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Primary biogenic aerosol particles in EC-Earth

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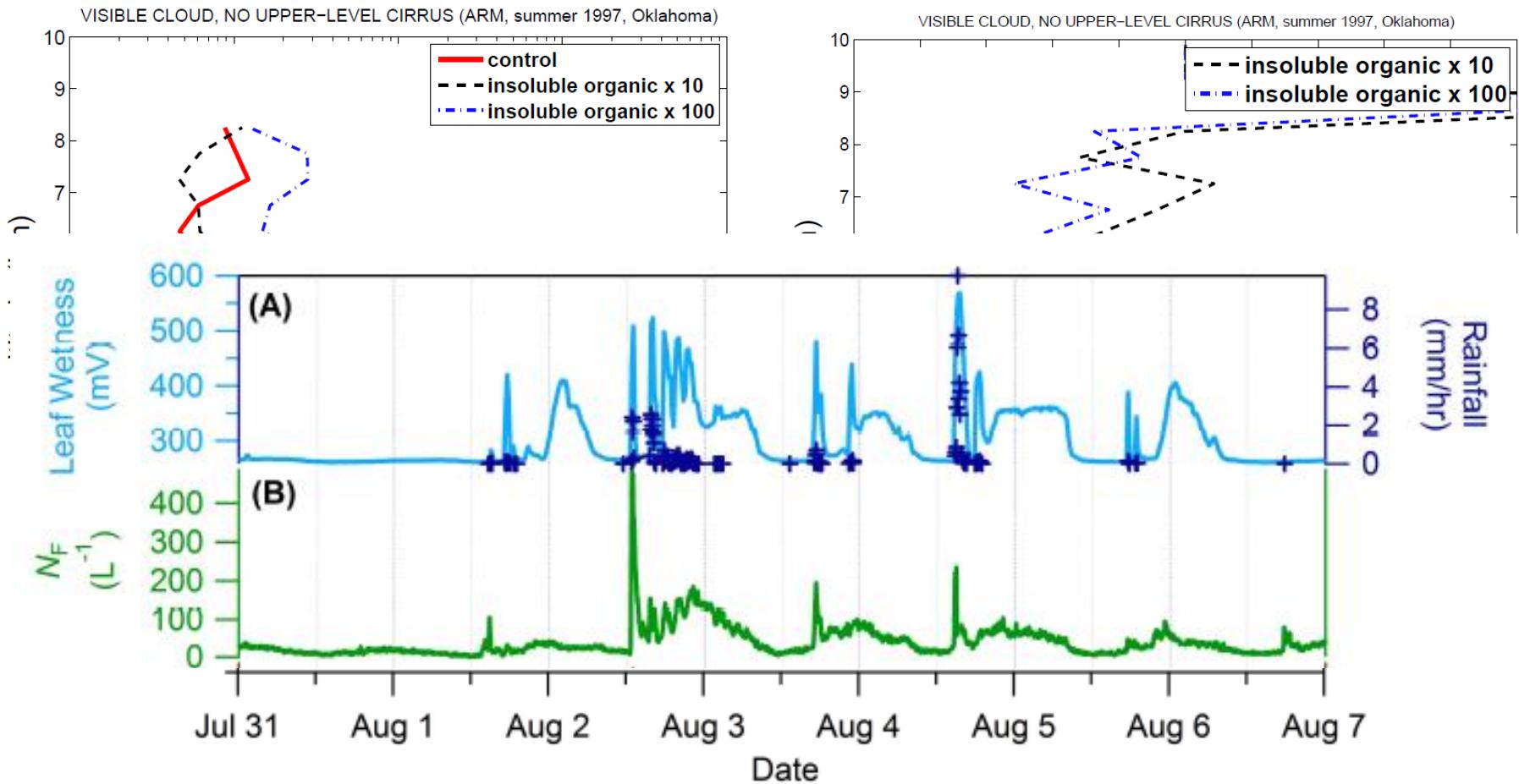


Introduction

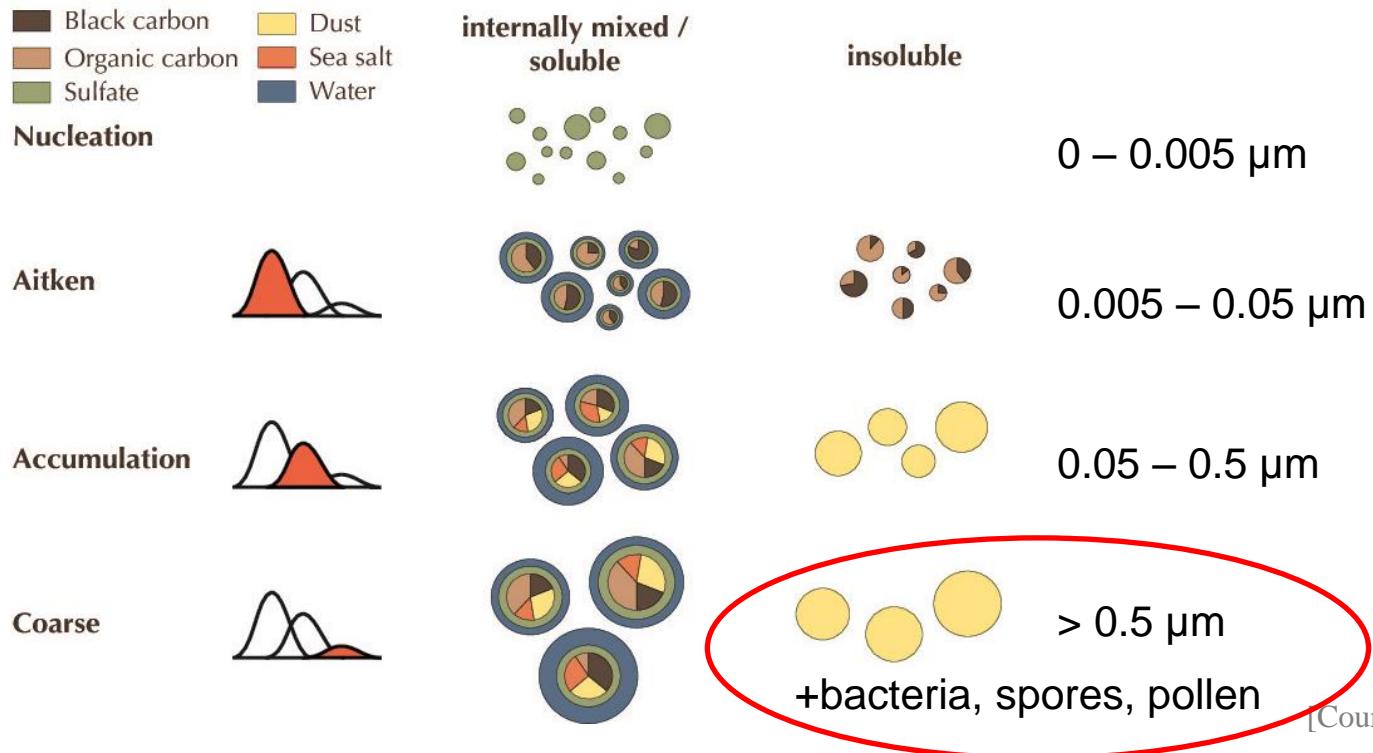
- Primary biological aerosol particles (PBAP):
 - bacteria, fungal spores, pollen, plant debris, ...
- can constitute major fraction of supermicron particle number (e.g., Jaenicke, 2005, Science) and organic mass
- can act as CCN and IN
- some ambient PBAP species can nucleate ice at warmer temperatures than mineral dust (Després et al., 2012, Tellus B)
- airborne spread of diseases

How do they impact cloud properties and on which scale?

Cloud-System Resolving Modelling



Particle microphysics: M7 [Vignati et al., 2004, JGR]



[Courtesy, IACETH]

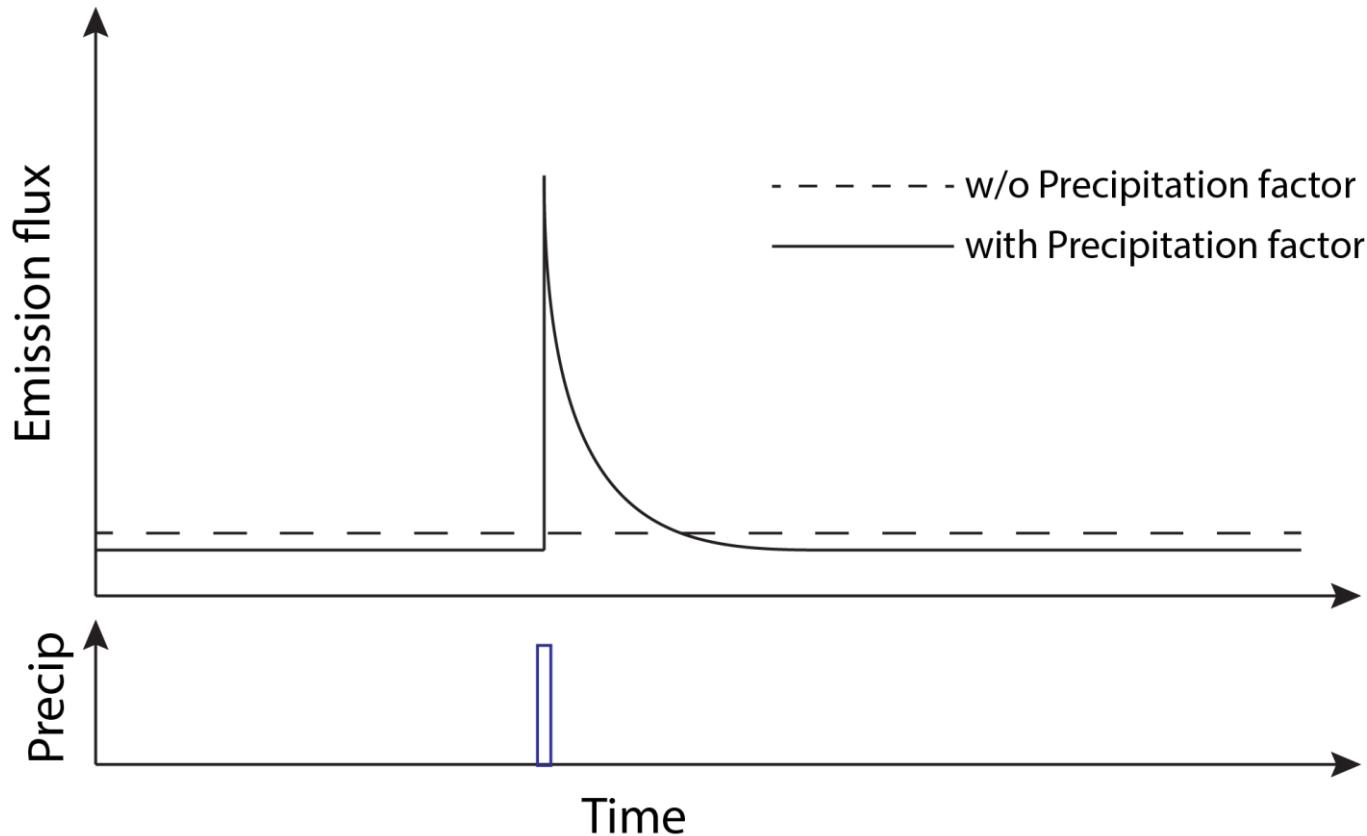
- 7 lognormal modes
- 25+3 prognostic variables (number in mode + mass per species and mode)
- in TM5: + nitrate partitioning (EQSAM) and reactive uptake of N_2O_5

PBAP emissions

- depend on meteorological parameters...
 - gustiness
 - precipitation
 - relative humidity
 - temperature
- ...and vegetation type and fraction / LAI
- starting point: emission fluxes from Hoose et al. (2010, Env. Res. L.)
- + dependency on gustiness and seasonality (Jacobson and Streets, 2009, JGR)
- + dependency on precipitation rate (derived from Huffman et al., 2013, ACP)

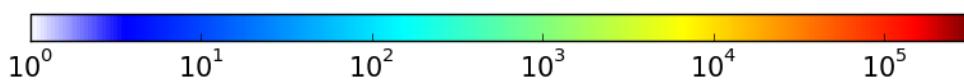
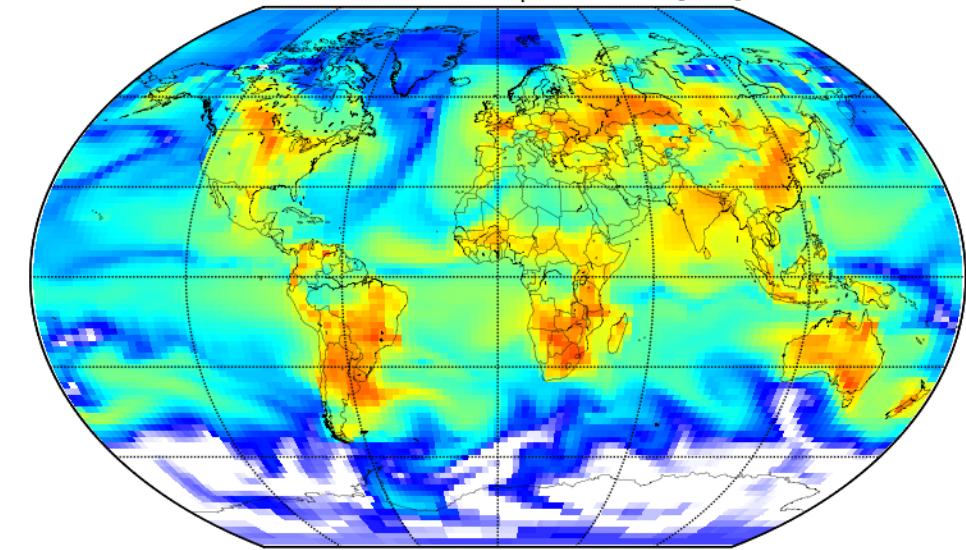
$$F_{Bacteria} = f_{gust} \ f_{season} \ f_{precip} \sum F_{avg}(veg)$$

f_{Precip}

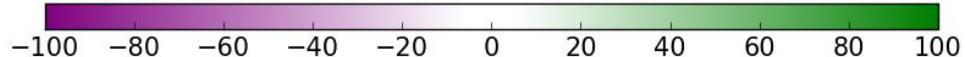
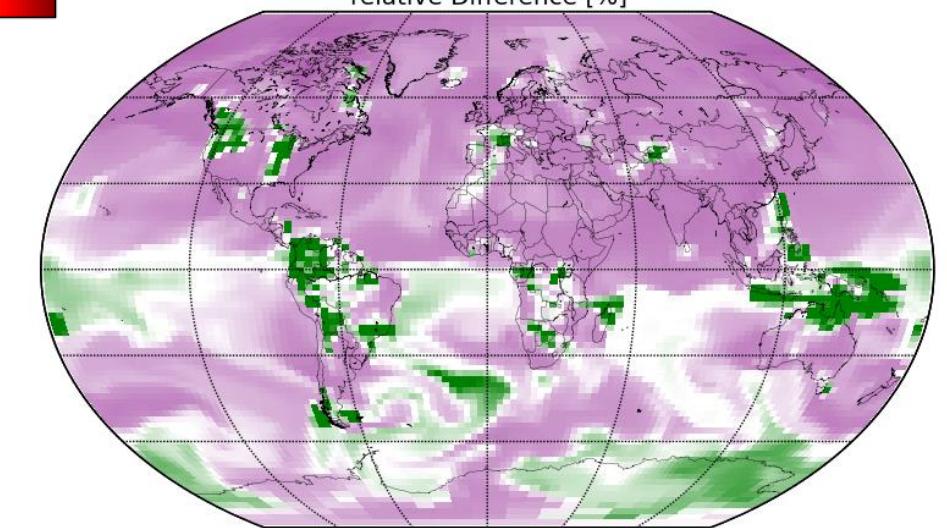


Snapshot Bacteria

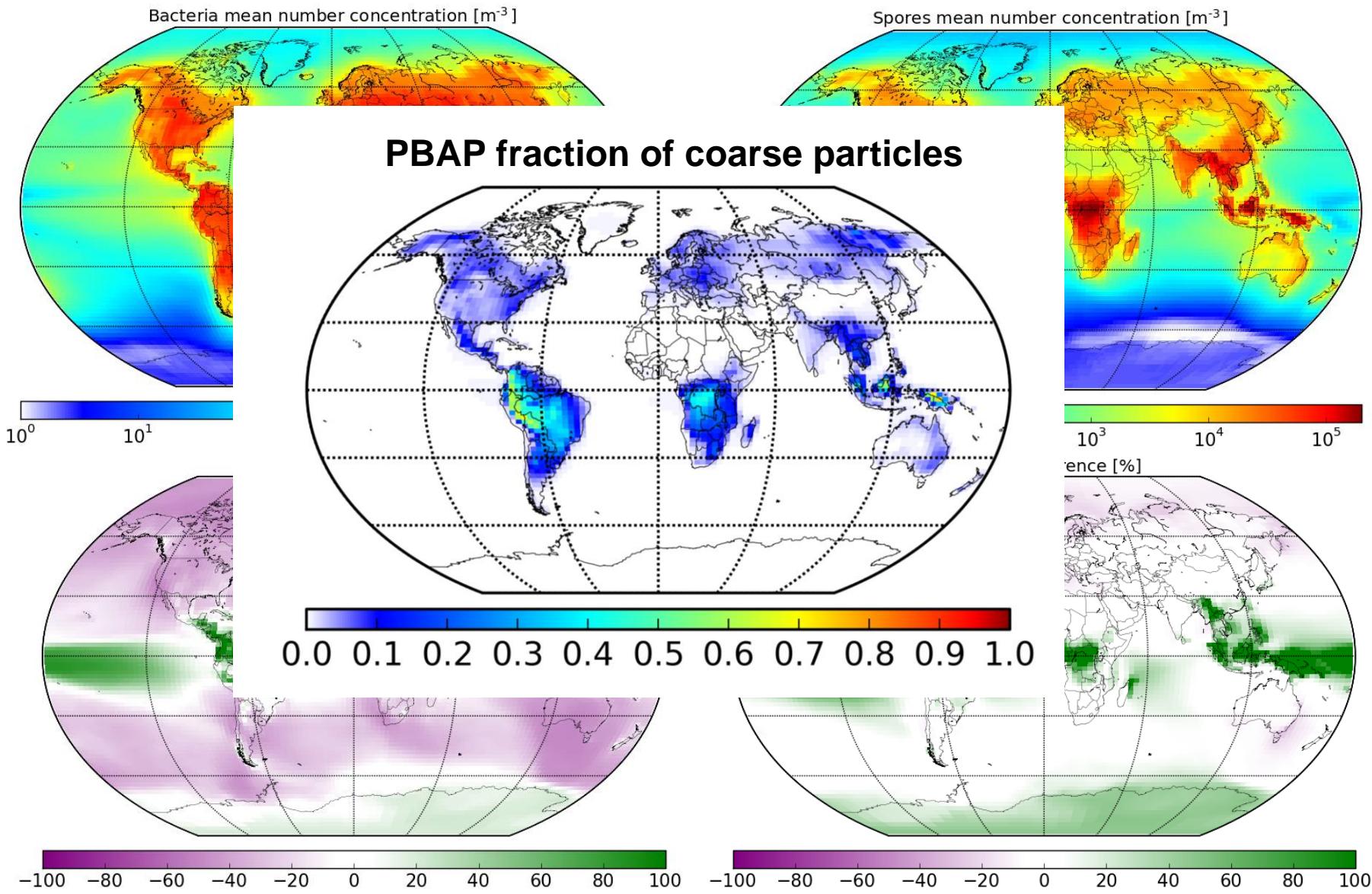
Bacteria, with RPrecip, 6:00 UTC [m^{-3}]



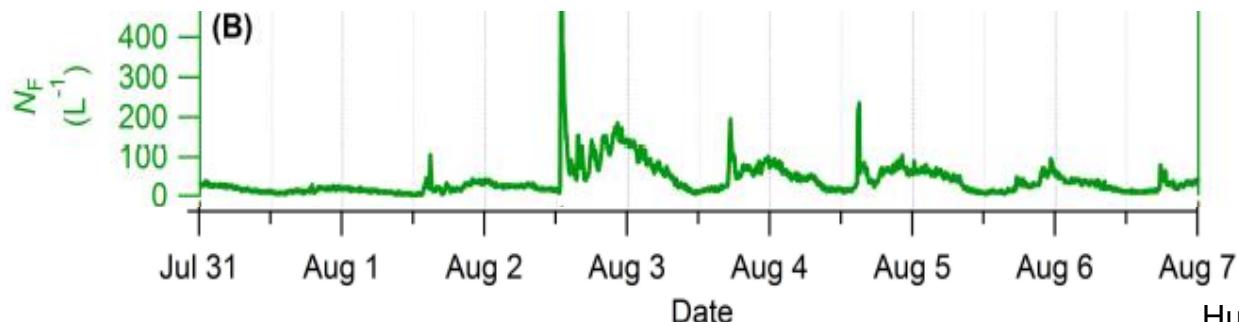
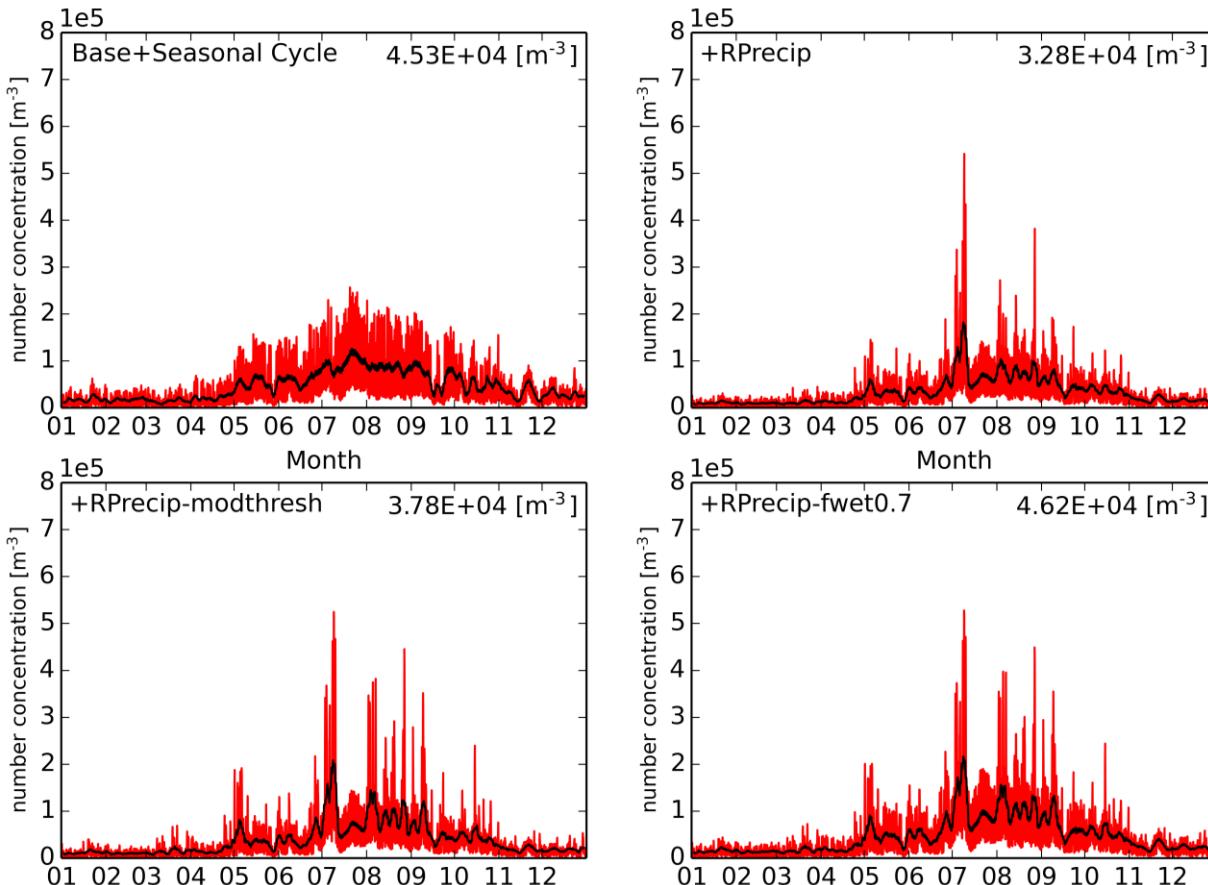
relative Difference [%]



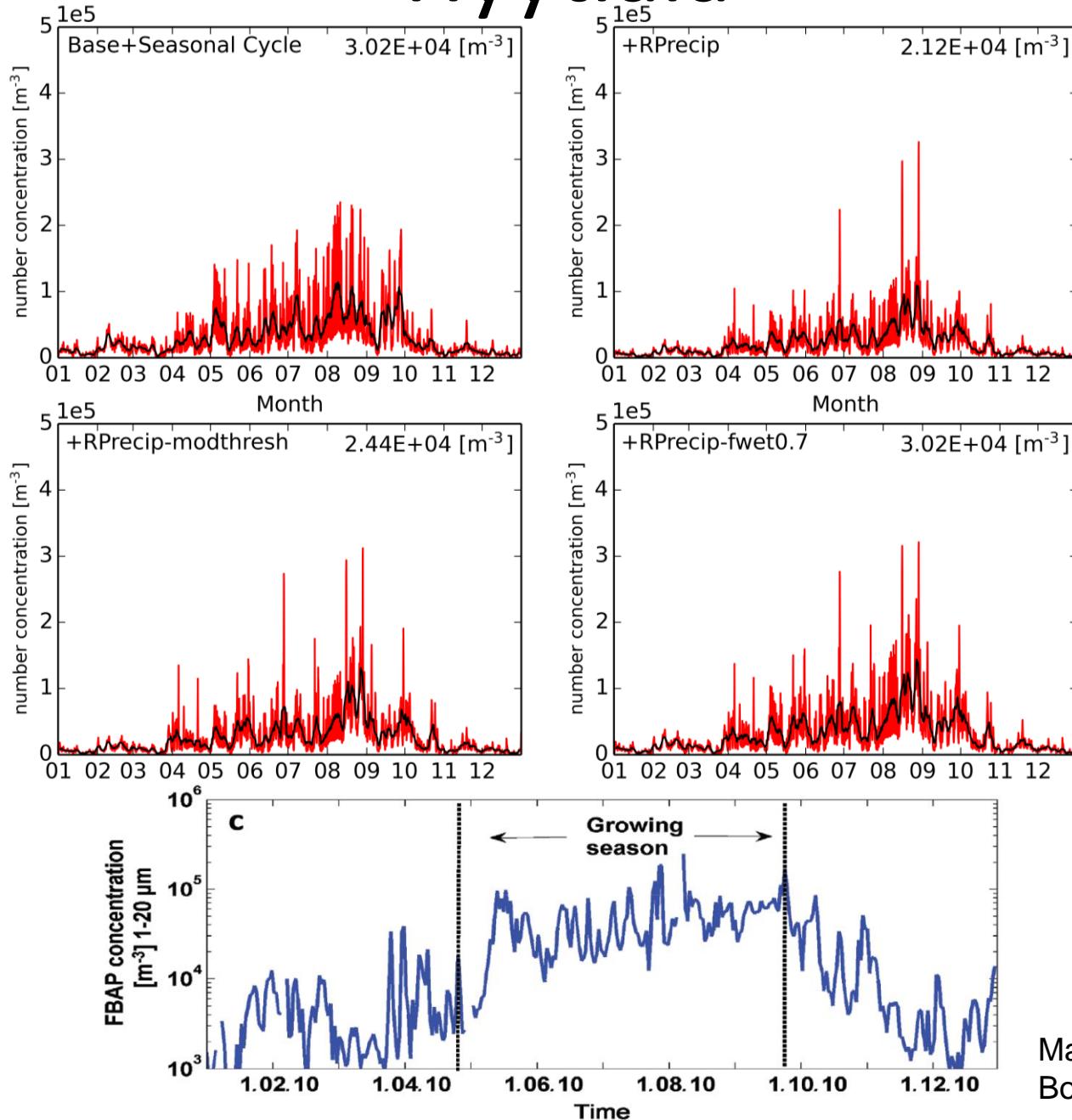
Annual mean number concentration [m^{-3}]



Colorado



Hyytiälä



Annual emission

	Global emissions (Tg yr^{-1})	References
Bacteria	0.74 (0.4–1.8)	Burrows et al. (2009b)
	0.7	Hoose et al. (2010a)
	2.58	A. Sesartic, personal communication
	28.1	Jacobson and Streets (2009)
	60	This work
Fungal spores	8	Sesartic and Dallaflor (2011)
	28	Heald and Spracklen, (2009)
	31	Hoose et al. (2010a)
	50	Elbert et al. (2007)
	186	Jacobson and Streets (2009)
	163	This work

Deprés et al., 2012, Tellus B

What's next?

- Validation of PBAP emissions
- SOA from BVOCs
- Link PBAP to cloud processes in IFS