Sea salt over the Southern Ocean

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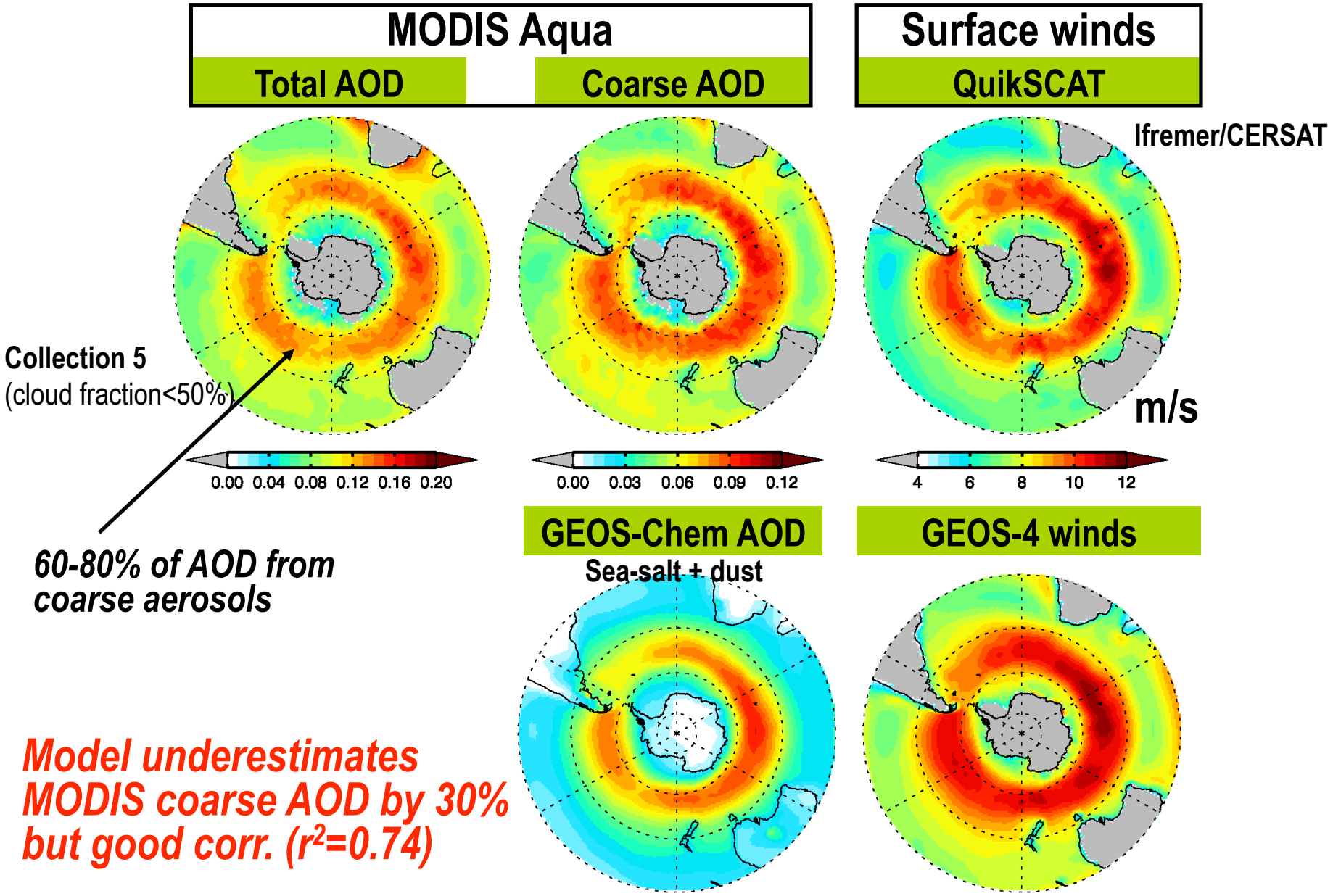
- **Sea salt aerosols are a major contributor to aerosol mass, but emissions remain highly uncertain**

Global source (Tg/yr)	Reference
5,000 (1,200-20,000)	Lewis & Schwartz, 2004
5,400	Alexander et al., 2005: Monahan et al. (1986) 2 size bins (0.1-0.5 and 0.5-10μm); GEOS-STRAT
8,000	GEOS-4 (2003-2006)
→13,000	**Based on MODIS AOD ←**

$3.41\ u_{10m}$

NOAA NWS Collection

MODIS AOD: 20°S-80°S (2003-2006)



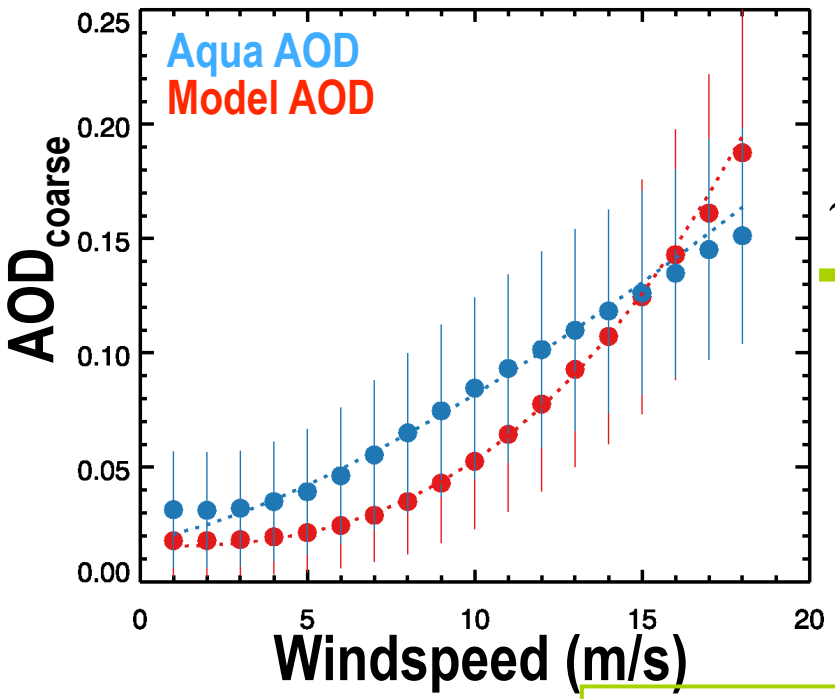
Windspeed dependence

2003-2006 daily AOD grouped in 1 m/s wind bins (620,000 points)

Eliminate cloud fraction>50% + dust>10% AOD_{coarse}

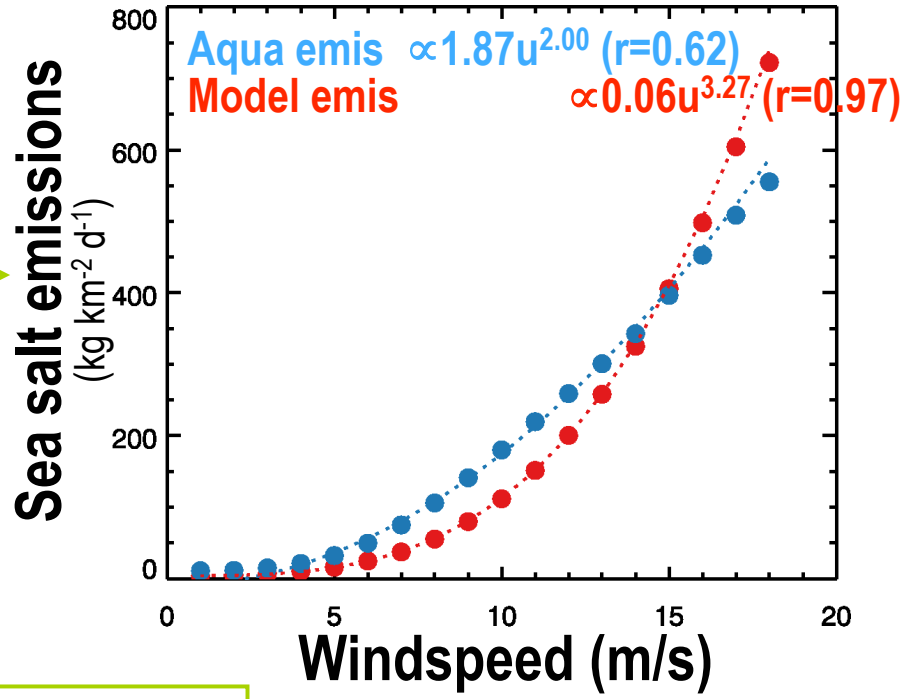
20°S-80°S

$AOD_{coarse} = f(u_{10})$



τ_{ss}~12h

$Emis(sea\ salt) = f(u_{10})$

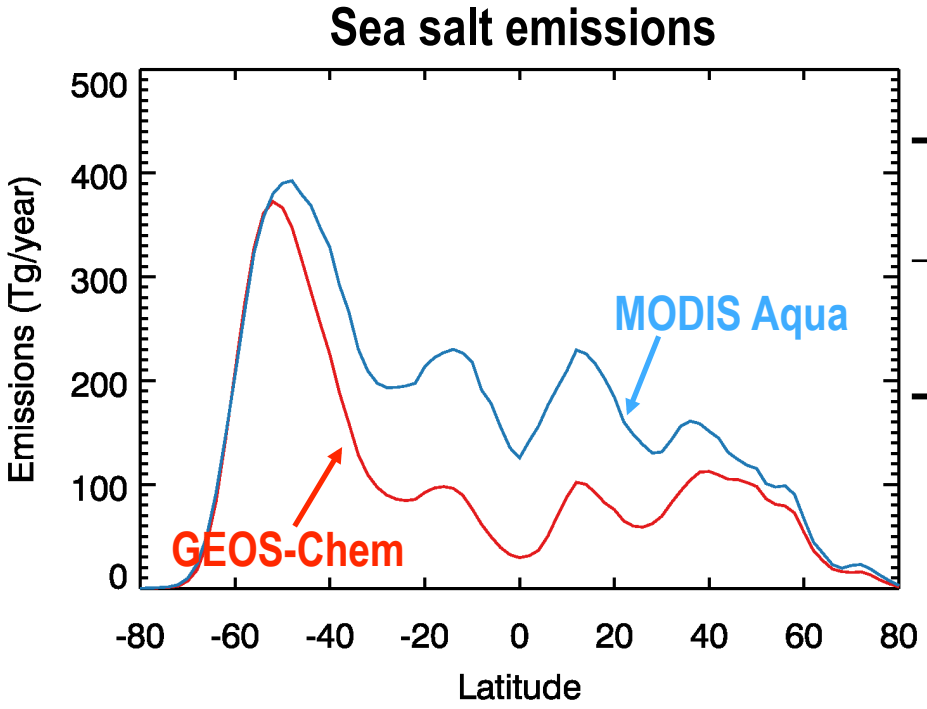


$$AOD_{coarse}(obs) \times \frac{Emis\ (model)}{AOD_{coarse}(model)}$$

Infer higher sea salt emissions for winds <12 m/s but lower emissions at very high winds (>16 m/s)

Implications

Let's apply this empirical f(u^2) relationship to daily QuikSCAT winds
→ calculate global sea salt emissions



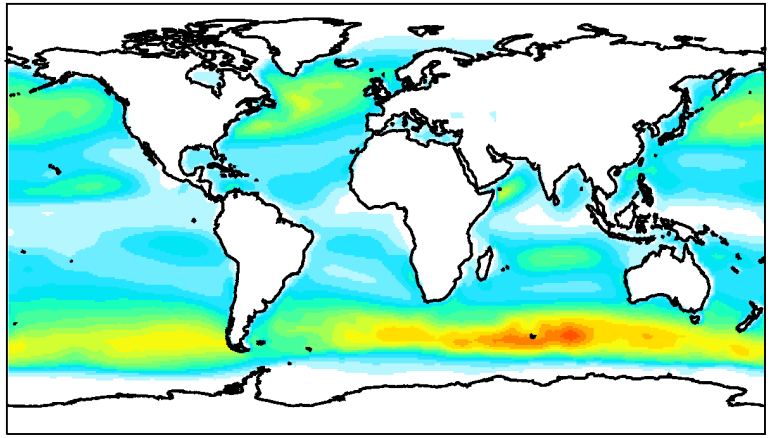
Sea salt emissions (Tg/year)

	Southern Ocean (20°-80°S)	Global
GEOS-Chem	4,800	8,000
MODIS Aqua	6,200	12,900

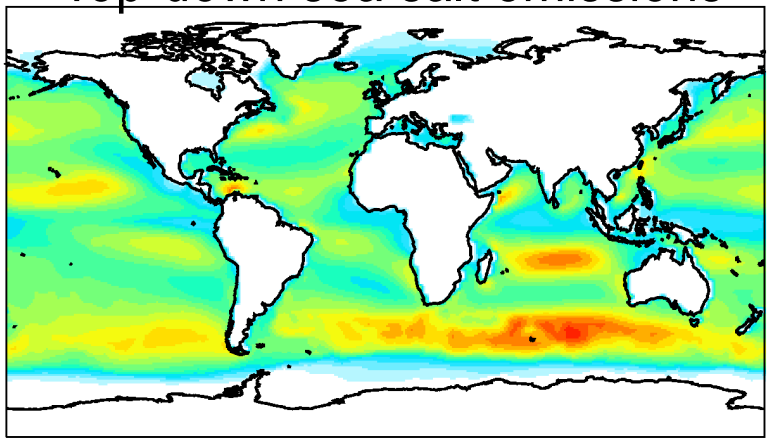
- Inferred global sea salt emissions 60% larger than modeled
- Largest discrepancy for tropical latitudes with weak winds (4-7m/s). Is there a dependence on factors other than wind?

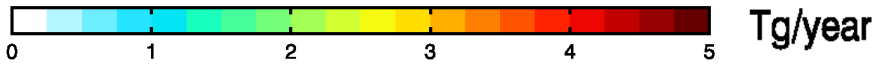
Global distribution of emissions

GEOS-Chem sea salt emissions



Top-down sea salt emissions

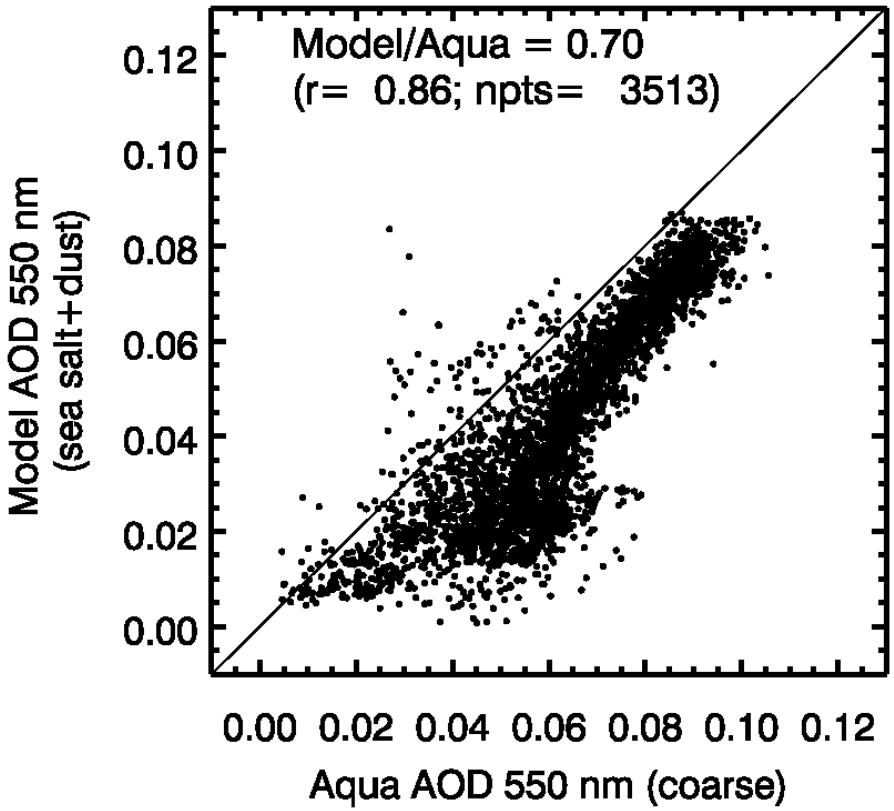




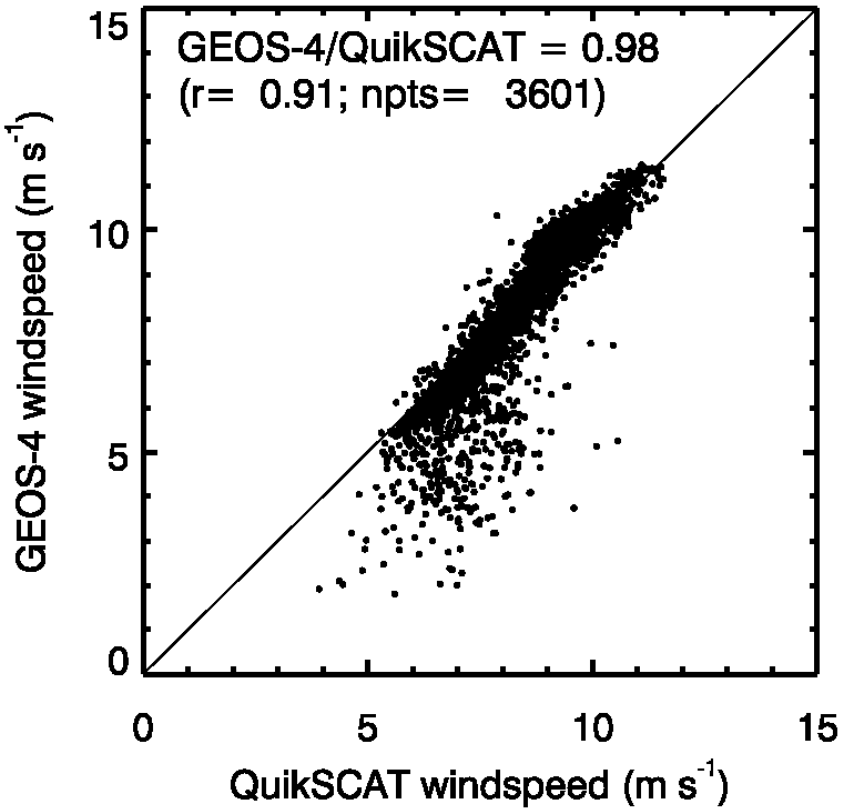
Model/Satellite comparison

20°S-80°S

Coarse AOD



Windspeed



- *Model underestimates observed AOD by ~30% on average*
- *Good agreement GEOS-4/QuikSCAT winds*