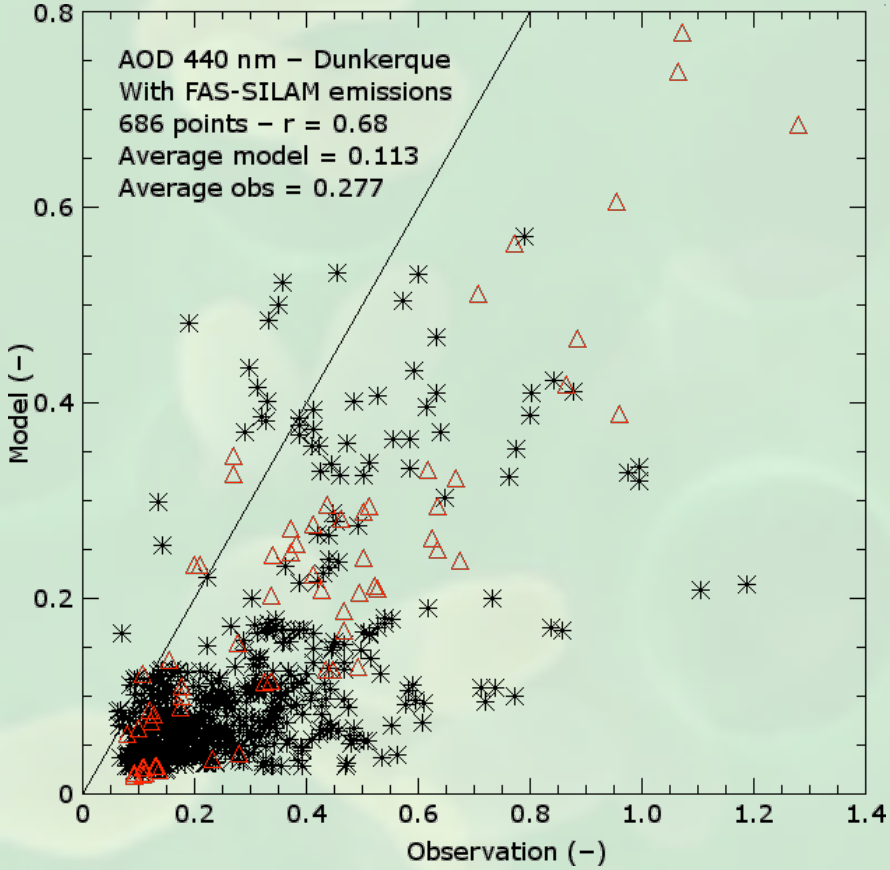

Generic chemistry

- Kinetic PreProcessor (KPP)
- Chemistry in a language like TM5 rc-files
- Generates code
- Integrators
- http://people.cs.vt.edu/~asandu/Software/Kpp/

Conclusion

- Paper
  - Sodium
  - Budget
  - Fluxes
  - Wet removal
  - Forest fires
- KPP

Questions

- Paper
  - Sodium
  - Budget
  - Fluxes
  - Wet removal
  - Forest fires
- KPP

Wageningen

Heraklion