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Corrigendum to

"Impact of cloud-borne aerosol representation on aerosol direct and indirect effects" published in Atmos. Chem. Phys., 6, 4163–4174, 2006

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Ghan and Easter (2006) (hereafter referred to as GE2006) used a global aerosol model to estimate the sensitivity of aerosol direct and indirect effects to a variety of simplified treatments of the cloud-borne aerosol. They found that neglecting transport of cloud-borne particles introduces little error, but that diagnosing cloud-borne particles produces global mean biases of 20% and local errors of up to 40% for aerosol, droplet number, and direct and indirect radiative forcing However, we have recently found that in those experiments we had inadvertently turned off the first aerosol indirect effect. In the radiation module, the droplet effective radius was prescribed at 10 microns rather than related to the droplet number concentration. The second indirect effect, in which droplet number influences droplet collision and coalescence, was treated, so that the simulations produced an aerosol indirect effect, albeit one that is much smaller (about $-0.2\,\mathrm{W\,m^{-2}}$ for anthropogenic sulfate) than other previous estimates.

We repeated the experiments of GE2006 with the first indirect effect turned on. Figure 1 shows pointwise scatterplots of the annual mean indirect effect for each treatment plotted against the reference treatment (P-FULL). The global mean indirect effect is now much larger (about $-0.7\,\mathrm{W\,m^{-2}}$) than it was without the first indirect effect, and is more consistent with other estimates with a similar treatment of droplet nucleation (Storelvmo et al., 2006). Scatter associated with natural variability between the two simulations with and without anthropogenic aerosol is much less pronounced relative to the signal because the signal is now larger. The root mean square difference with the reference simuluation, normalized by the global mean, (Table 1) is much smaller than in GE2006, and the spatial correlation is now much higher, nearly exceeding 0.9 for all treatments.

Thus, although the inadvertent neglect of first indirect effects by GE2006 resulted in a significant underestimate of the total indirect effect, it did not affect the primary conclusion that neglecting transport of cloud-borne particles introduces very little error in estimates of aerosol direct and indirect effects, but diagnosing cloud-borne particles produces larger errors. The estimate of the total indirect effect by GE2006 should be disregarded. The estimate here of about $-0.7\,\mathrm{W\,m^{-2}}$ is much more plausible.

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Table 1. Mean and root mean square errors of the annual mean indirect effect due to anthropogenic sulfur, normalized by the global mean of the reference simulation. Also listed is the spatial correlation with the reference simulation.

	P-NOADV			P-RESUSP			P-TOTM			DIAG		
	mean	rms	cor	mean	rms	cor	mean	rms	cor	mean	rms	cor
Anthro indirect	0.00	0.39	.952	−0.17	0.63	.898	−0.06	0.41	.951	0.26	0.62	.951

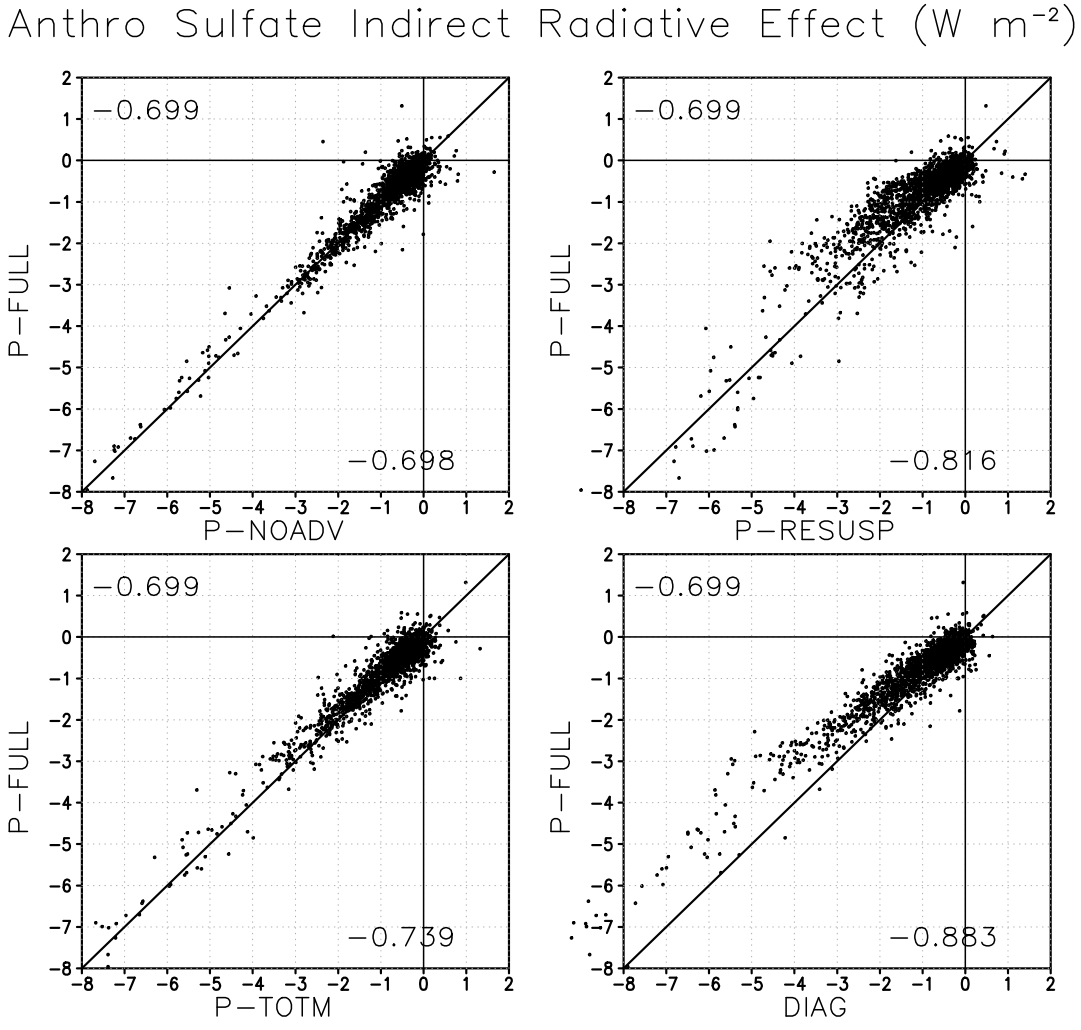

Fig. 1. Scatterplots of annual mean indirect effect due to anthropogenic sulfur for the reference treatment vs. each of the four approximate treatments. The global means for the reference and other treatments are printed in the upper-left and lower-right corners of each plot, respectively.