Environmental Chemical Process Laboratory

Update from Crete

Nikos Daskalakis, Kostas Tsigaridis, Stelios Myriokefalitakis, Maria Kanakidou

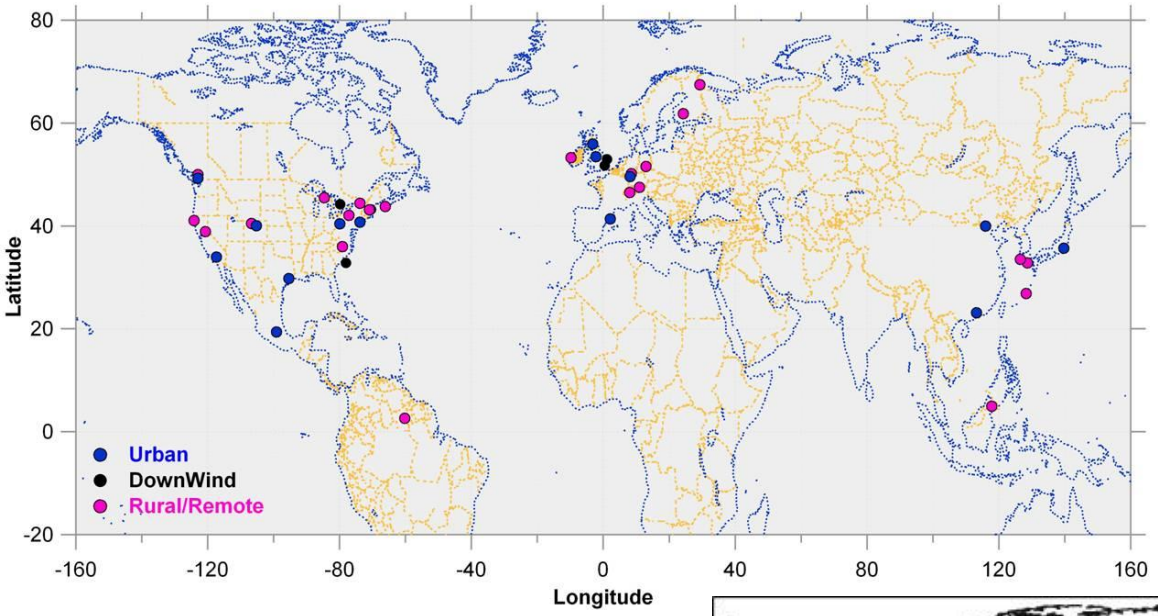
OA model intercomparison – AEROCOM

- http://dataipsl.ipsl.jussieu.fr/AEROCOM/

- Compare models against measurements
- Study organic aerosol composition, not only bulk

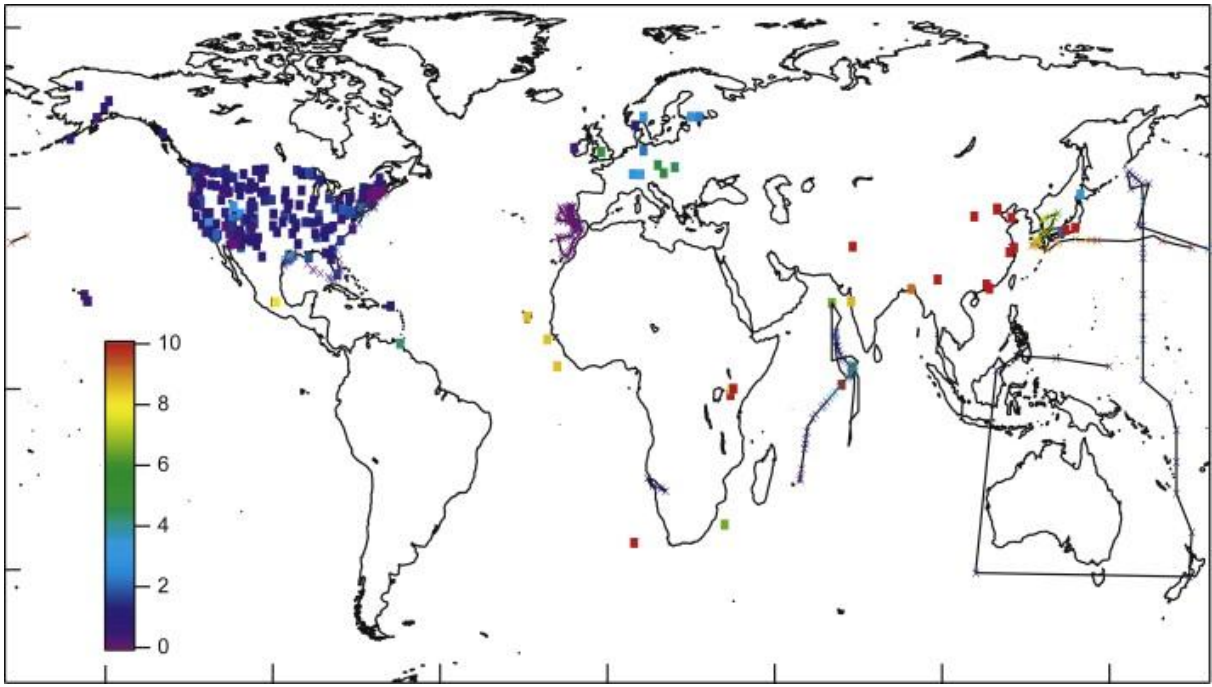
- Until now:
  - 15 global models (1 more at least is expected)
  - OC obs (mainly from Bahadur et al., 2010)
  - OA obs (mainly from Zhang et al., 2007)
  - OC obs - Amsterdam island (Sciare et al., 2009)
  - OC obs - Finokalia Crete, Greece (Koulouri et al., 2008 & Mihalopoulos unpublished)

Measurement stations



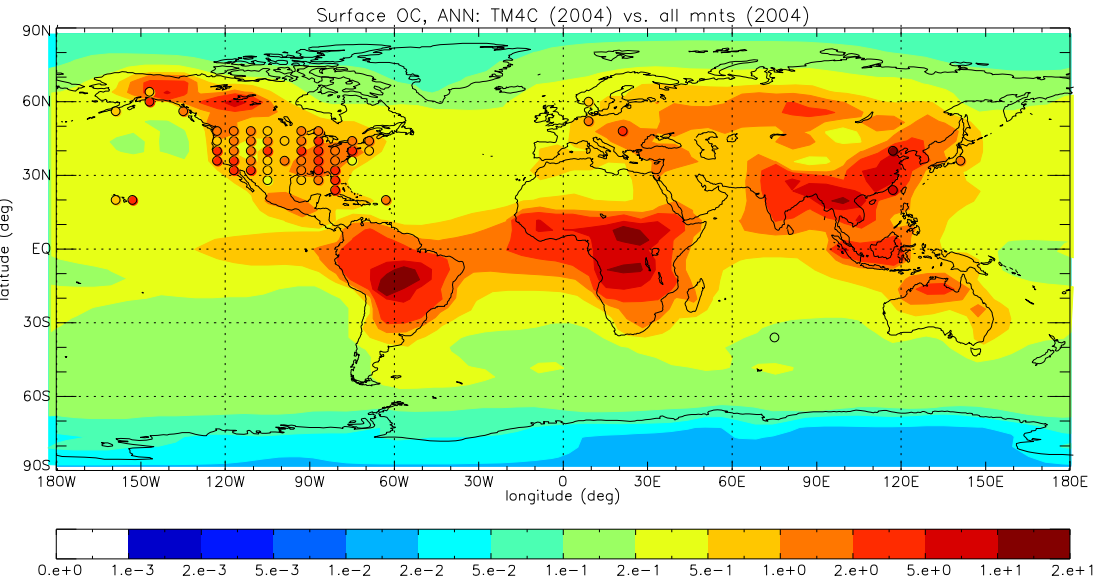
OA – AMS measurements

Zhang et al, 2007

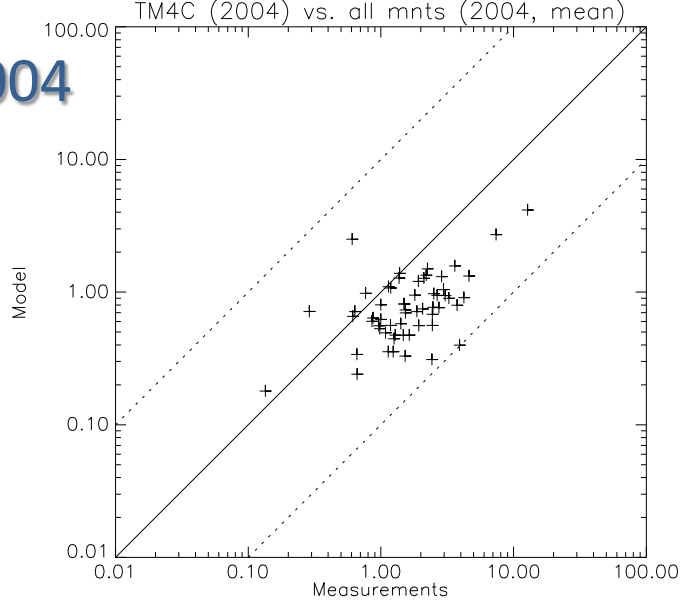


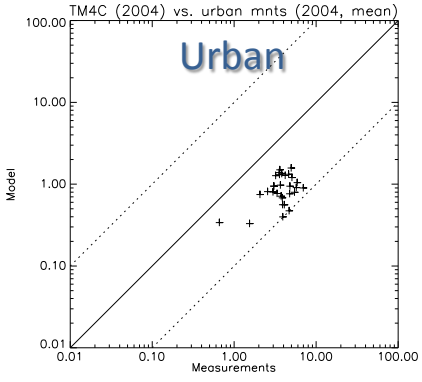
OA – PM2.5 measurements

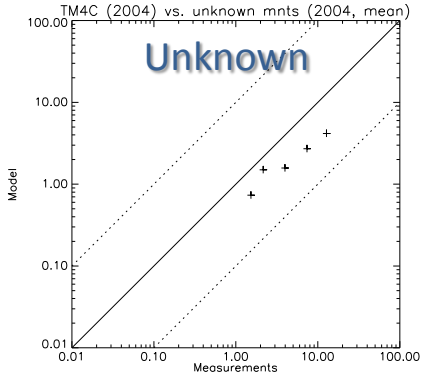
Bahadur et al, Atm. Env., 2009

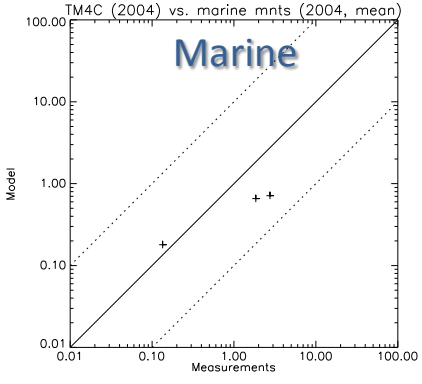


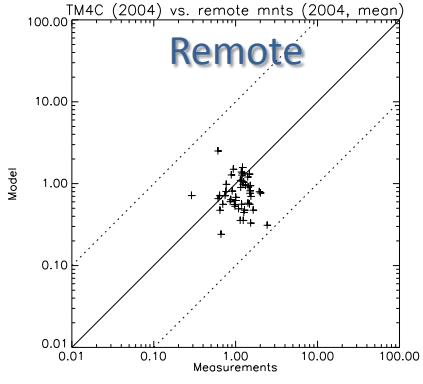
2004



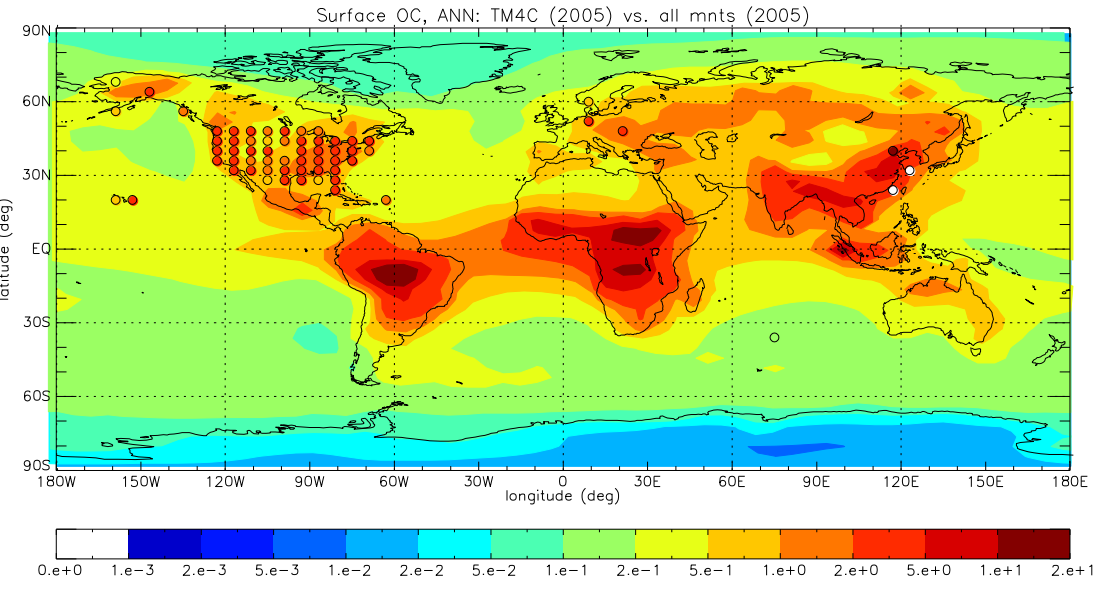




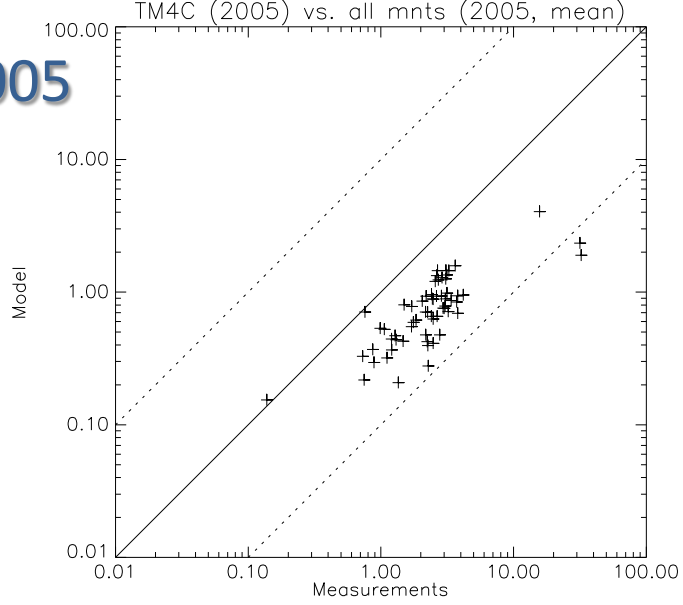


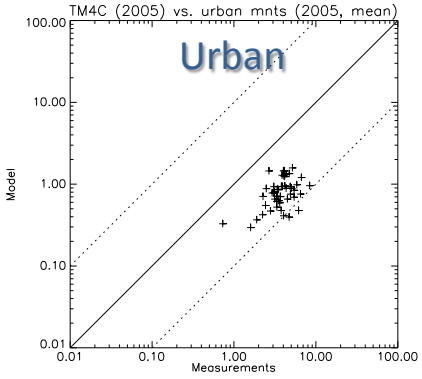


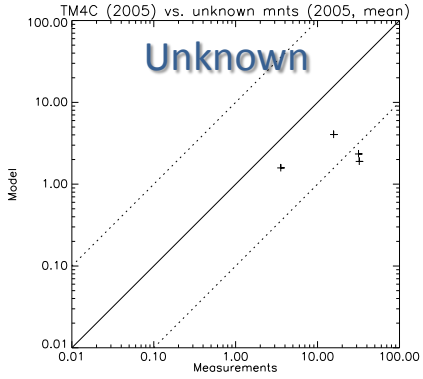
Month	R^2	Slope	MNB %	#obs	#grid boxes
Annual	**0.4139**	**0.3516**	**-39.78**	**29529**	**58**
Urban	**-0.205**	**0.2206**	**-74.4**	**8668**	**30**
Remote	**-0.584**	**0.6228**	**-17.51**	**20413**	**49**
Marine	**0.7596**	**0.291**	**-35.17**	**448**	**3**
January	-0.043	0.2433	-44.88	2435	53
February	0.2569	0.3254	-42.7	2369	55
March	0.55	0.4634	-34.22	2465	53
April	0.2611	0.3301	-44.86	2298	53
May	0.229	0.3113	-54.41	2930	53
June	-0.239	0.4308	-24.87	2577	55
July	-0.339	0.4225	-29.29	2361	51
August	-0.199	0.3897	5.32	2623	52
September	-0.205	0.3558	-43.58	2239	52
Octomber	-0.05	0.4409	-27.34	2541	54
November	-0.463	0.3466	-26.06	2268	51
December	-0.009	0.3274	-50.18	2423	51

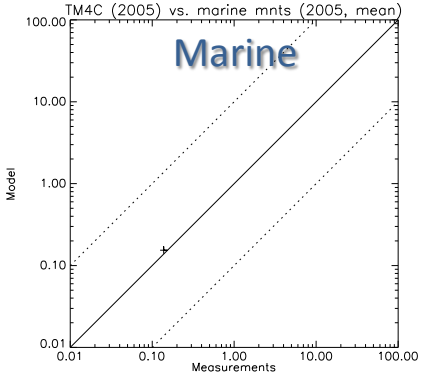


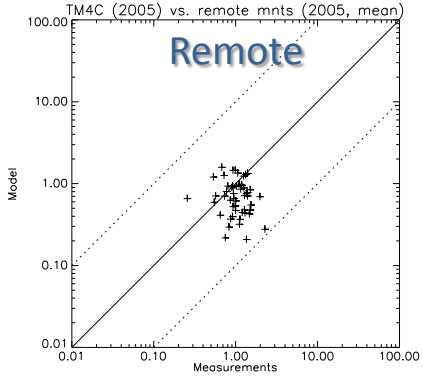
2005



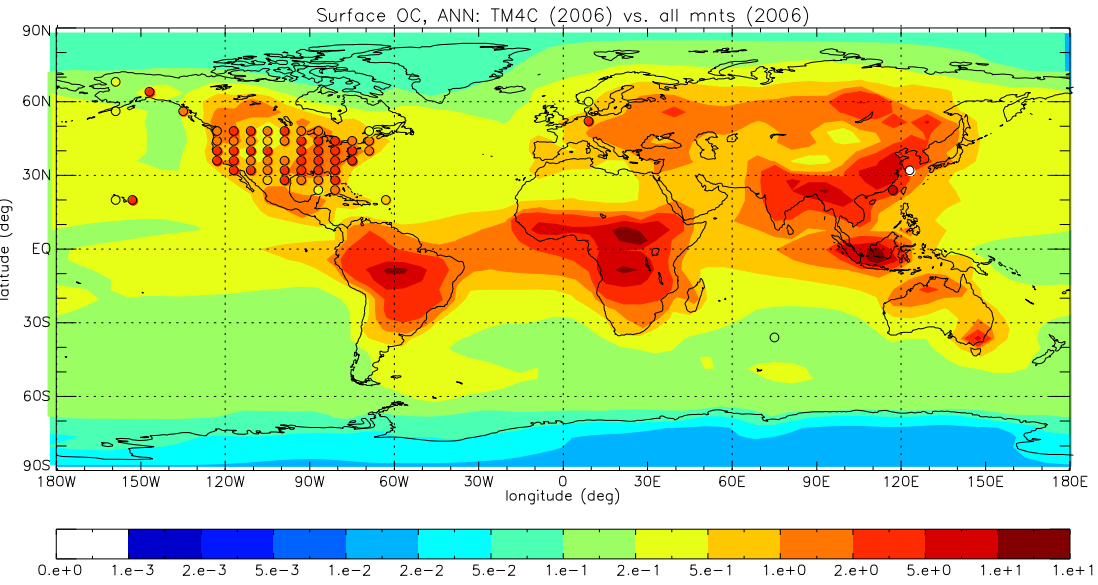


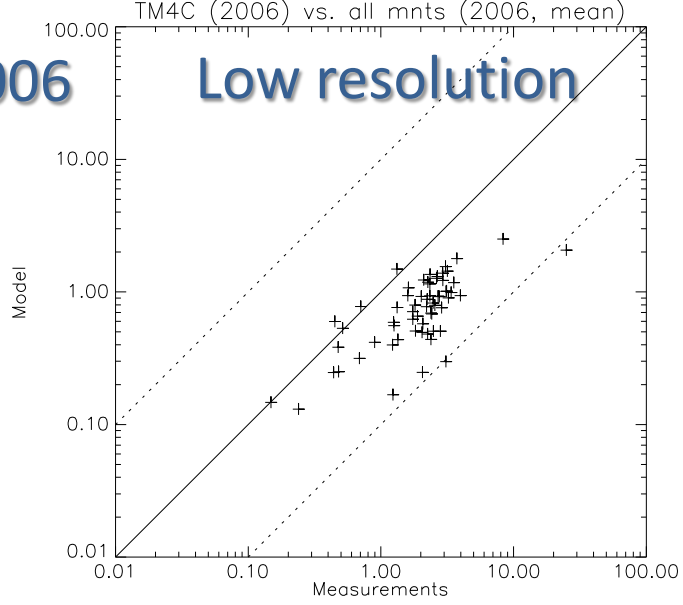


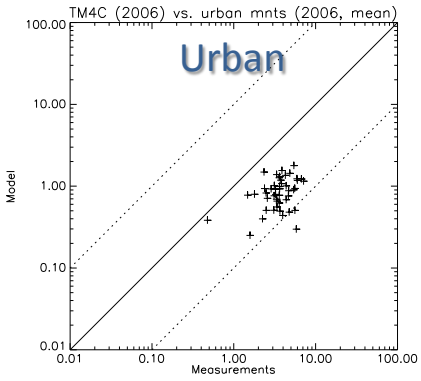


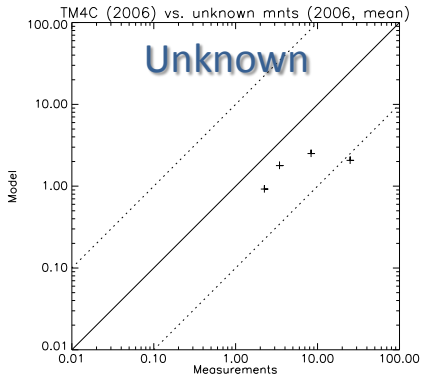


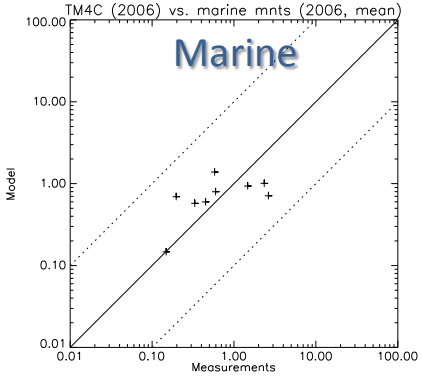
Month	R^2	Slope	MNB %	#obs	#grid boxes
Annual	**-0.351**	**0.1178**	**-65.33**	**39380**	**62**
Urban	**-0.137**	**0.1978**	**-77.32**	**19064**	**49**
Remote	**-0.656**	**0.6087**	**-19.5**	**19951**	**50**
Marine	**–**	**–**	**11.44**	**365**	**1**
January	0.1797	0.268	-64.18	3595	58
February	0.6511	0.3044	-58.18	3128	56
March	0.3813	0.3515	-60.46	3355	55
April	0.1067	0.2199	-70.71	3489	55
May	0.3248	0.24	-71.48	3648	57
June	0.4298	0.27	-69.56	3248	55
July	0.3245	0.319	-64.02	3208	55
August	-0.014	0.4346	-48.01	3175	55
September	0.1567	0.3163	-61.82	3255	57
Octomber	0.335	0.4149	-54.13	3344	55
November	-0.513	0.1193	-64.99	2976	56
December	-0.677	0.0952	-67.61	2959	57

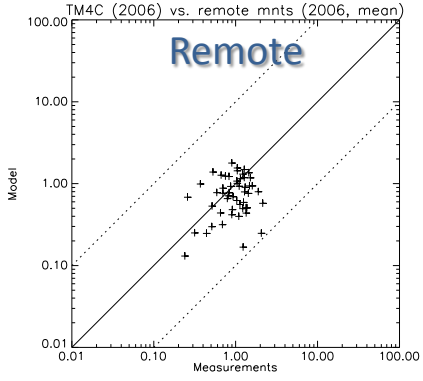




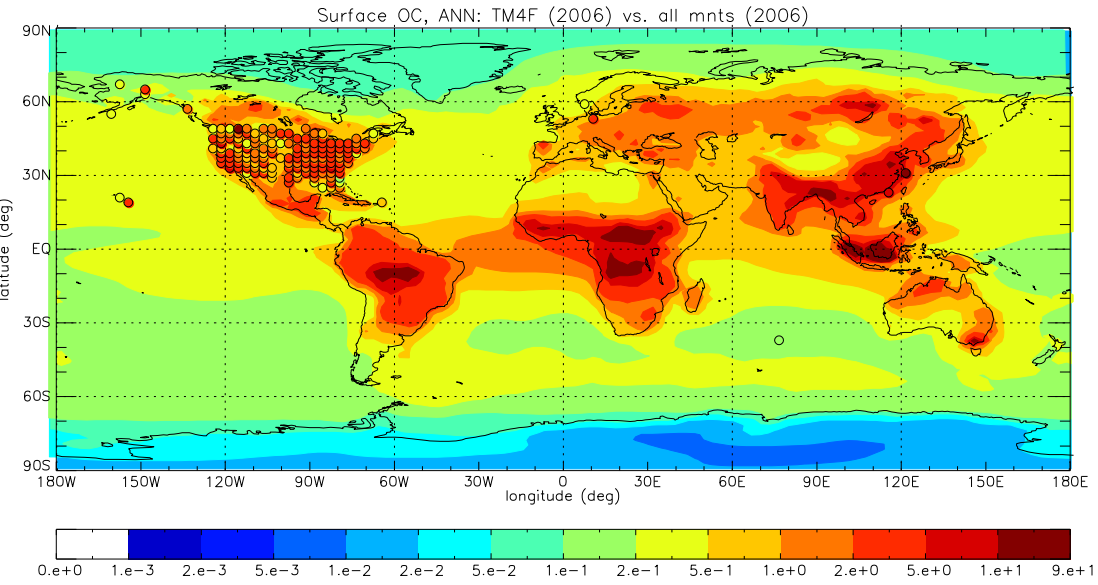






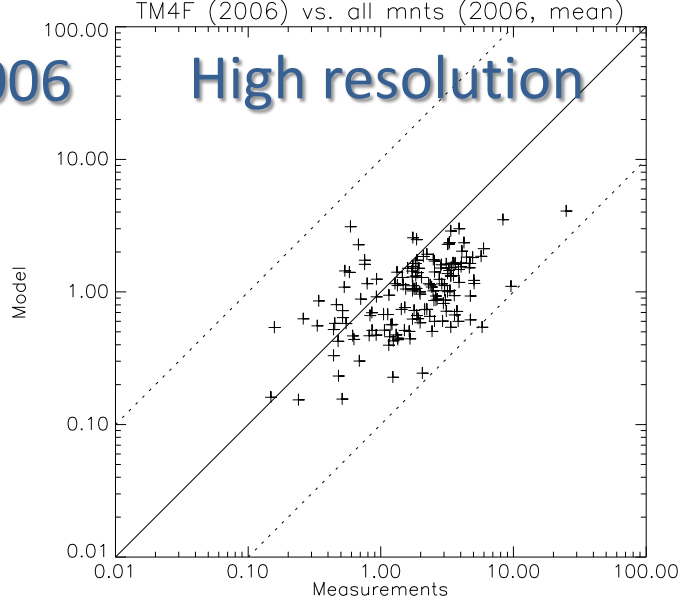


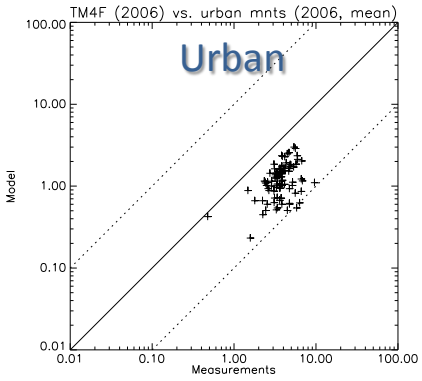
Month	R^2	Slope	MNB %	#obs	#grid boxes
Annual	**-0.733**	**0.1824**	**-56.08**	**35658**	**62**
Urban	**-0.192**	**0.217**	**-73.6**	**16007**	**47**
Remote	**-0.47**	**0.6848**	**-8.26**	**19185**	**52**
Marine	**-1.747**	**0.4787**	**40.31**	**466**	**9**
January	-0.472	0.0953	-63.2	3334	59
February	-0.252	0.1479	-66.7	2981	56
March	0.1015	0.1483	-62.47	3067	56
April	0.3842	0.1872	-64.97	3008	57
May	0.1908	0.1998	-64.39	3127	57
June	0.2225	0.2671	-64.04	2751	56
July	-0.245	0.2699	-58.21	2986	58
August	-0.774	0.2685	-47.73	2945	56
September	-0.379	0.2217	-33.03	2770	57
Octomber	-1.246	0.1385	-44.98	2804	57
November	-1.427	0.1002	-55.83	2789	57
December	0.0751	0.3034	-58.3	3096	56

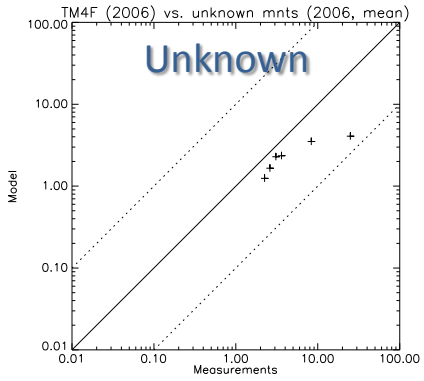


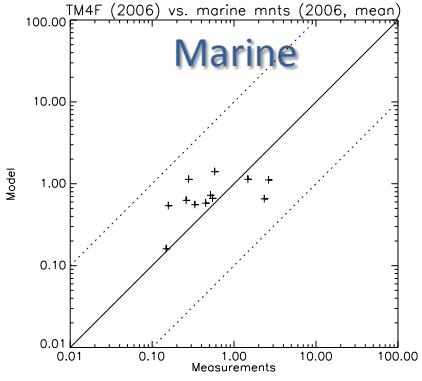
2006

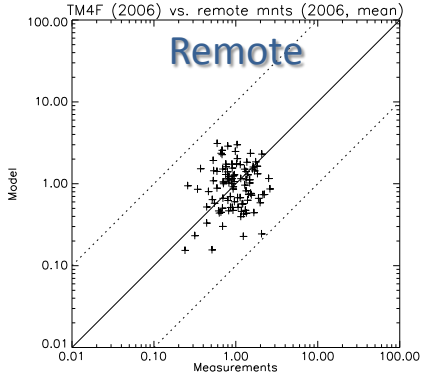
High resolution



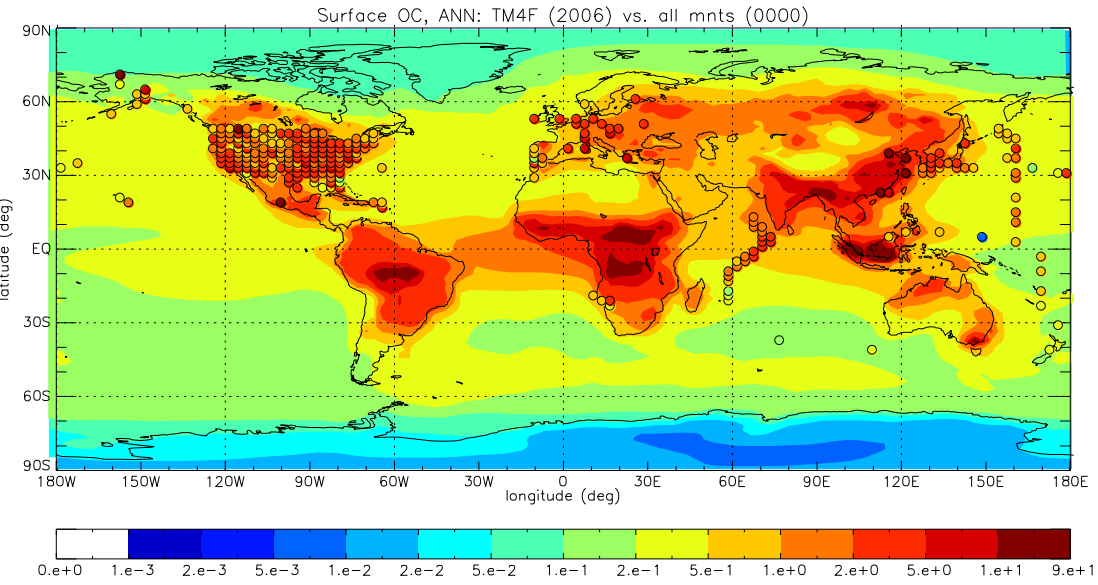




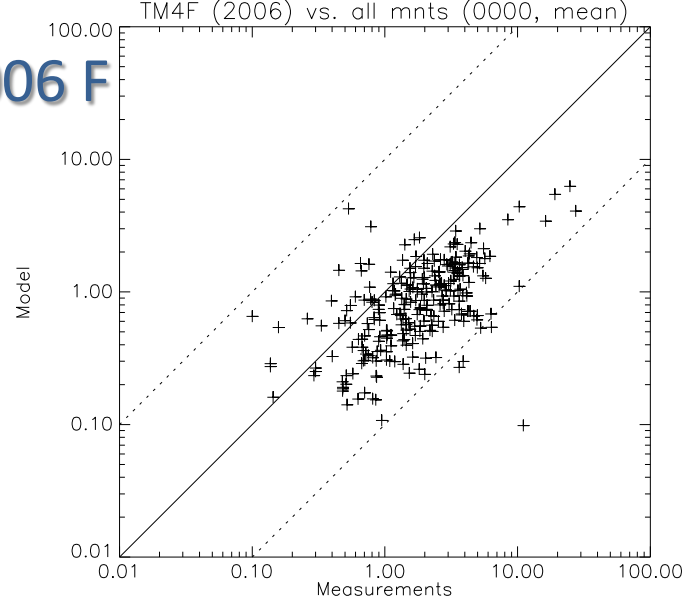


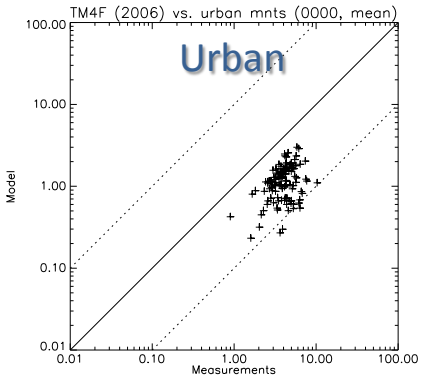


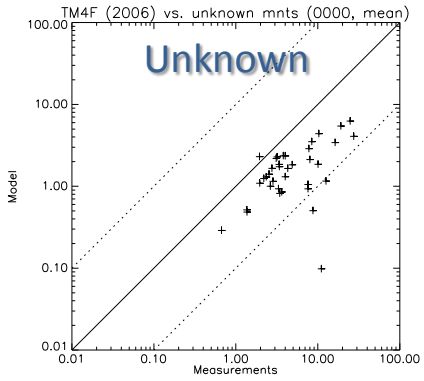
Month	R^2	Slope	MNB %	#obs	#grid boxes
Annual	**0.2871**	**1.9089**	**-28.29**	**35658**	**154**
Urban	**0.1224**	**0.8259**	**-65.60**	**14959**	**94**
Remote	**0.0002**	**0.0095**	**26.06**	**19185**	**101**
Marine	**0.1338**	**0.9025**	**70.20**	**466**	**12**
January	0.2345	2.4652	-43.97	3334	141
February	0.2946	1.8889	-45.53	2981	138
March	0.3961	2.5132	-42.20	3067	138
April	0.4027	2.2564	-56.27	3008	139
May	0.3745	1.9971	-52.64	3127	139
June	0.3339	1.2920	-49.90	2751	136
July	0.2067	0.9600	-35.82	2986	143
August	0.0242	0.2363	-0.37	2945	139
September	0.0022	0.0527	20.01	2770	138
Octomber	0.1500	1.1981	-5.69	2804	135
November	0.1569	1.7426	-29.22	2789	136
December	0.0898	0.7728	-34.37	3096	134

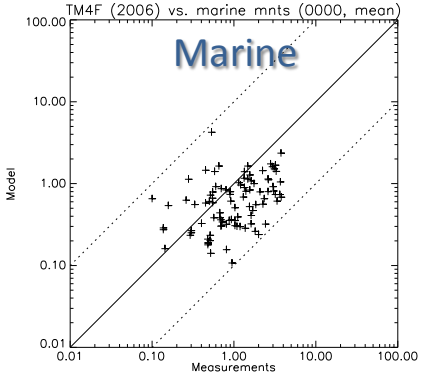


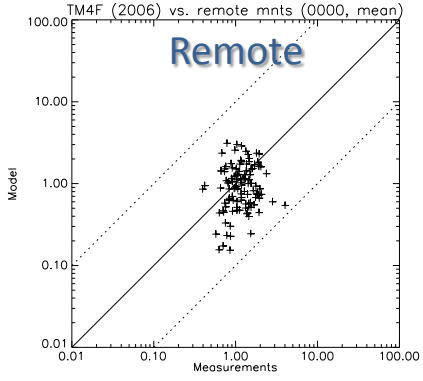
2006 F







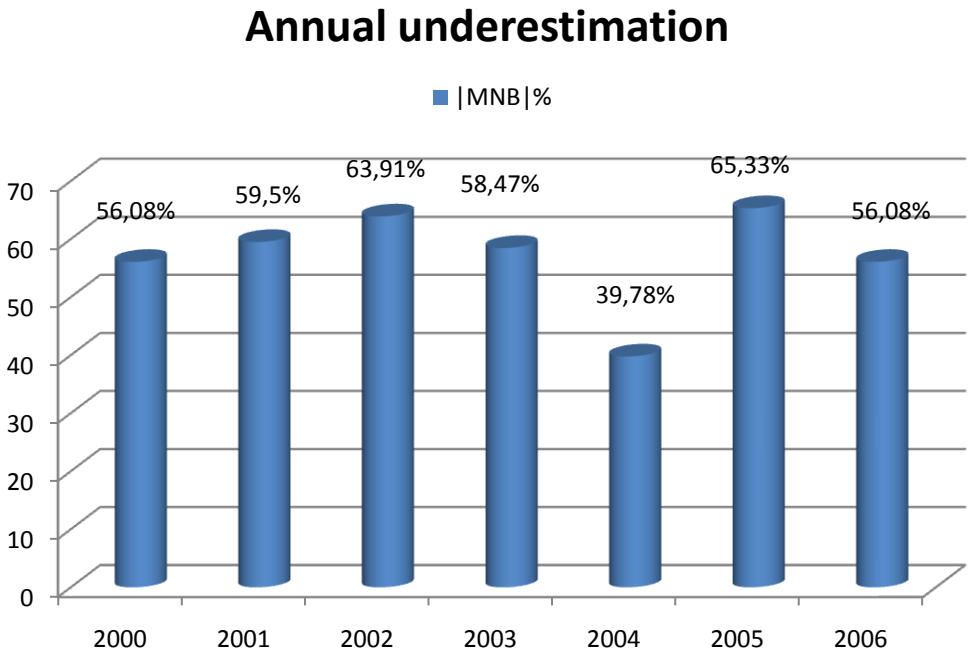


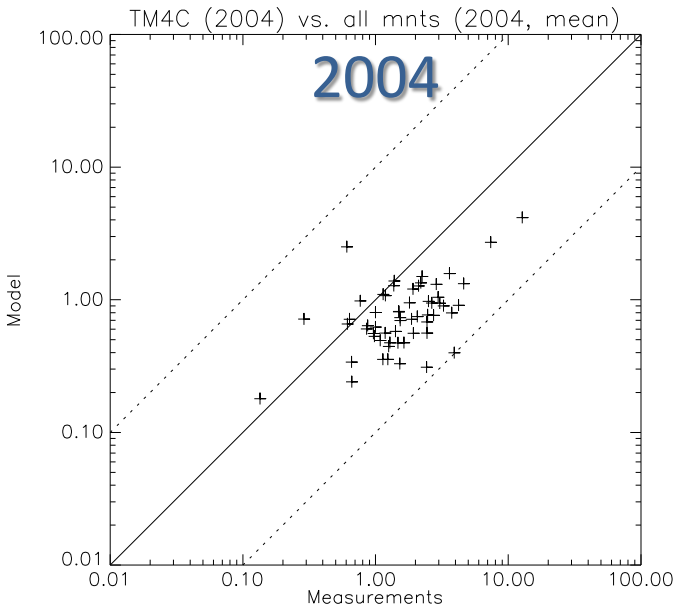


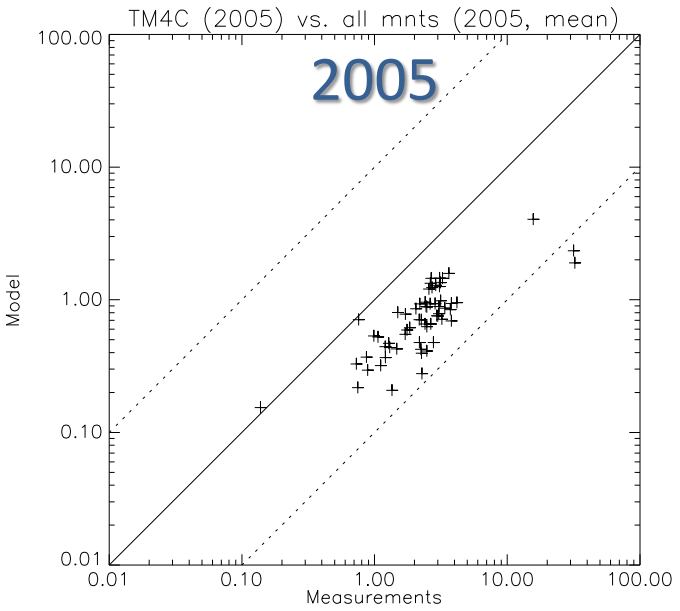
Month	R^2	Slope	MNB %	#obs	#grid boxes
Annual	**0.4480**	**2.427**	**-23.90**	**272912**	**271**
Urban	**0.0911**	**0.746**	**-69.05**	**100927**	**157**
Remote	**0.0018**	**0.034**	**-3.87**	**169952**	**117**
Marine	**0.1187**	**0.5945**	**26.16**	**2033**	**96**
January	0.3838	2.586	-53.47	22482	172
February	0.3795	2.4188	-54.63	21073	165
March	0.3758	2.7039	-53.70	23111	198
April	0.4617	2.3595	-59.70	22173	178
May	0.4852	2.2361	-54.16	23550	181
June	0.2887	1.8351	-49.64	22081	172
July	0.2304	0.9588	-25.21	23955	193
August	0.1168	0.5865	-26.01	23480	169
September	0.0262	0.2071	3.76	21965	169
Octomber	0.2928	1.8179	-32.29	22922	165
November	0.3376	3.0458	-42.87	23583	175
December	0.4294	2.6188	-44.30	22537	165

Total 2000-2006

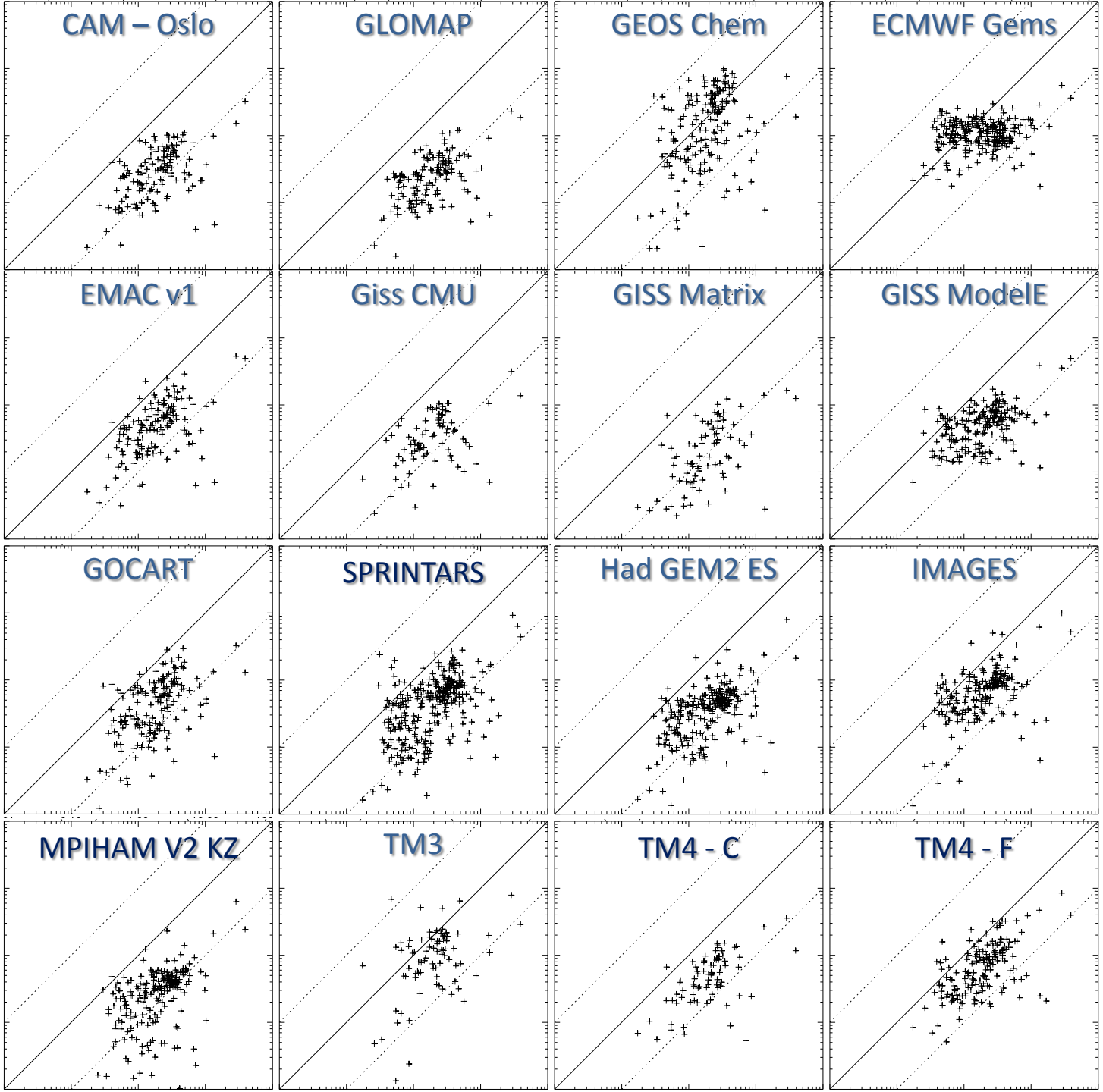
Year	R^2	Slope	MNB %	#obs	#grid boxes
2000	-0.733	0.1824	**-56.08**	35658	62
2001	0.436	0.1667	**-59.5**	23251	79
2002	0.0533	0.1841	**-63.91**	34425	68
2003	0.5469	0.2984	**-58.47**	38879	70
2004	0.4139	0.3516	**-39.78**	29529	58
2005	-0.351	0.1178	**-65.33**	39380	62
2006	-0.733	0.1824	**-56.08**	35658	62



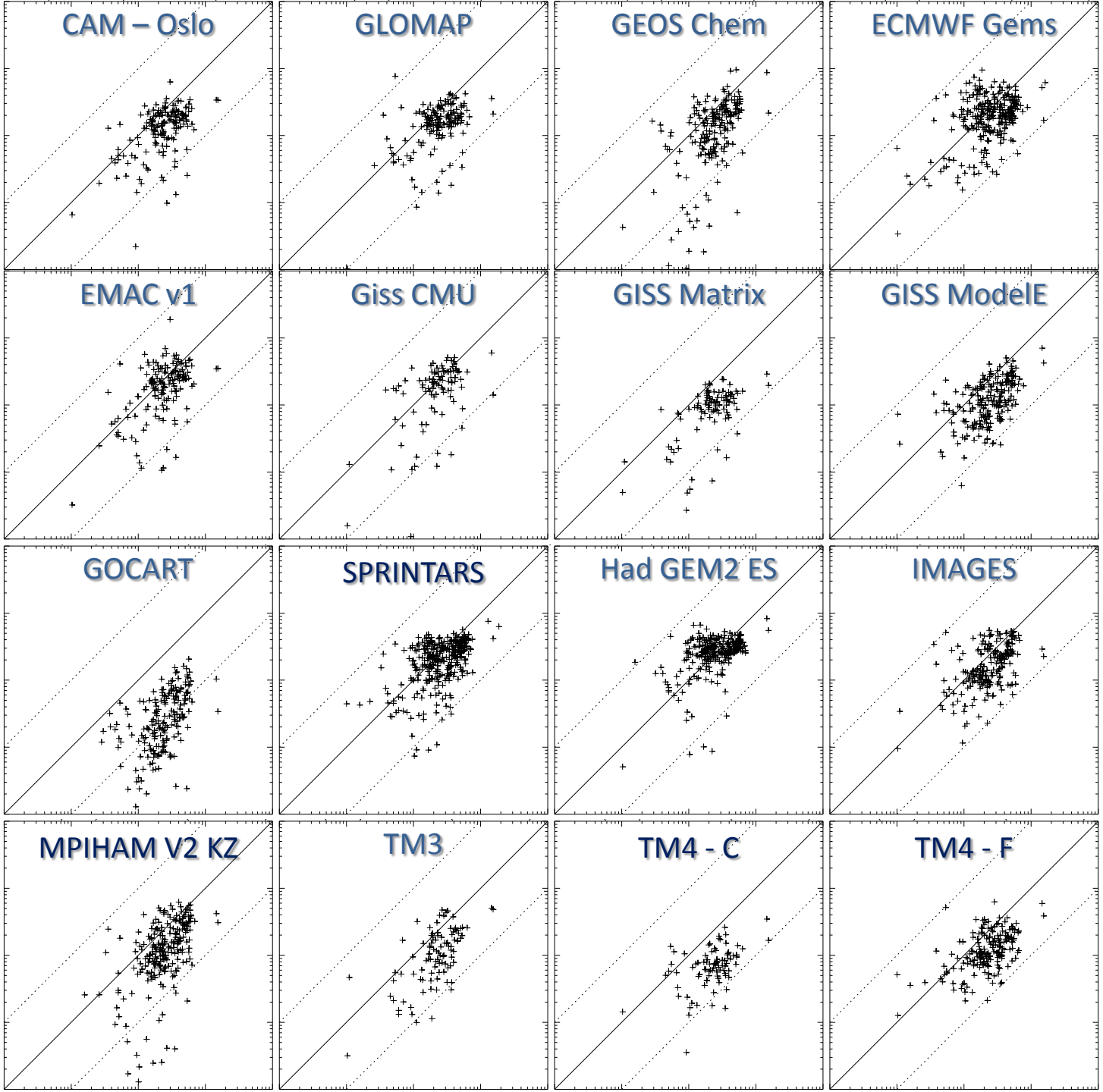


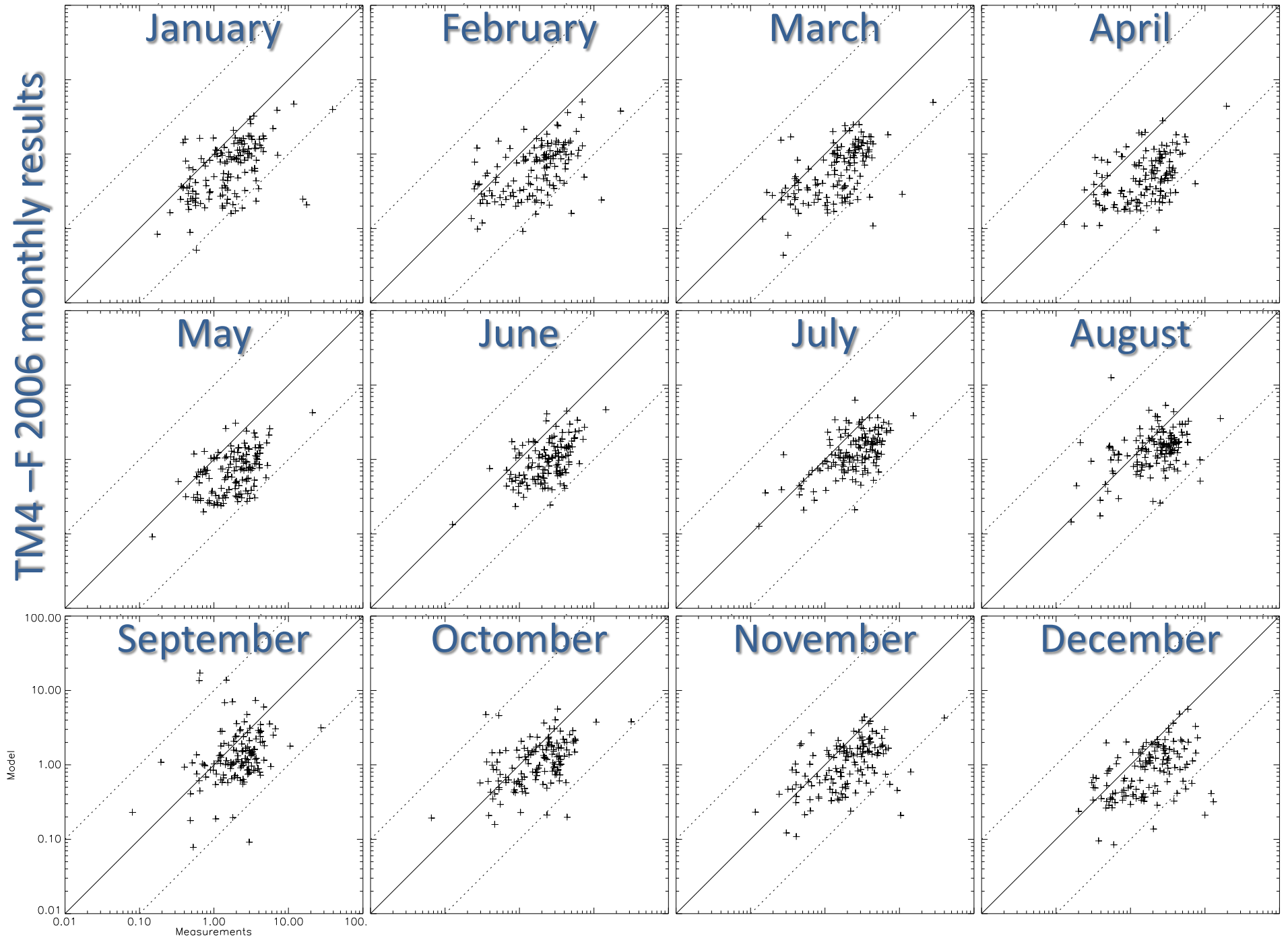


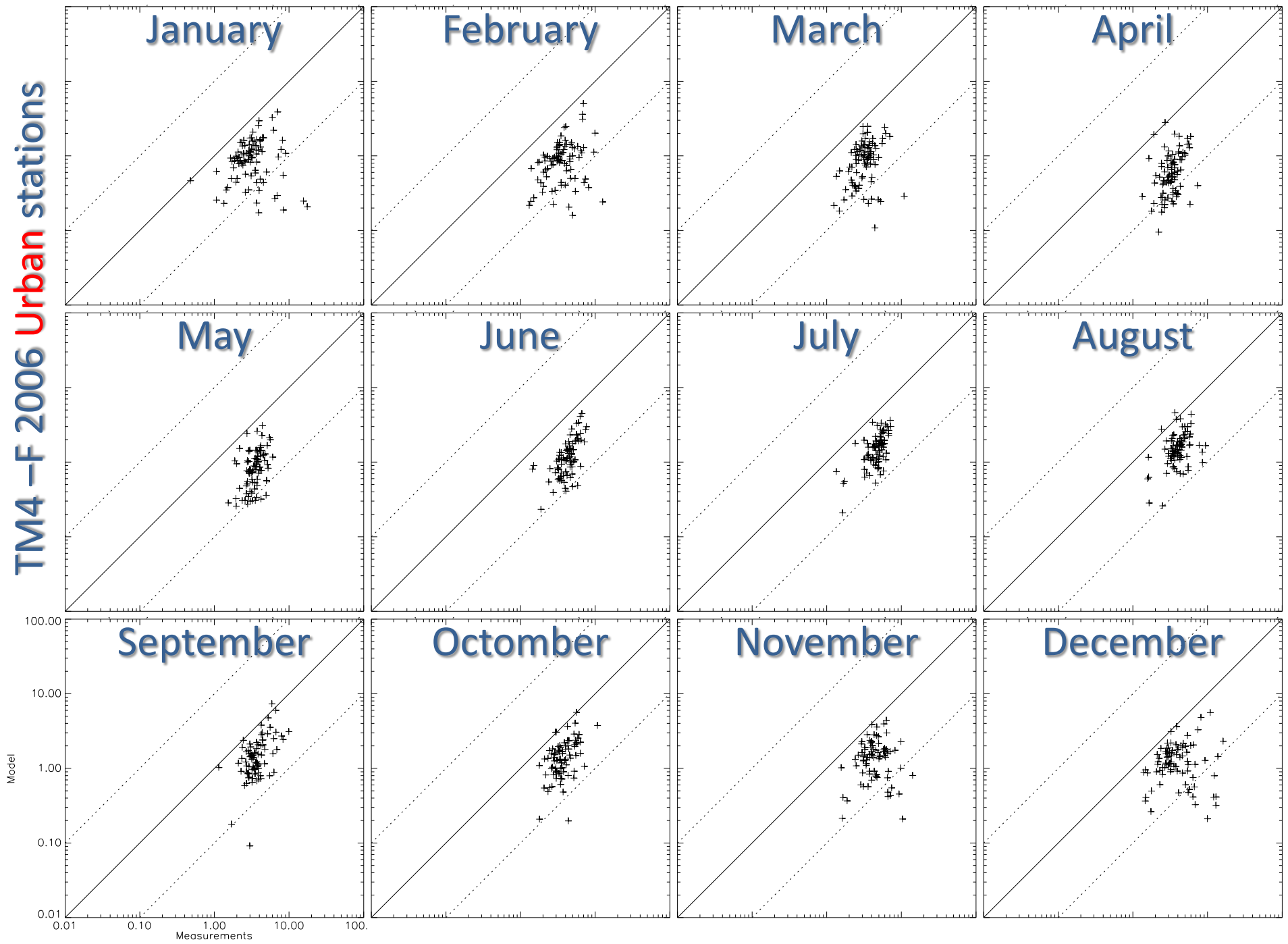
January – all measurements

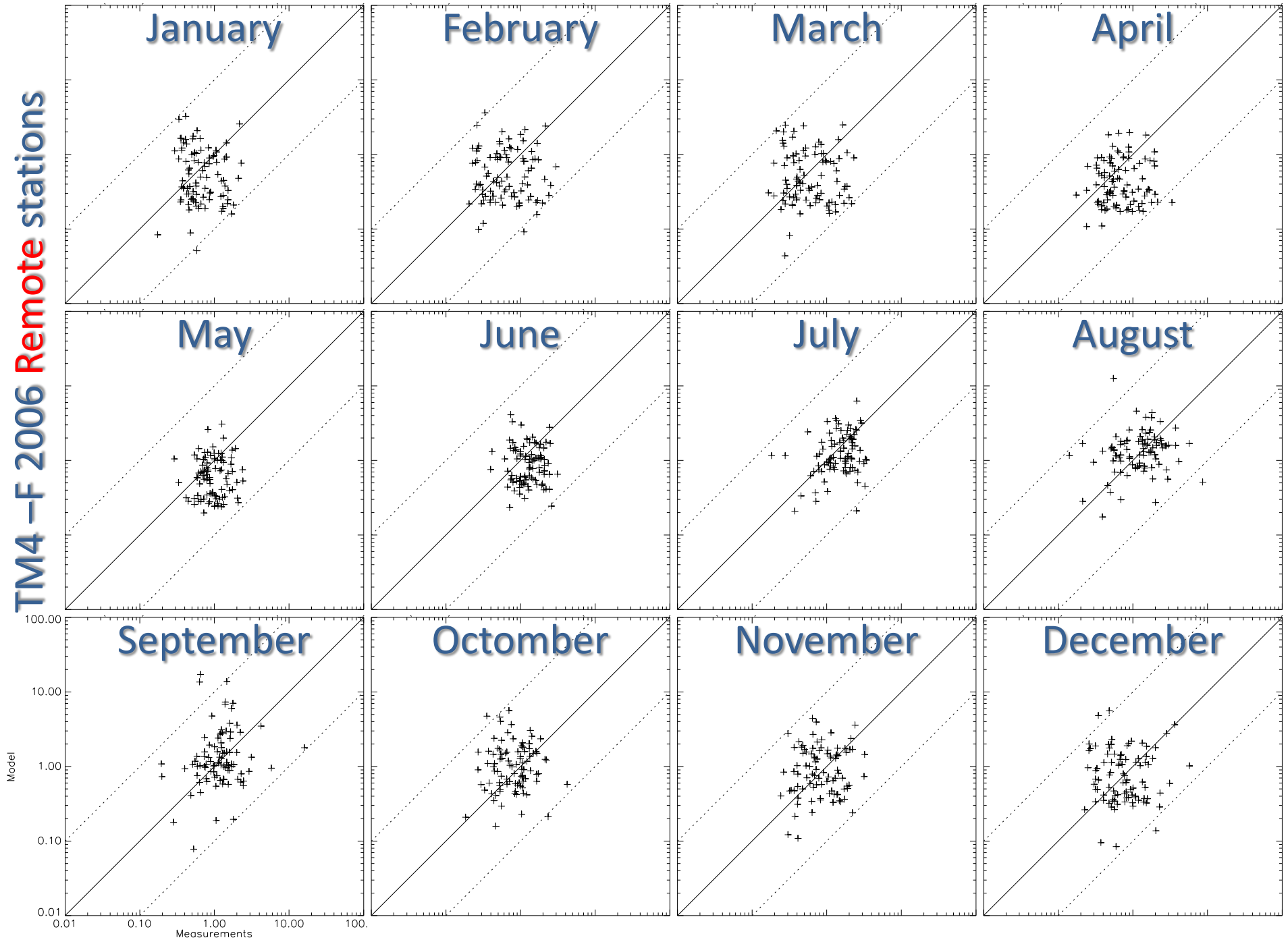


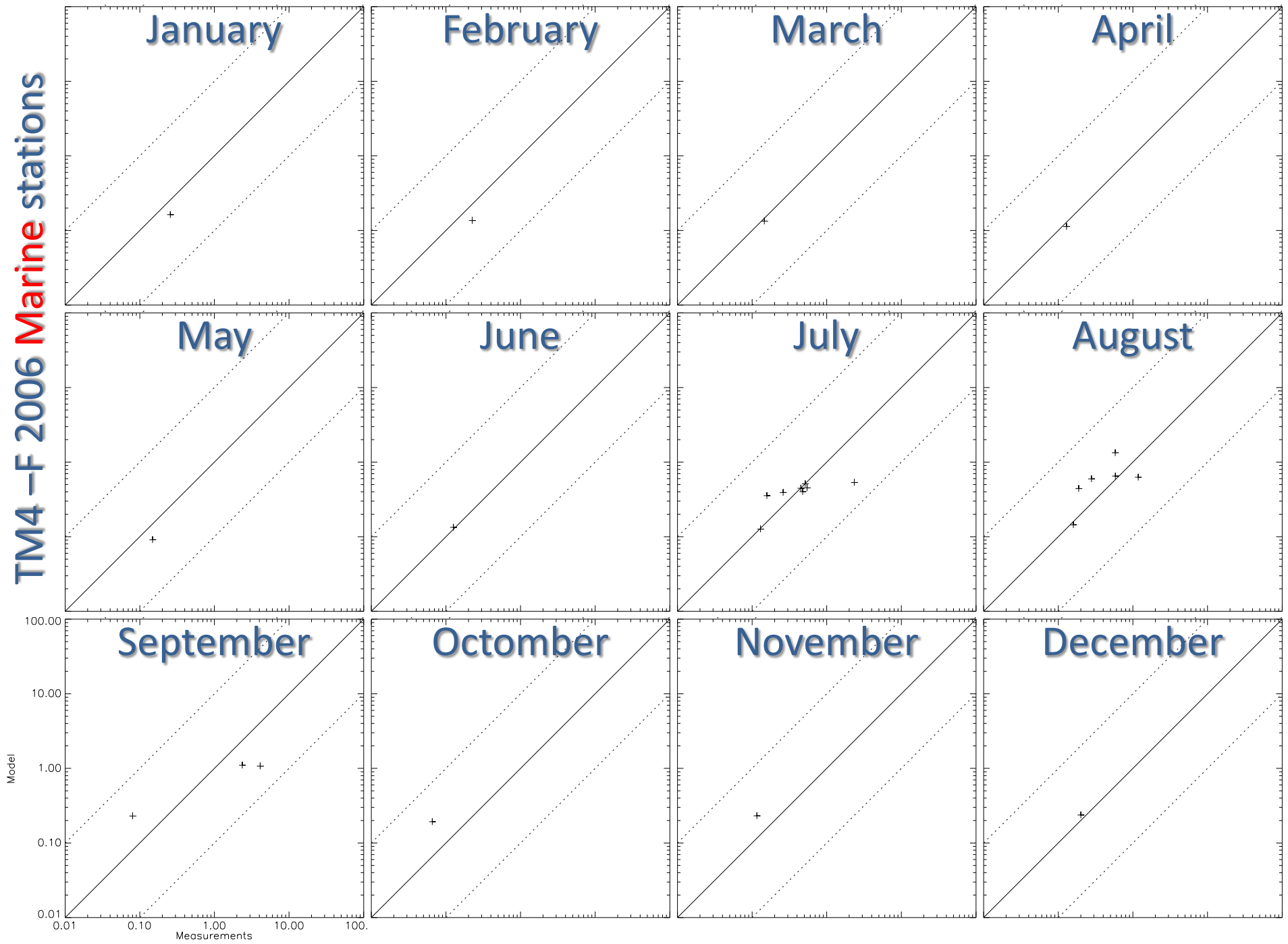
July – all measurements

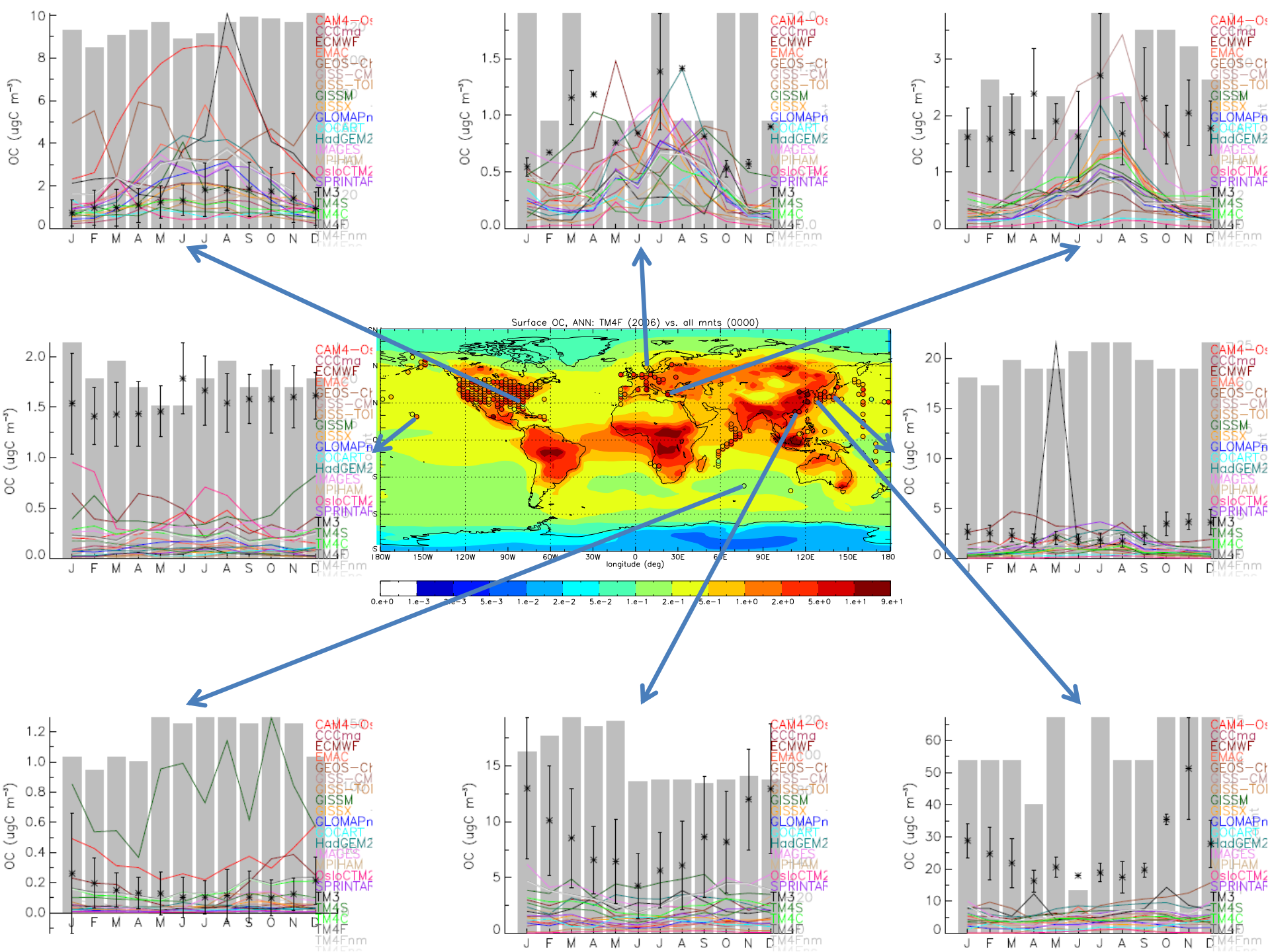


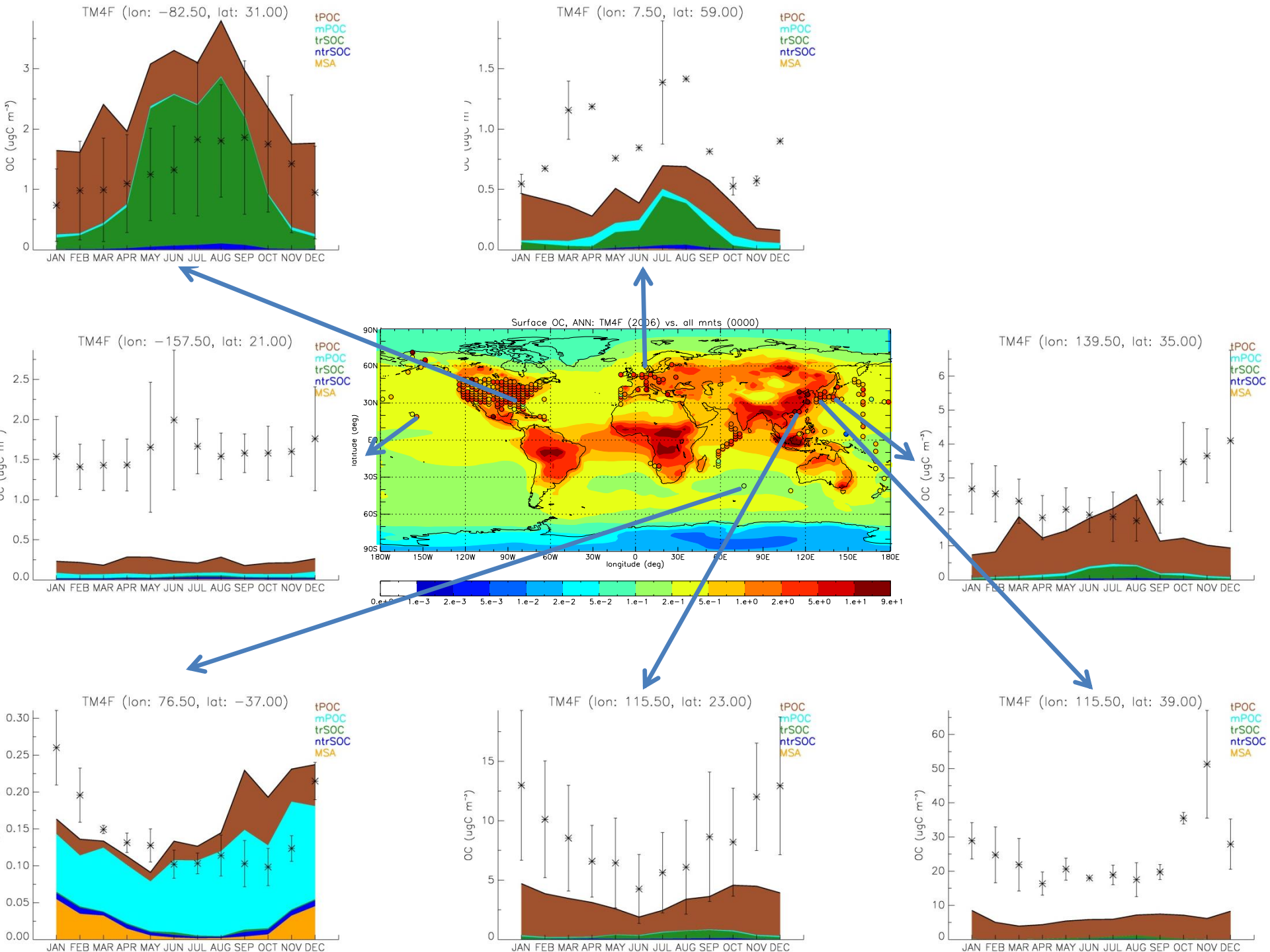

TM4 –F 2006 monthly results
January
February
March
April
May
June
July
August
September
October
November
December
100.00
10.00
1.00
0.10
0.01
Model
0.01
0.10
1.00
10.00
100.
Measurements

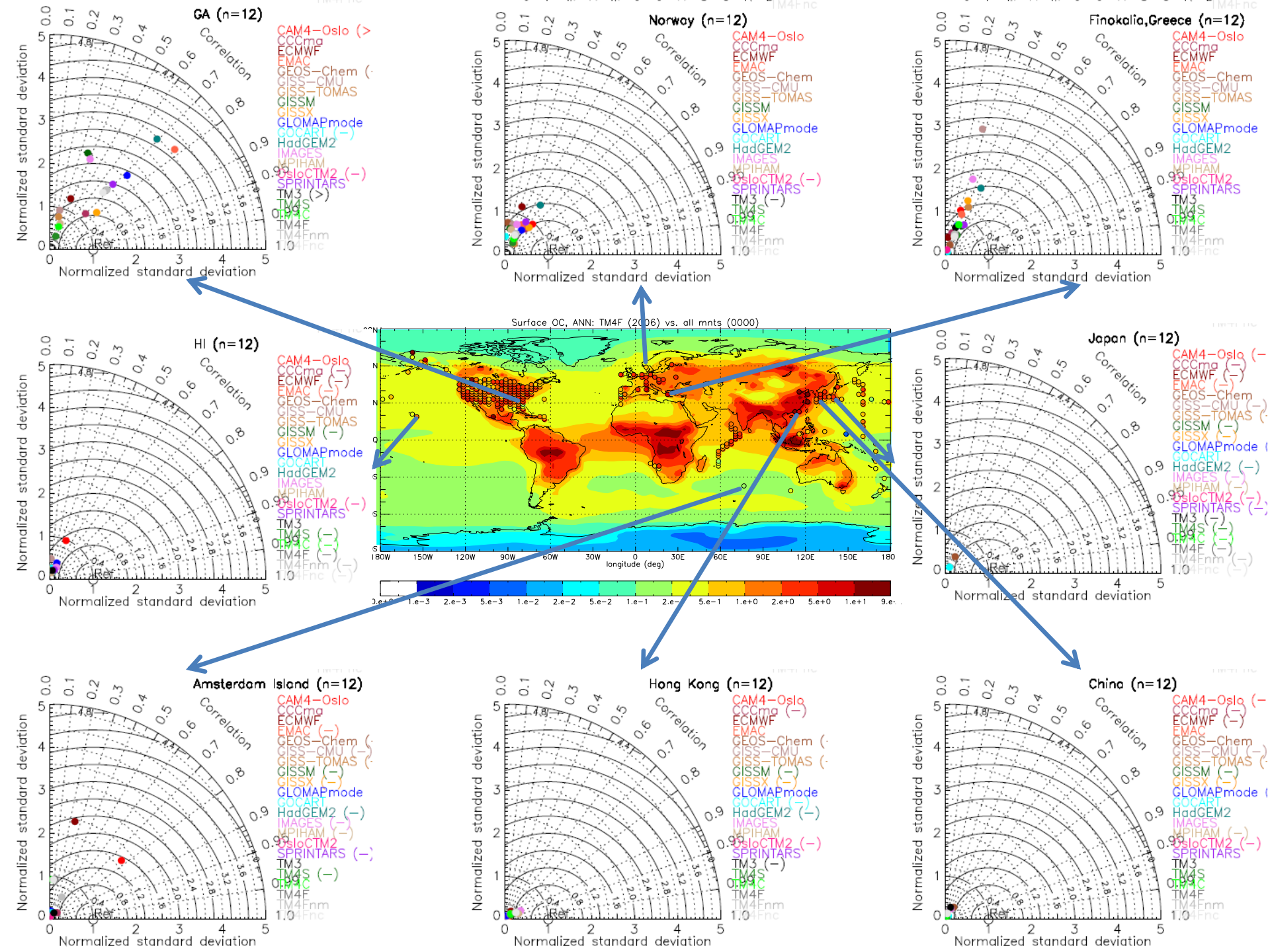

TM4 –F 2006 Urban stations
January
February
March
April
May
June
July
August
September
October
November
December
100.00
10.00
1.00
0.10
0.01
Model
0.01
0.10
1.00
10.00
100.
Measurements


TM4 –F 2006 Remote stations
January
February
March
April
May
June
July
August
September
October
November
December
100.00
10.00
1.00
0.10
0.01
Model
0.01
0.10
1.00
10.00
100.
Measurements


TM4 –F 2006 Marine stations
January
February
March
April
May
June
July
August
September
October
November
December
100.00
10.00
1.00
0.10
0.01
Model
0.01
0.10
1.00
10.00
100.
Measurements


Surface OC, ANN: TM4F (2006) vs. all mnts (0000)
OC (ugC m⁻³)
J F M A M J J A S O N D
CAM4-Os
CCCma
ECMWF
EMAC
GEOS-Ch
GISS-CM
GISS-TOI
GISSM
GISSX
GLOMAPn
HadGEM2
IMAGES
OsloCTM2
SPRINTAF
TM3
TM4S
TM4C
TM4F
TM4Fnm
longitude (deg)
0.e+0 1.e-3 2.e-3 5.e-3 1.e-2 2.e-2 5.e-2 1.e-1 2.e-1 5.e-1 1.e+0 2.e+0 5.e+0 1.e+1 9.e+1


TM4F (lon: −82.50, lat: 31.00)
TM4F (lon: 7.50, lat: 59.00)
TM4F (lon: −157.50, lat: 21.00)
TM4F (lon: 139.50, lat: 35.00)
TM4F (lon: 76.50, lat: −37.00)
TM4F (lon: 115.50, lat: 23.00)
TM4F (lon: 115.50, lat: 39.00)
tPOC
mPOC
trSOC
ntrSOC
MSA
OC (ugC m⁻³)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
Surface OC, ANN: TM4F (2006) vs. all mnts (0000)
latitude (deg)
longitude (deg)
90N
60N
30N
EQ
30S
60S
90S
180W 150W 120W 90W 60W 30W 0 30E 60E 90E 120E 150E 180E
0.e+0 1.e-3 2.e-3 5.e-3 1.e-2 2.e-2 5.e-2 1.e-1 2.e-1 5.e-1 1.e+0 2.e+0 5.e+0 1.e+1 9.e+1


GA (n=12)
Norway (n=12)
Finokalia,Greece (n=12)
HI (n=12)
Japan (n=12)
Amsterdam Island (n=12)
Hong Kong (n=12)
China (n=12)
Surface OC, ANN: TM4F (2006) vs. all mnts (0000)
Normalized standard deviation
Correlation
longitude (deg)
CAM4-Oslo
CCCma
ECMWF
EMAC
GEOS-Chem
GISS-CMU
GISS-TOMAS
GISSM
GISSX
GLOMAPmode
GOCART
HadGEM2
IMAGES
MPIHAM
OsloCTM2
SPRINTARS
TM3
TM4S
TM4C
TM4F
TM4Fnm

Changes on the TM4 – ECPL model and their effect

- 34 vertical levels instead of 31
  - better vertical distributions
  - no discontinuity in air mass profiles
- ERA – interim meteo instead of operational
  - Global burden of OA reduced by ~30%
  - Mostly from ageing and aqueous face OA
- GFED emission database in 3D

Thank you!