AGU PUBLICATIONS

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Supporting Information for

Evaluation of the aerosol vertical distribution in global aerosol models through comparison against CALIOP measurements: AeroCom phase II results

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Table S1. Comparison and inter-correlation between AeroCom I and AeroCom II individual models' bias in simulating 2007-2009 CALIOP-derived $Z_{\alpha 0\text{-}6\ km}$ and AOD diagnostics over the 12 selected regions. $Nlev_{0\text{-}10\ km}$ is the number of model levels below 10 km. Significant correlation ($p < 0.05$; bold) are highlighted (see also Figure S7).

	Model performance metrics	R correlation coefficients N = 8 models				R correlation coefficients N =7 models (GISS-ModelE excluded)			
		MAM	JJA	SON	DJF	MAM	JJA	SON	DJF
AeroCom I	$Z_{\alpha 0\text{-}6\ km}$ bias : AOD bias	0.554	0.640	0.178	0.024	0.567	0.630	0.012	0.029
	$Z_{\alpha 0\text{-}6\ km}$ bias : $Nlev_{0\text{-}10\ km}$	0.086	0.114	-0.060	-0.256	0.099	0.052	-0.193	-0.322
	AOD bias : $Nlev_{0\text{-}10\ km}$	0.023	0.047	0.331	0.319	0.129	-0.021	0.125	0.368
AeroCom II	$Z_{\alpha 0\text{-}6\ km}$ bias : AOD bias	-0.150	-0.536	-0.440	-0.033	-0.599	**-0.818**	**-0.739**	-0.440
	$Z_{\alpha 0\text{-}6\ km}$ bias : $Nlev_{0\text{-}10\ km}$	-0.571	-0.318	-0.485	-0.554	-0.609	-0.379	-0.523	-0.606
	AOD bias : $Nlev_{0\text{-}10\ km}$	0.270	0.510	0.484	0.364	0.353	0.524	0.538	0.486
AeroCom II versus AeroCom I	$Z_{\alpha 0\text{-}6\ km}$ bias	0.336	0.312	0.570	**0.742**	0.343	0.416	0.690	**0.811**
	AOD bias	0.295	0.224	-0.665	0.418	0.186	0.322	-0.488	0.605
AeroCom II minus AeroCom I	$\Delta Z_{\alpha 0\text{-}6\ km}$ bias : ΔAOD bias	-0.084	-0.236	-0.230	0.127	-0.465	-0.599	**-0.780**	-0.610
	$\Delta Z_{\alpha 0\text{-}6\ km}$ bias : $\Delta Nlev_{0\text{-}10\ km}$	-0.581	-0.382	-0.436	-0.393	**-0.859**	**-0.861**	**-0.951**	**-0.910**
	Δ AOD bias : $\Delta Nlev_{0\text{-}10\ km}$	**0.831**	**0.898**	**0.891**	**0.755**	**0.799**	**0.869**	**0.848**	0.671

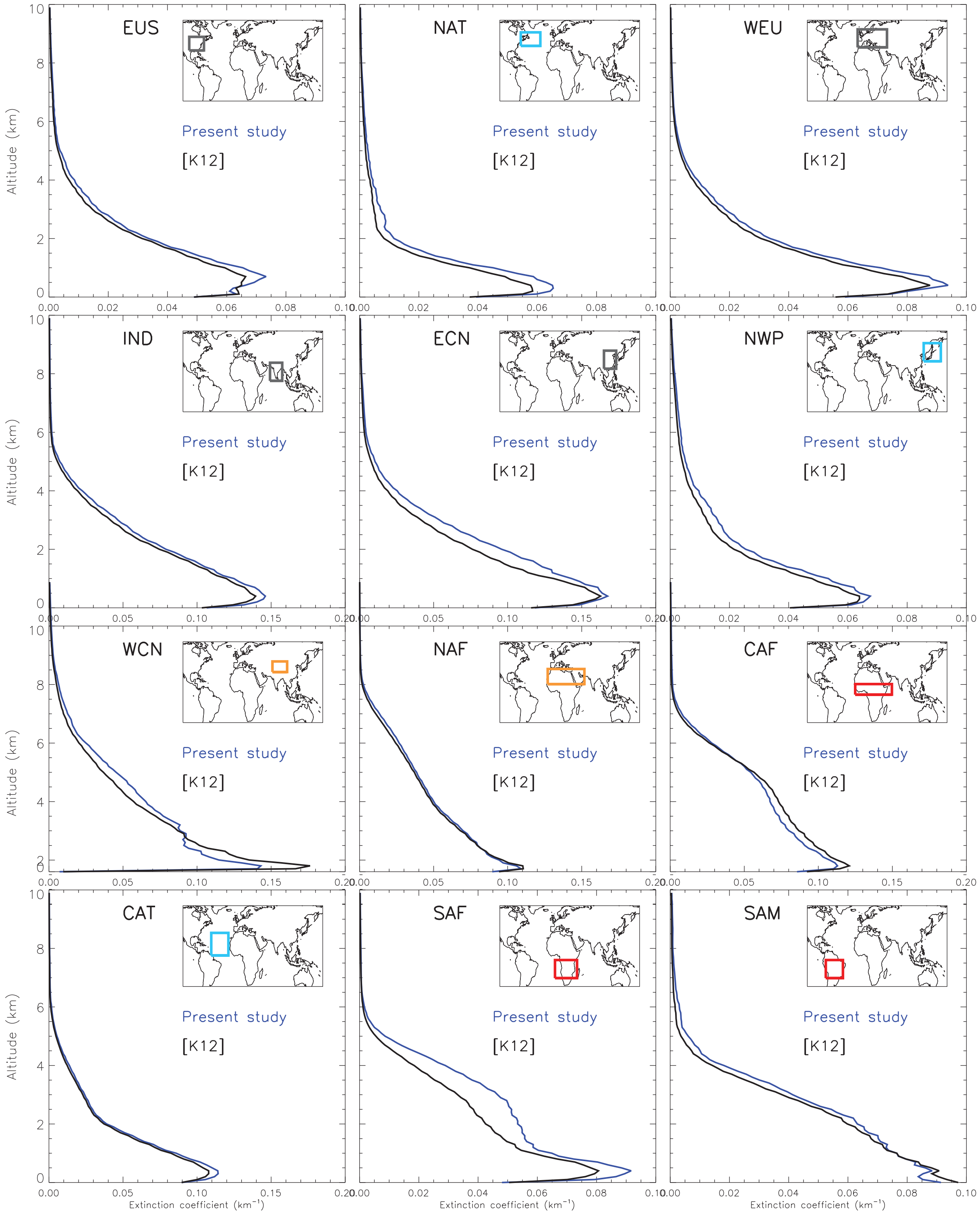

Figure S1a. 2007 mean annual absolute extinction coefficient (km^{-1}) profiles at 532 nm over the 12 selected regions, as derived from the AeroCom-CALIOP gridded product (black; this study) and compared to the ones derived from regional averaging ([K12]). The mean extinction height (km) at 532 nm over the 0-6 km altitude range ($Z_{\alpha\ 0\text{-}6\ km}$) is also reported.

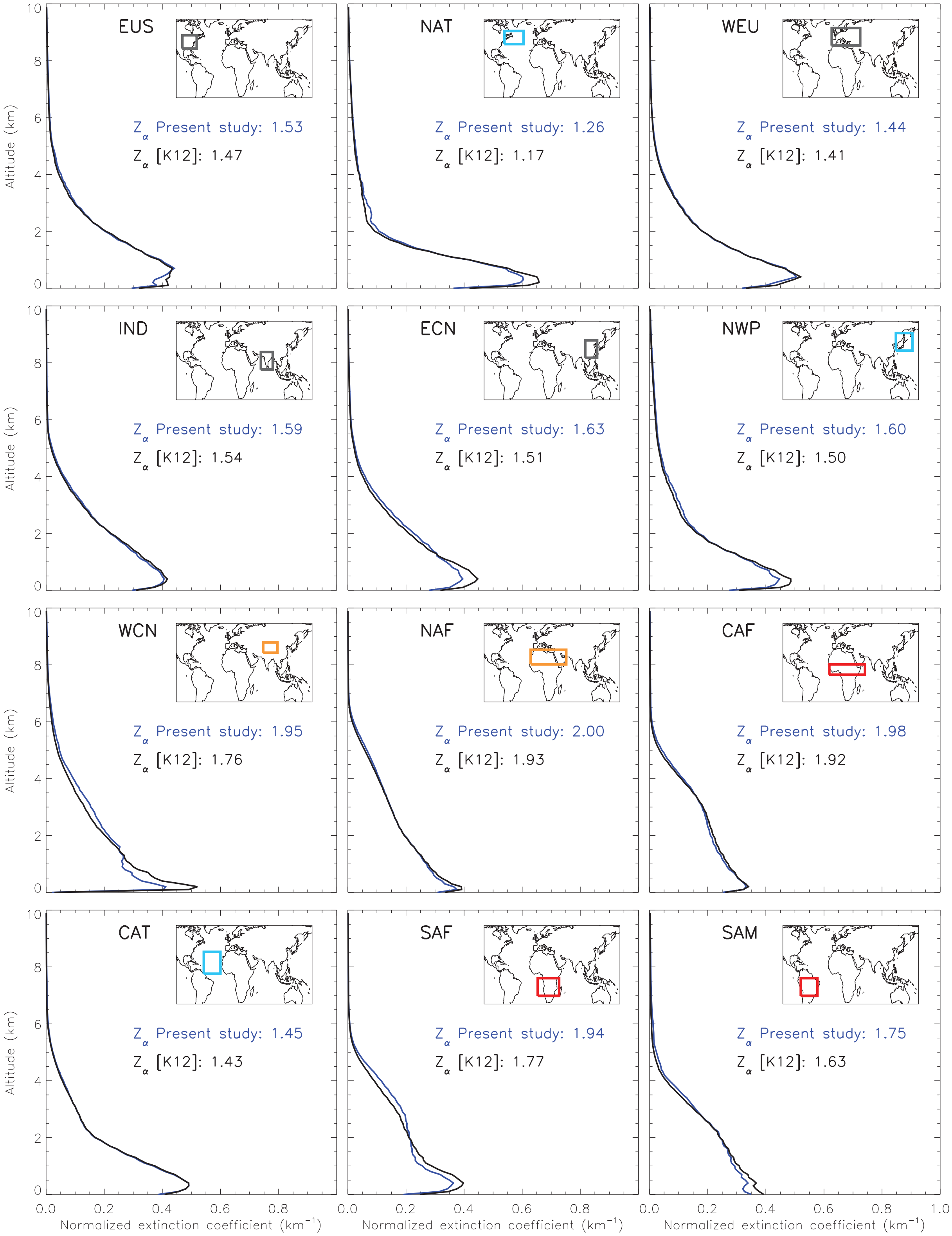

Figure S1b. As Figure S1a but for the mean annual "normalized" (AOD =1) aerosol extinction coefficient (km^{-1}) profiles (see discussion section for details).

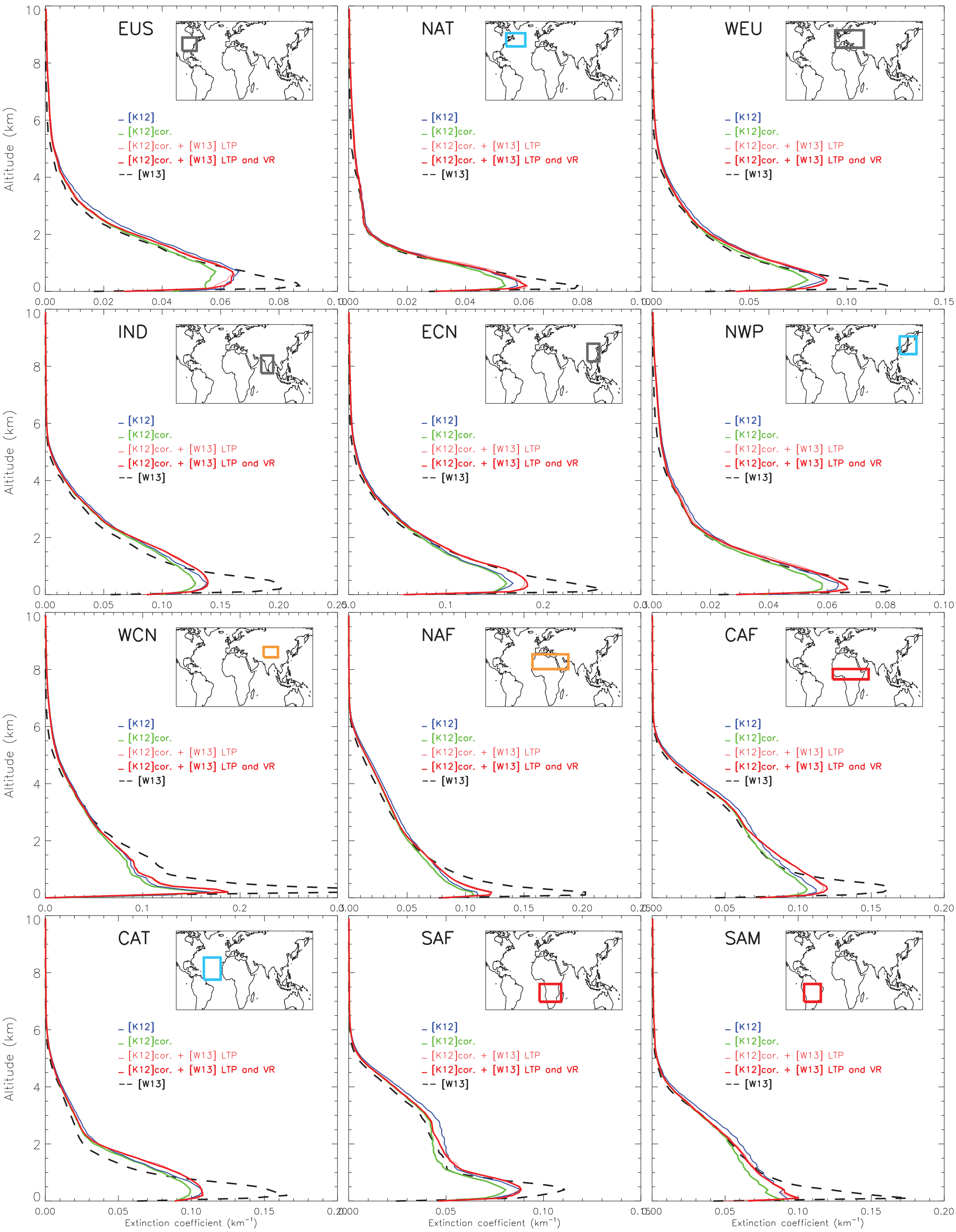

Figure S2a. 2007 mean annual absolute aerosol extinction coefficient (km^{-1}) profiles at 532 nm over the 12 selected regions, as derived from K12 (solid blue) and Winker *et al.* [2013] (W13, dotted black) methodologies. Our study shows that K12 profiles, after correcting for the overlapping aerosol layers (solid green) and applying Winker *et al.* [2013] Vertical Resolution (VR) and Low Troposphere Processing method (LTP) still significantly differ from W13 profiles.

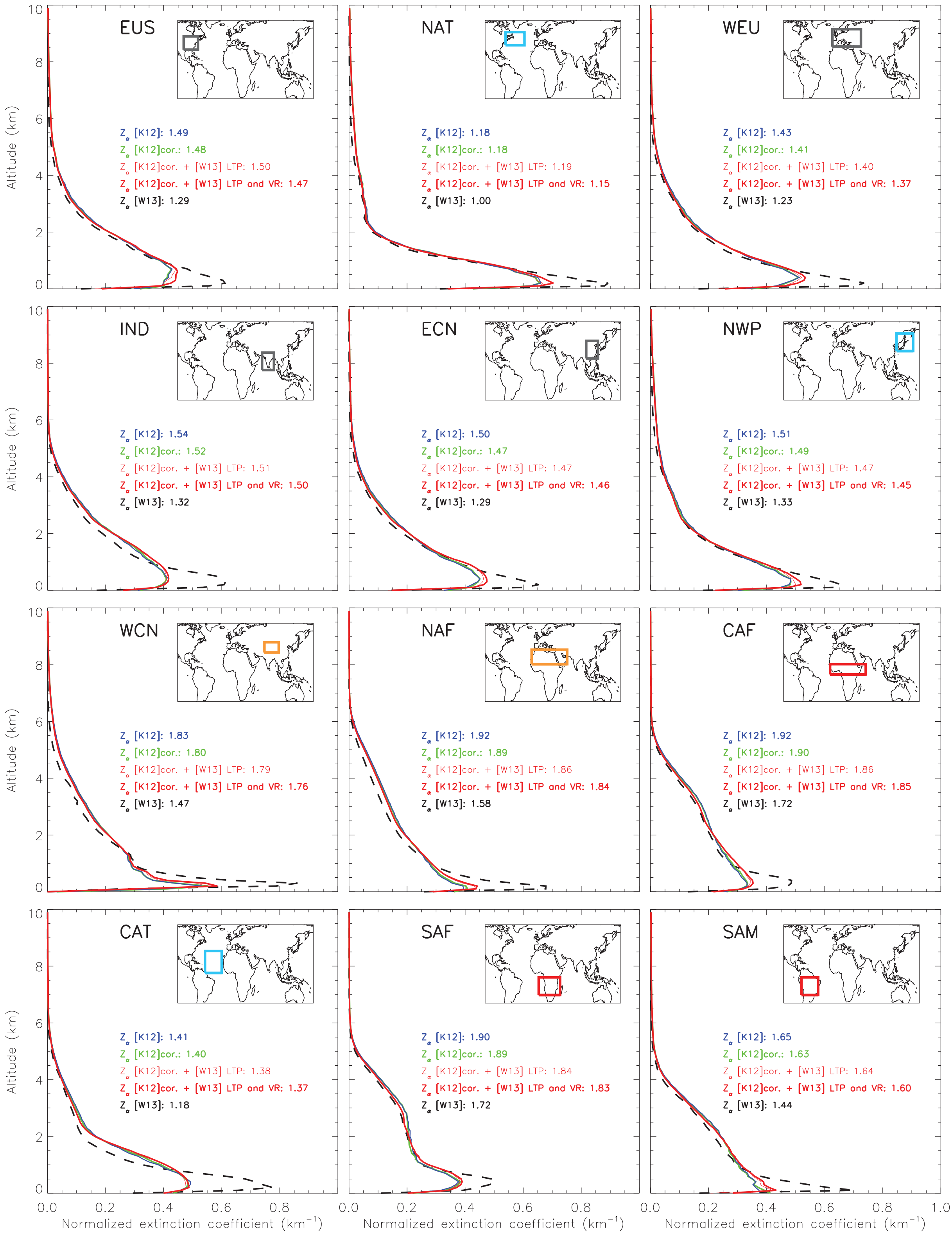

Figure S2b. As Figure S2a but for the mean annual "normalized" aerosol extinction coefficient (km^{-1}) profiles. The $Z_{\alpha\ 0\text{-}6\ km}$ extinction heights are reported (see discussion section for details).

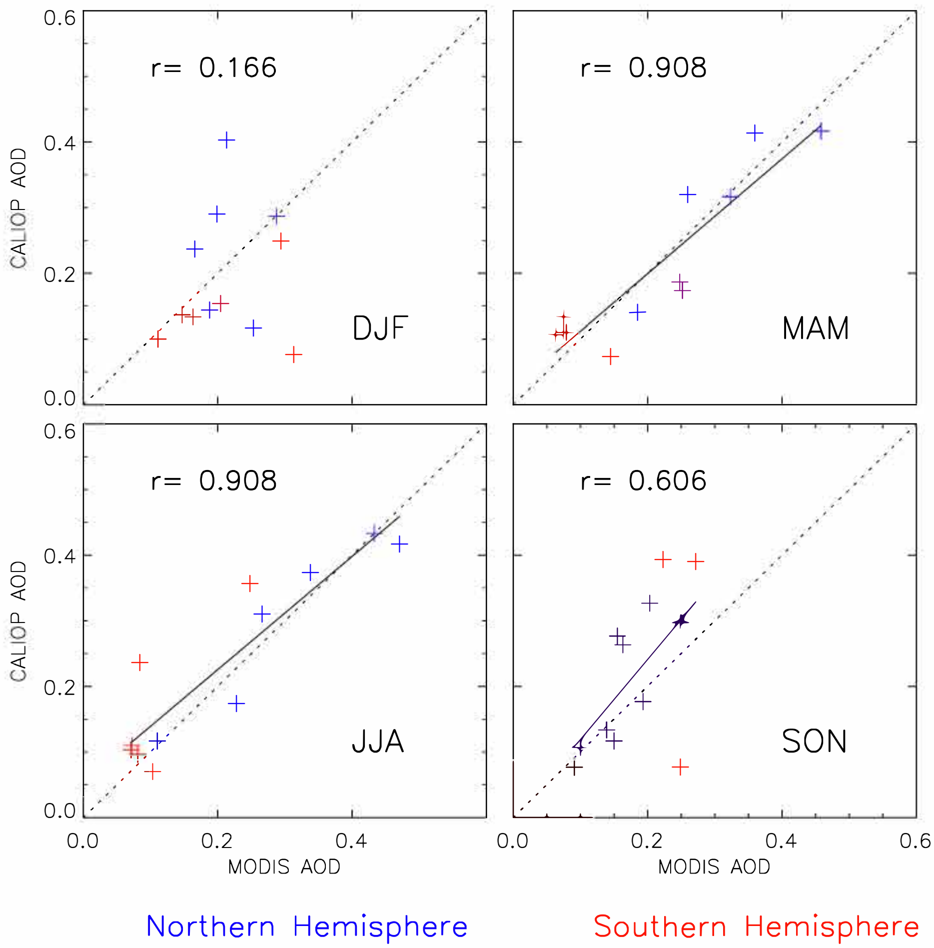

Figure S3a. 2007-2009 mean seasonal AOD over the 70°N to 70°S latitude range (14 bands of 10°), as derived from the AeroCom CALIOP-derived product, compared to MODIS measurements for land. Significant ($p < 0.05$) regression lines are plotted.

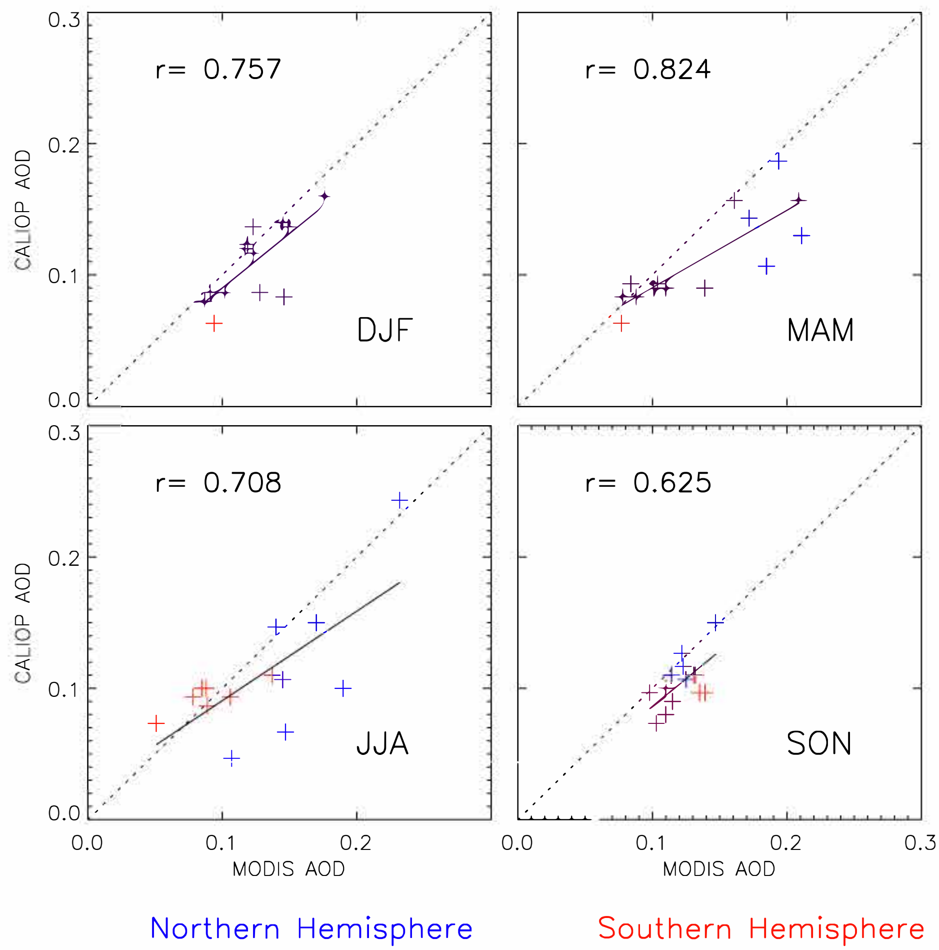

Figure S3b. As Figure S3a but over ocean (different scales are used).

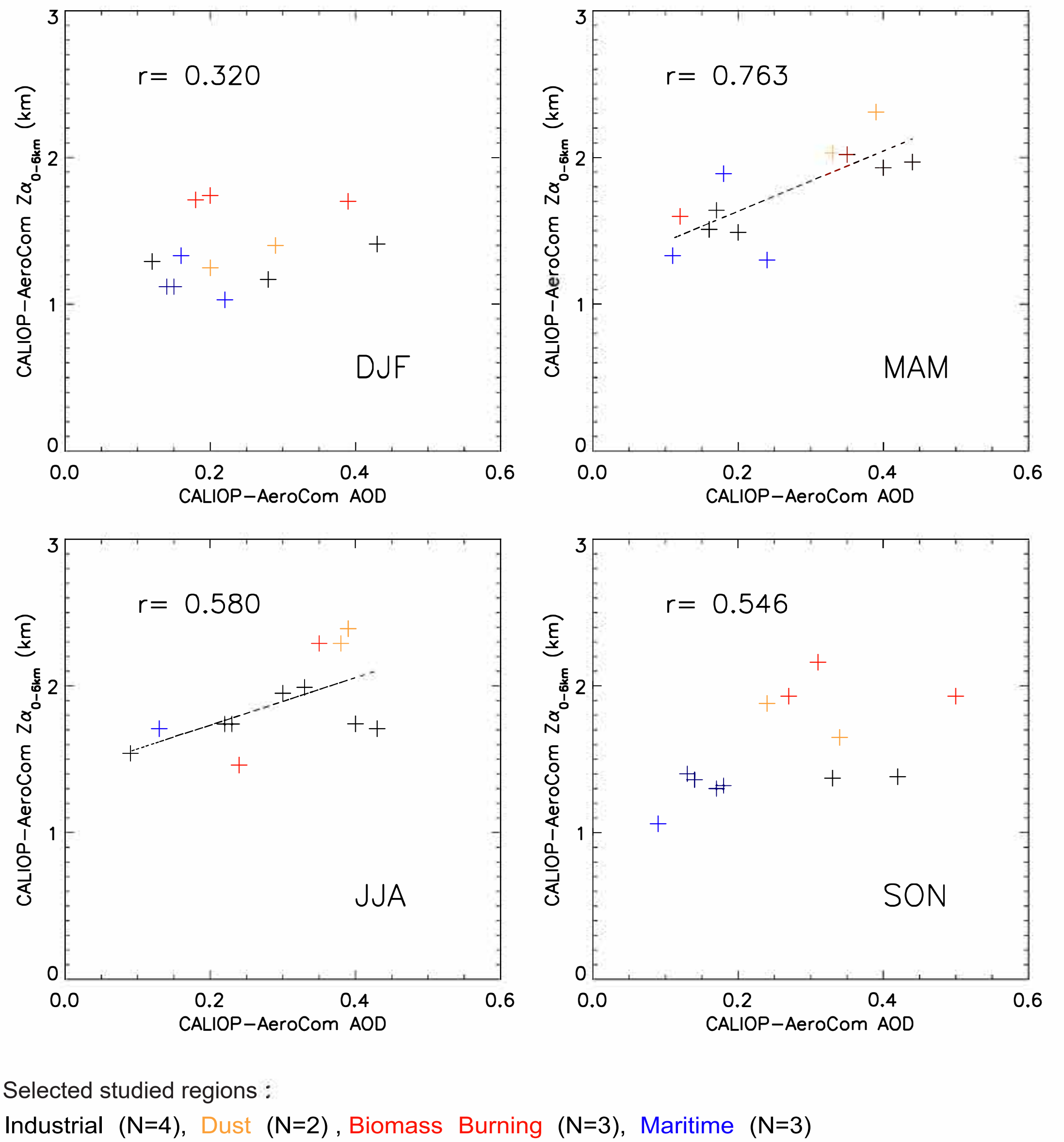

Figure S4. 2007-2009 mean seasonal Zα $_{0\text{-}6\ \mathrm{km}}$ extinction height and AOD, as derived from the AeroCom CALIOP product over the 12 selected regions. Significant ($p < 0.05$) regression lines are plotted.

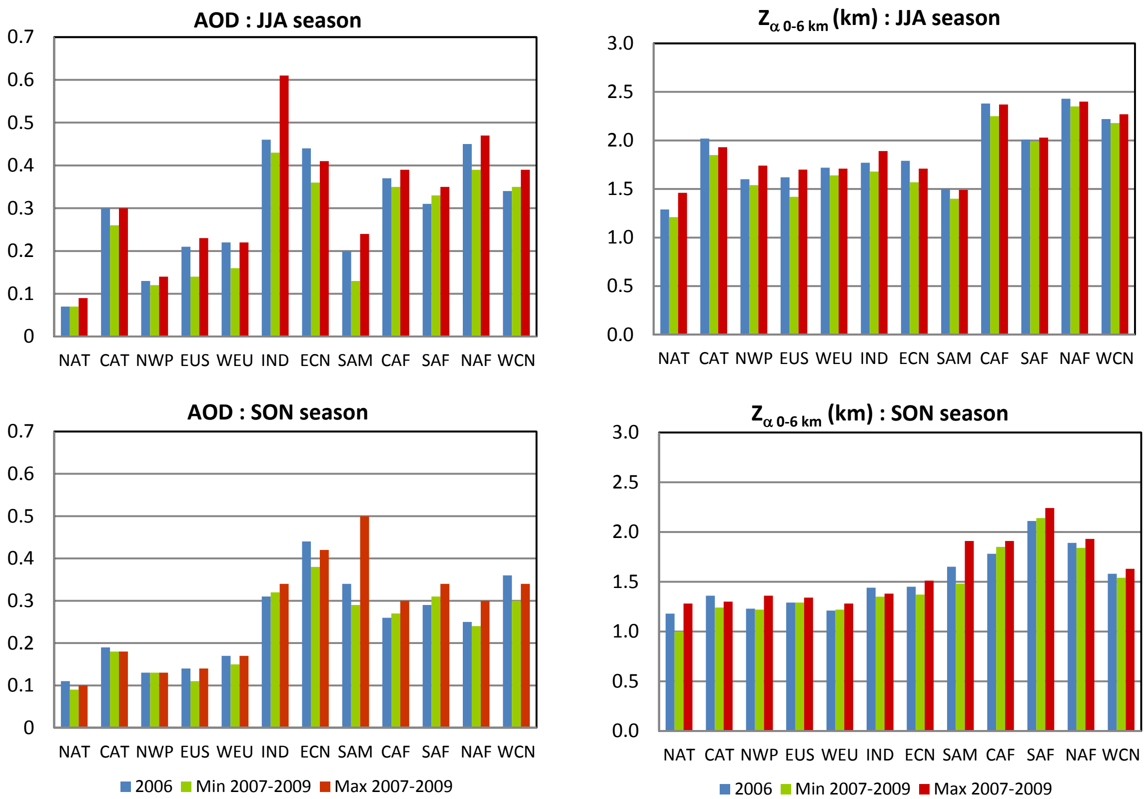

Figure S5. JJA (top) and SON (bottom) mean AOD (left) and $Z\alpha_{\text{0-6 km}}$ extinction height (right) over the 12 selected regions: 2006 compared to 2007-2009 values.

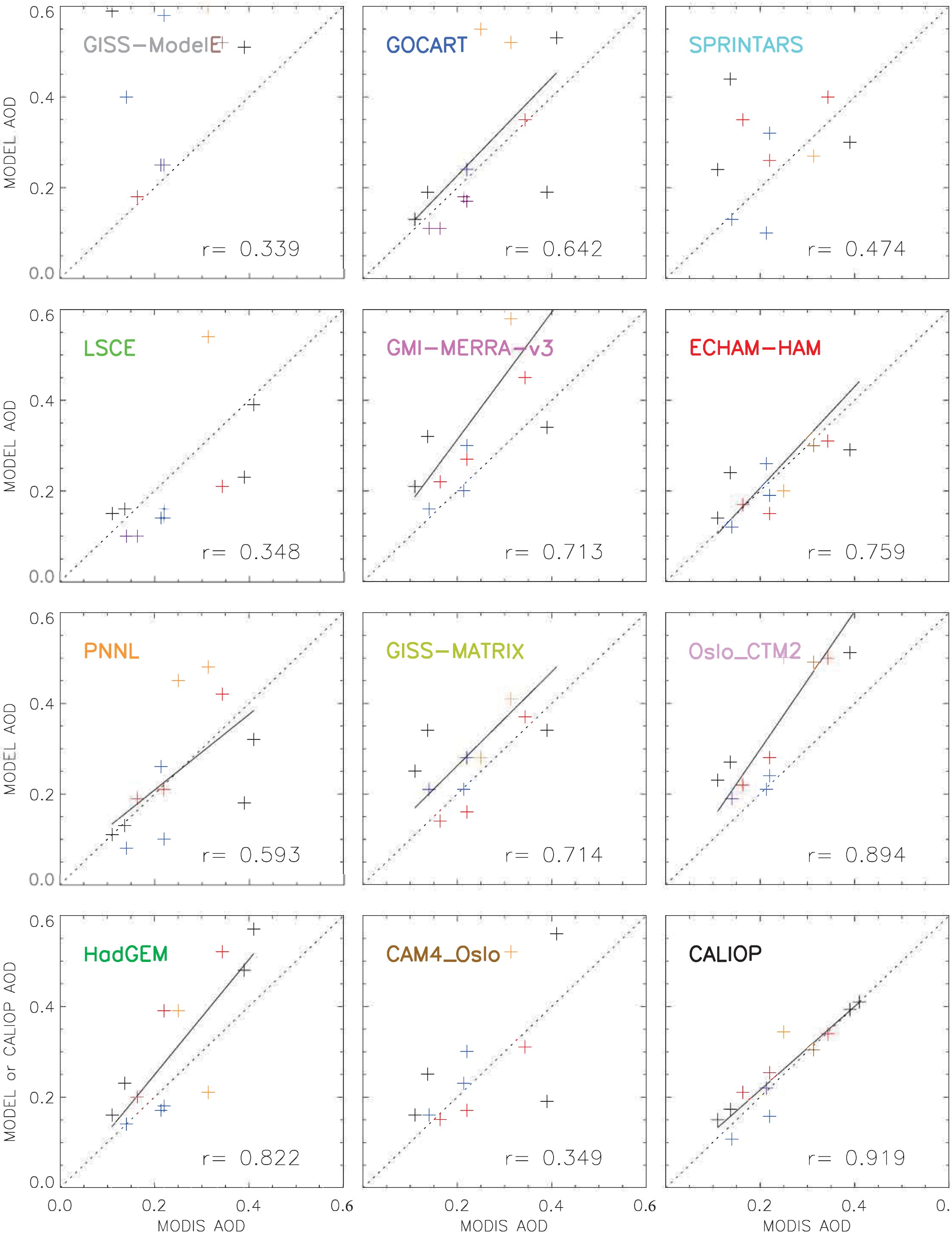

Figure S6. Mean annual AOD as derived from the AeroCom II models (2000, 2006), compared to AeroCom CALIOP-derived gridded product (2007-2009) over the 12 selected regions. Significant ($p < 0.05$) regression lines are plotted.

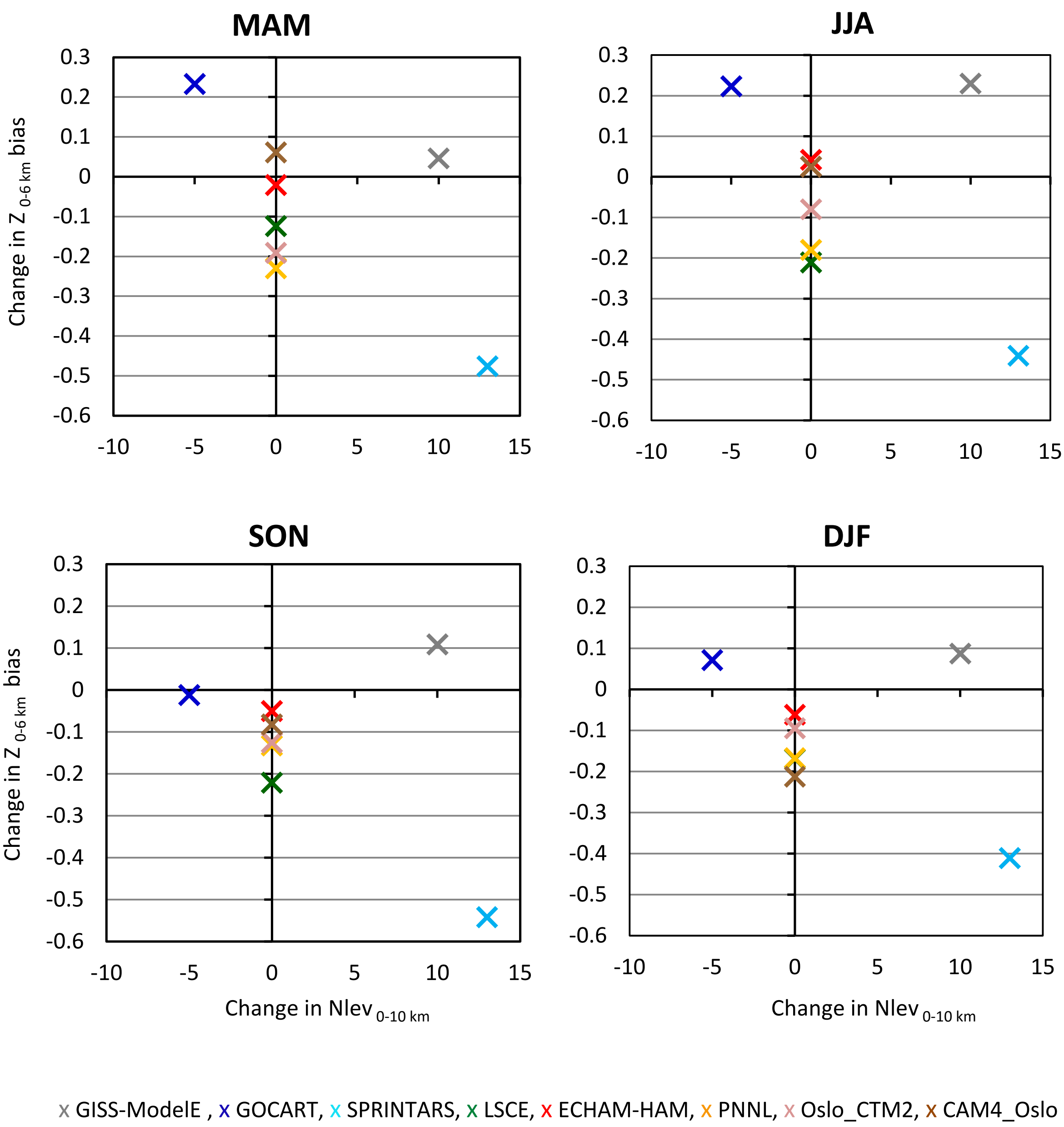

Figure S7. Change in $Z_{0\text{-}6\ km}$ seasonal bias over the 12 selected regions between AeroCom I and AeroCom II simulations, as a function of the change in the number of model levels below 10 km ($Nlev_{0\text{-}10\ km}$). The regression coefficients are provided in Table S1.

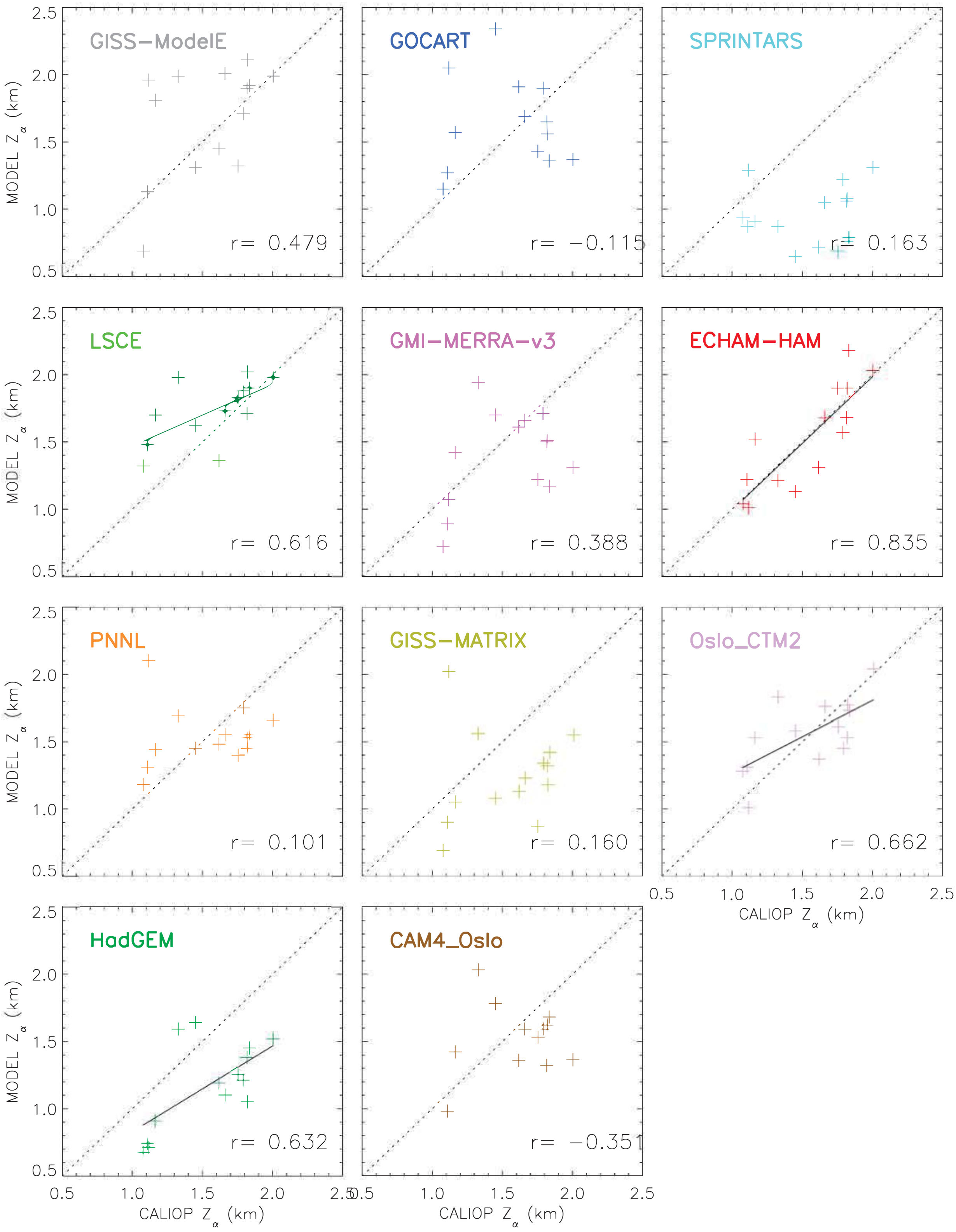

Figure S8a. $Z\alpha_{0\text{-}6\ km}$ mean annual extinction height over land (70°N to 70°S latitude range ; 14 bands of 10°), as derived from the AeroCom II models (2000, 2006), compared to AeroCom CALIOP-derived gridded product (2007-2009). Significant ($p < 0.05$) regression lines are plotted.

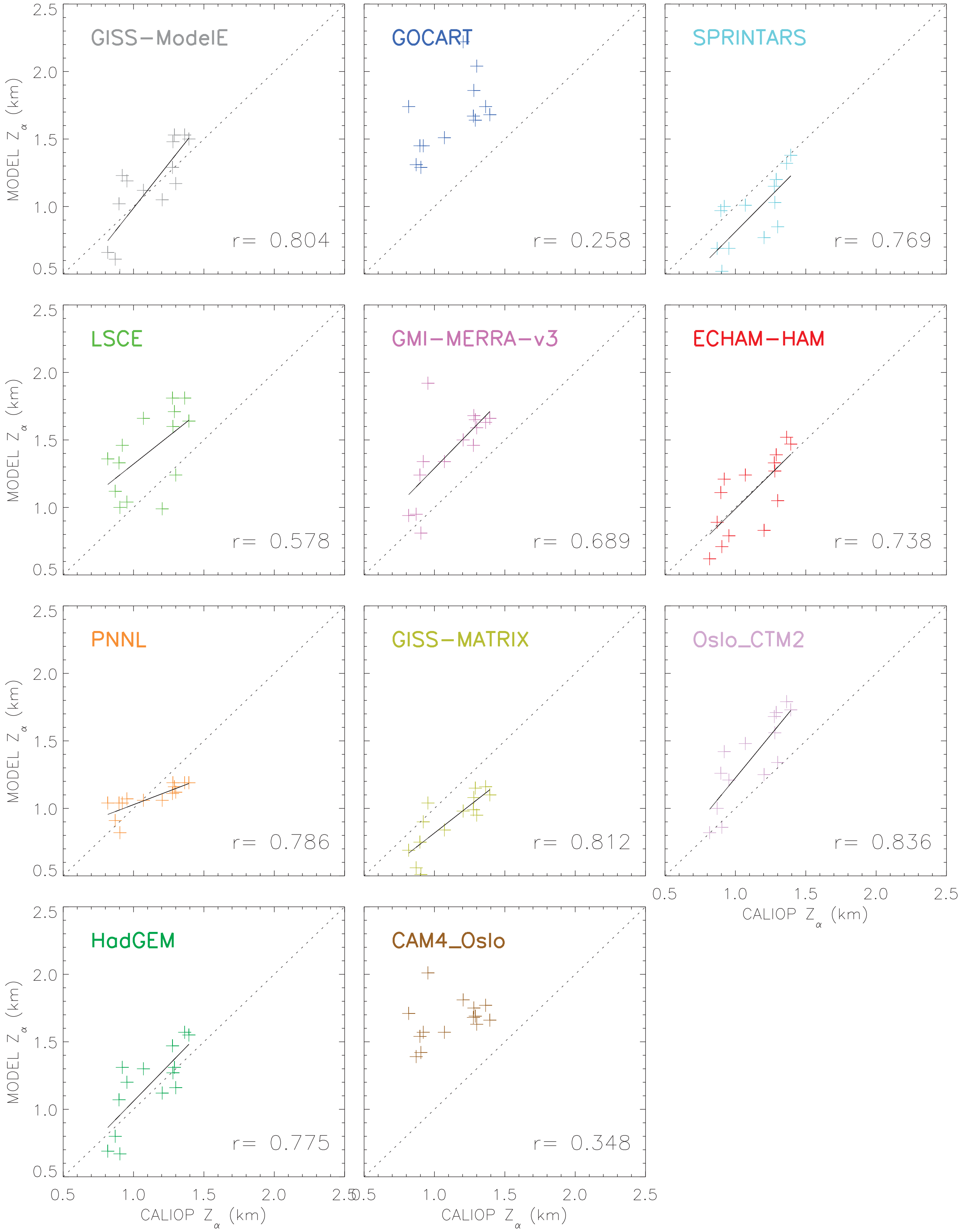

Figure S8b. As Figure S8a but over ocean.

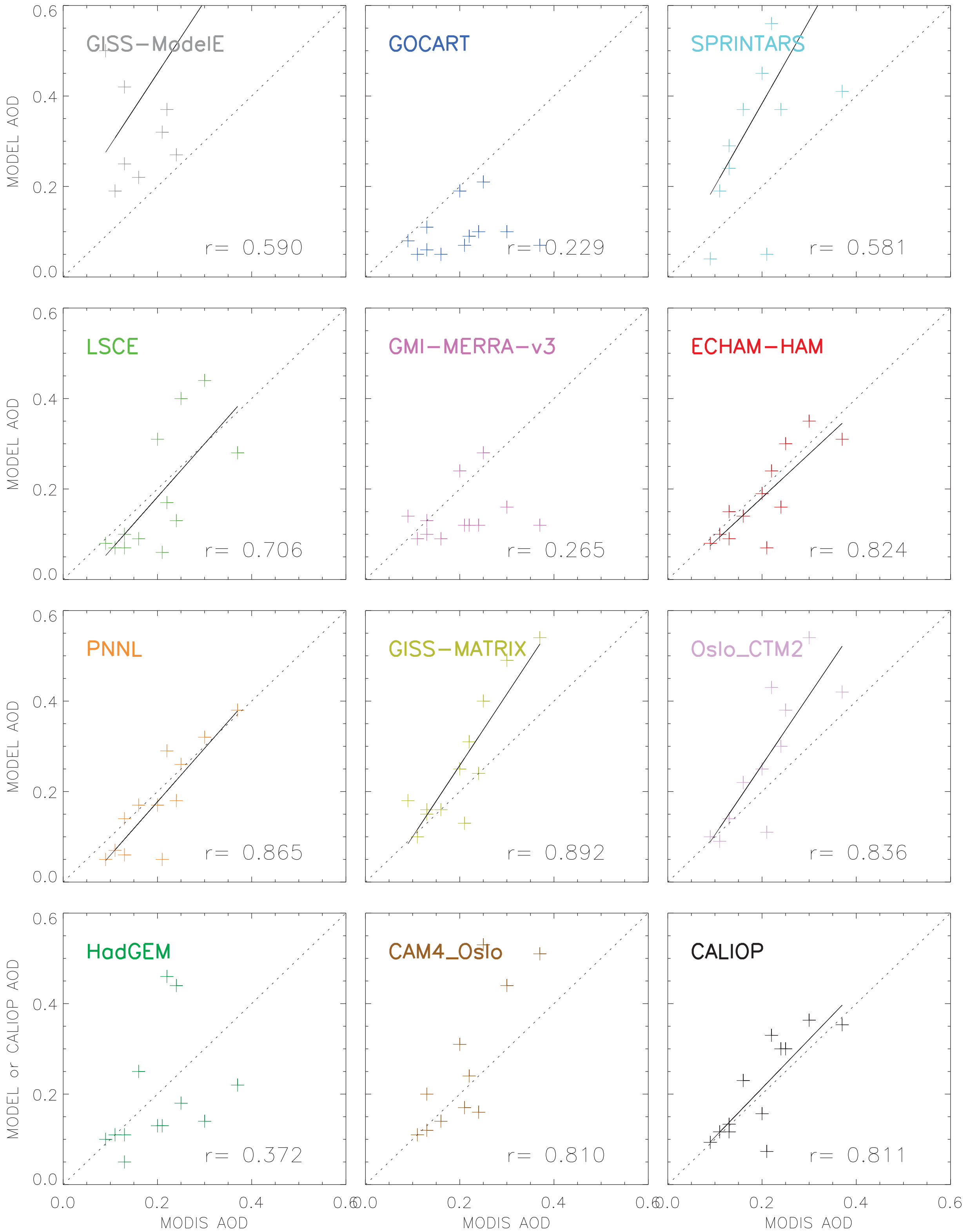

Figure S9a. As Figure S8a but for the mean annual AOD over land.

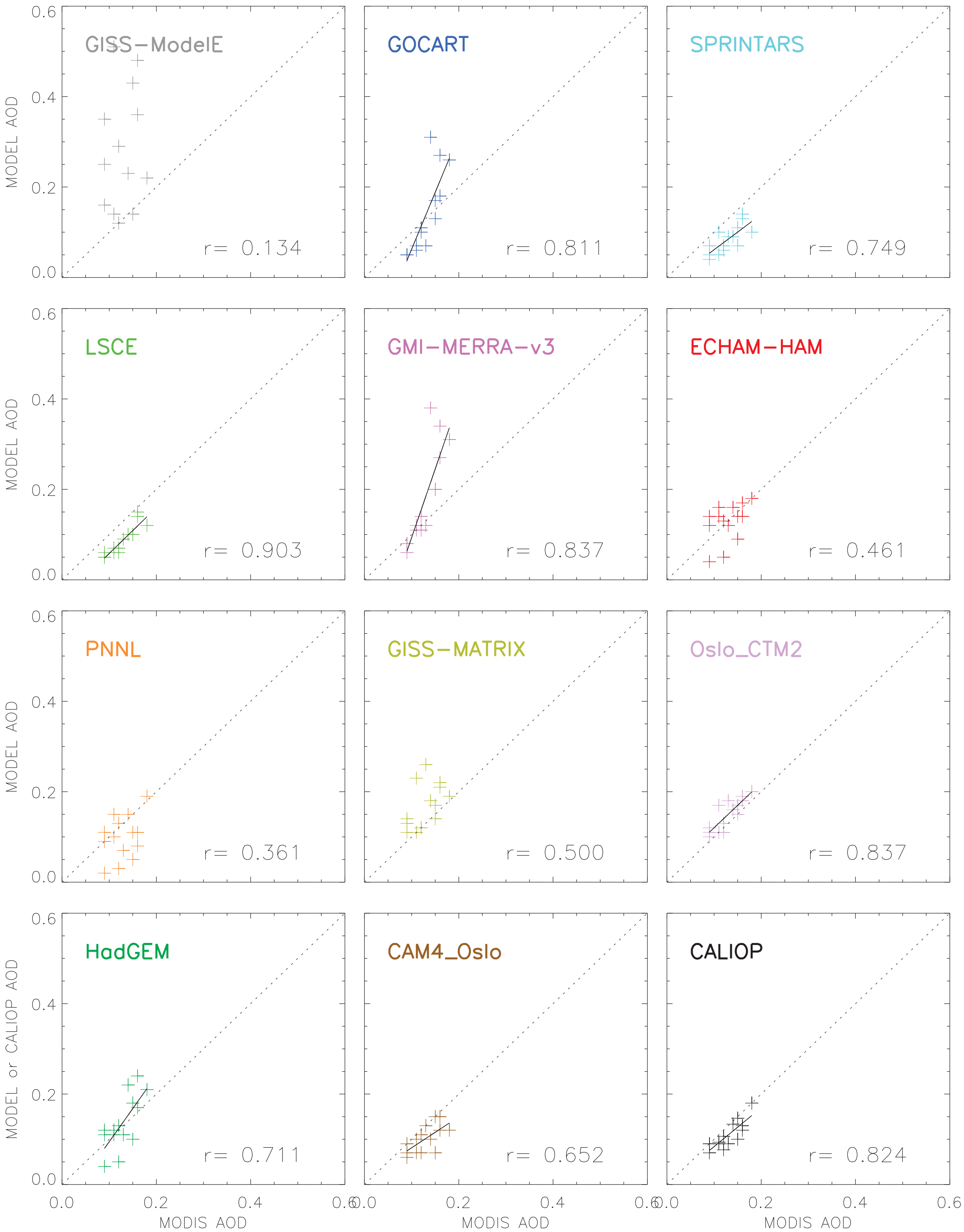

Figure S9b. As Figure S8b but for the mean annual AOD over ocean.

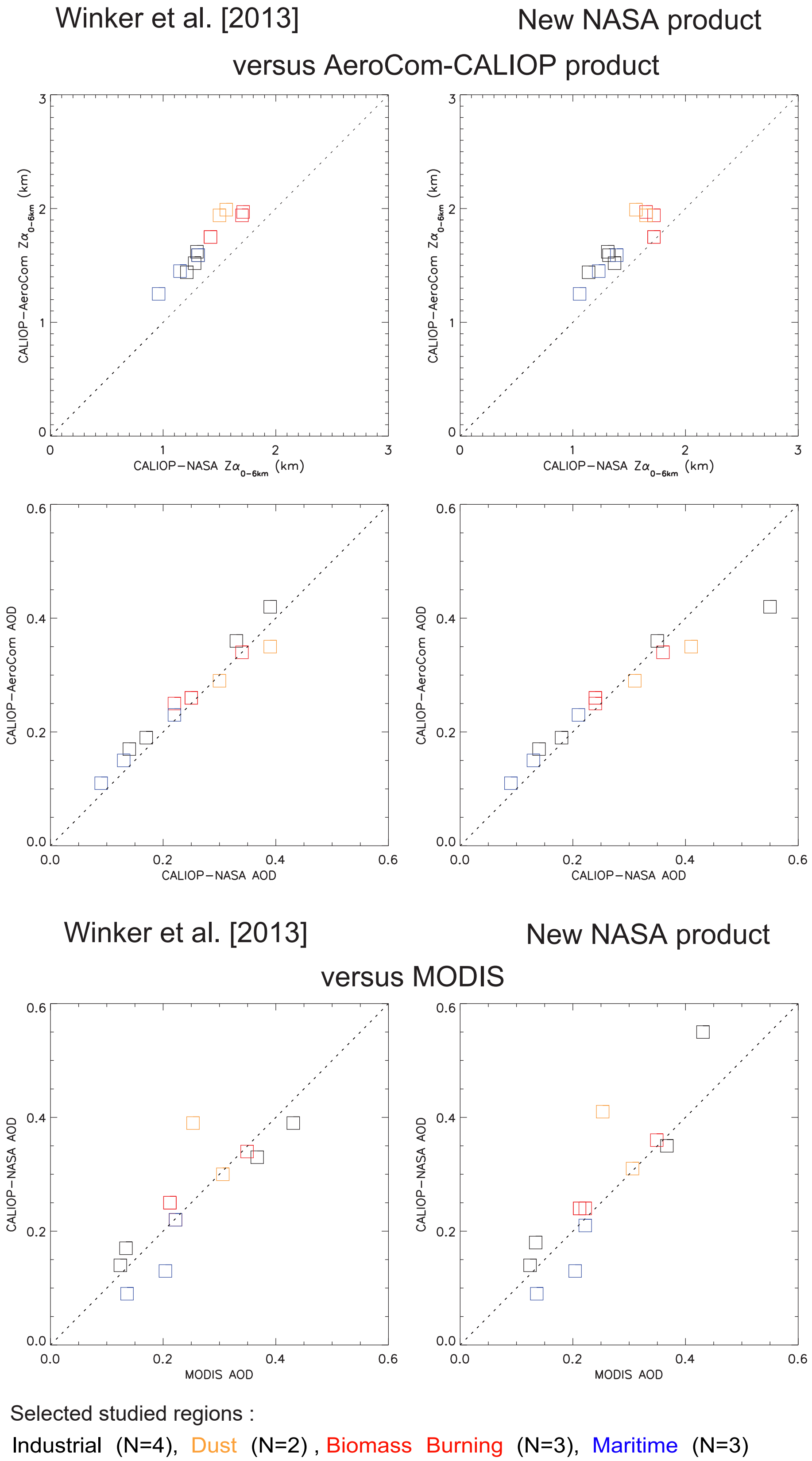

Figure S10. 2007 mean annual $Z\alpha_{0\text{-}6\ km}$ extinction height and AOD over the 12 selected regions as derived from the (a) previous [Winker et al., 2013] and (b) new version of the NASA product: comparison to the AeroCom-CALIOP product (top and middle plots) and to MODIS measurements (bottom plots).