Supplementary Materials for the Manuscript "Radiative Signature of Absorbing Aerosol over the Eastern Mediterranean Basin"

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Table S1 Averaged Optical properties of (level 2) of Mediterranean AERONET sites used in this study. 'N' represents the number of level 2 observation days used in analyses (entire data). The subscripts of parameters name show wavelength in nm. Period (L2)* shows the time span of available AERONET level 2 data for respective sites. More details on seasonal availability of level 2 data for each site can be found in Mallet et al. (2013).

Site Name	**N**	**$AAE_{440-870}$**	**$EAE_{440-870}$**	**AOD_{440}**	**SSA_{440}**	**$AAOD_{440}$**	**$ASYP_{440}$**	**Period (L2)***
Pollution Dominated Sites								
Athens	708	1.35±0.42	1.39±0.41	0.23±0.12	0.91±0.03	0.04±0.01	0.70±0.02	2008-2012
Avignon	1816	1.23±0.46	1.47±0.32	0.20±0.13	0.91±0.03	0.04±0.01	0.70±0.03	2000-2012
Barcelona	1220	1.25±0.49	1.40±0.32	0.20±0.12	0.92±0.04	0.04±0.02	0.70±0.03	2005-2012
Burjassot	1045	1.27±0.45	1.28±0.33	0.18±0.12	0.93±0.03	0.03±0.02	0.70±0.03	2007-2013
Ersa	557	1.31±0.46	1.42±0.38	0.17±0.10	0.96±0.02	0.02±0.01	0.70±0.03	2008-2013
Ispra	1465	1.35±0.35	1.57±0.25	0.35±0.31	0.92±0.04	0.05±0.02	0.71±0.04	1997-2013
Lecce	1327	1.49±0.50	1.40±0.43	0.23±0.13	0.92±0.04	0.04±0.02	0.69±0.03	2003-2012
Messina	739	1.29±0.44	1.32±0.46	0.22±0.13	0.94±0.04	0.03±0.02	0.70±0.03	2005-2012
Modena	769	1.32±0.27	1.52±0.29	0.33±0.20	0.93±0.03	0.04±0.02	0.71±0.03	2002-2011
Moldova	1519	1.17±0.26	1.52±0.27	0.25±0.17	0.94±0.03	0.03±0.02	0.70±0.03	1999-2012
Potenza	608	1.33±0.72	1.35±0.41	0.17±0.11	0.92±0.05	0.04±0.03	0.70±0.03	2006-2012
Rome	1473	1.48±0.49	1.40±0.38	0.22±0.12	0.91±0.04	0.04±0.02	0.69±0.03	2001-2012
Thessaloniki	1042	1.28±0.26	1.56±0.31	0.30±0.16	0.94±0.03	0.03±0.01	0.70±0.03	2005-2012
Toulon	1008	1.27±0.44	1.49±0.30	0.17±0.11	0.93±0.03	0.03±0.01	0.69±0.03	2005-2010
Villefranche	975	0.98±0.36	1.50±0.33	0.20±0.14	0.95±0.03	0.03±0.01	0.71±0.03	2004-2012
Dust Affected Sites								
Blida	953	1.92±0.49	0.98±0.42	0.24±0.17	0.89±0.03	0.06±0.02	0.71±0.03	2004-2010
Malaga	869	1.57±0.47	1.06±0.37	0.17±0.11	0.90±0.03	0.05±0.02	0.71±0.02	2009-2012
Granada	1193	1.75±0.52	1.15±0.41	0.18±0.11	0.90±0.03	0.05±0.02	0.69±0.04	2005-2013
Forth Crete	1057	1.69±0.59	1.24±0.49	0.23±0.12	0.93±0.03	0.03±0.02	0.71±0.03	2003-2011
Lampedusa	789	2.17±0.67	0.95±0.50	0.20±0.14	0.92±0.03	0.04±0.02	0.71±0.03	2003-2012
Erdemli	1322	1.07±0.46	1.29±0.35	0.31±0.17	0.93±0.04	0.04±0.02	0.71±0.03	1999-2011
Sde Boker	3403	1.44±0.63	0.94±0.41	0.21±0.14	0.92±0.02	0.05±0.02	0.72±0.02	1996-2013
Nes Ziona	1264	1.37±0.62	1.05±0.43	0.28±0.16	0.91±0.06	0.05±0.04	0.72±0.04	2000-2012
Oristano	515	1.54±0.61	1.19±0.49	0.23±0.16	0.90±0.03	0.06±0.03	0.71±0.03	2000-2003

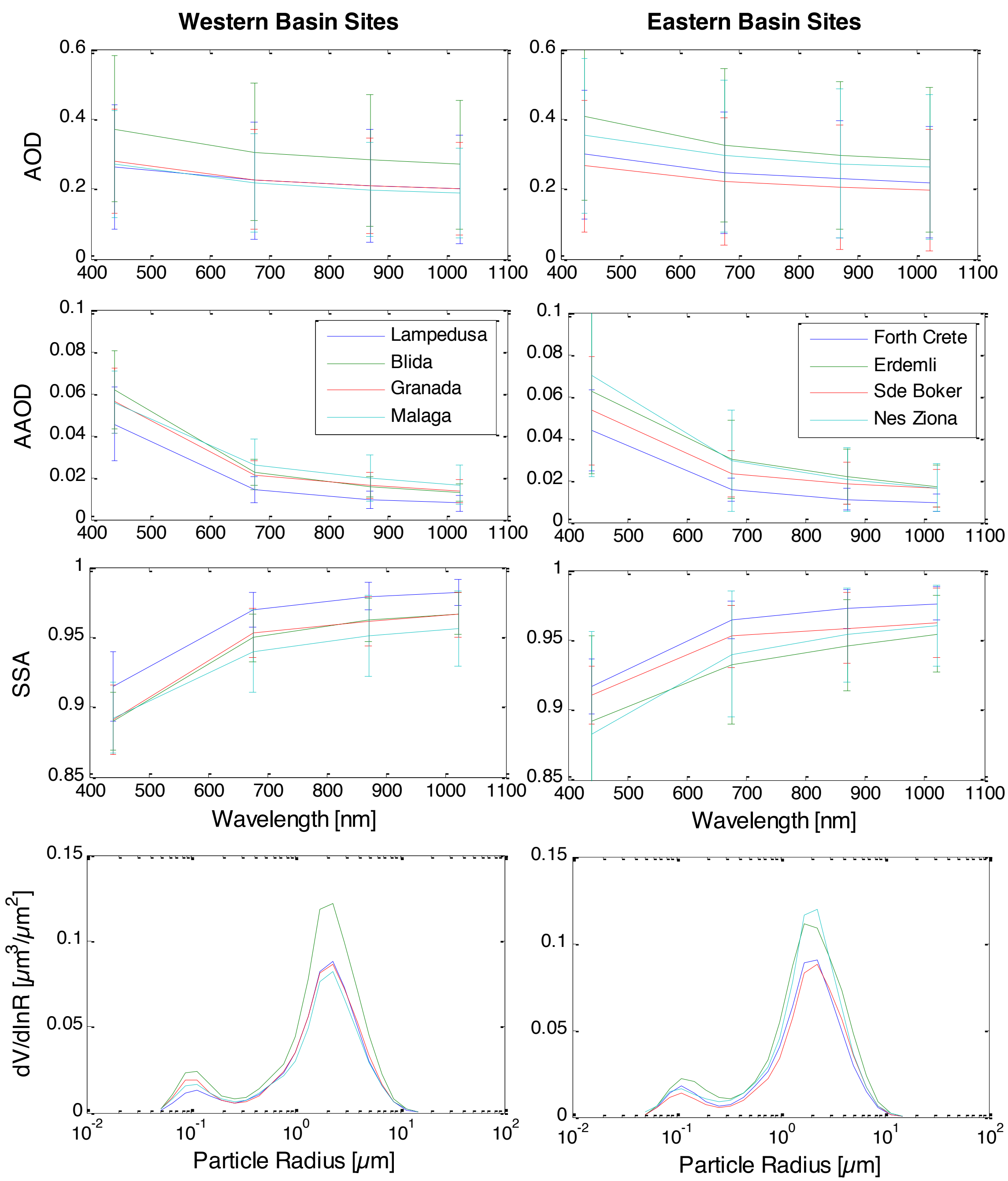

Fig. S1 The optical and microphysical properties of dust (EAE<0.6) aerosols for different dust affected sites in Mediterranean basin. The effect of sea salt could be seen in case of Lampedusa and Forth Crete in both SSA and AAOD spectral dependency. In spite of different plausible dust sources both eastern and western basin sites show a good consistency in optical and microphysical properties and could be regarded as dust model for the Mediterranean Basin.

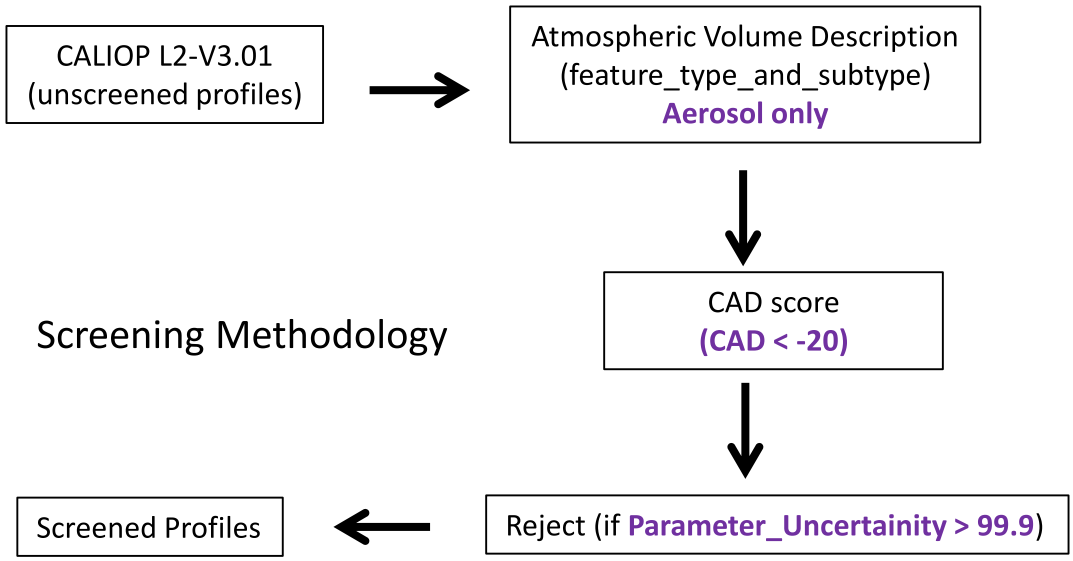

Fig. S2 Flow chart of screening methodology for CALIOP extinction profiles used in present study. The details can be found in Winker et al., 2013.

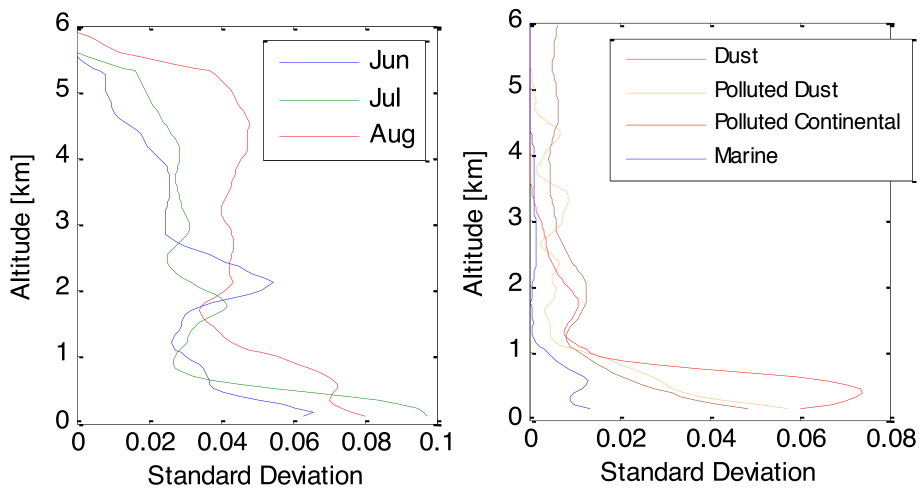

Fig. S3 Vertical distribution of standard deviation [km^{-1}] of monthly mean aerosol extinction coefficient (left panel) and seasonal mean (averaged from monthly mean) aerosol extinction coefficient for different dominant aerosols (right panel) during summer 2010. All points of individual profiles which did not characterized as aerosol (below<6 km altitude) are given 0.0 km^{-1} extinction values, which in results the higher standard deviation values.

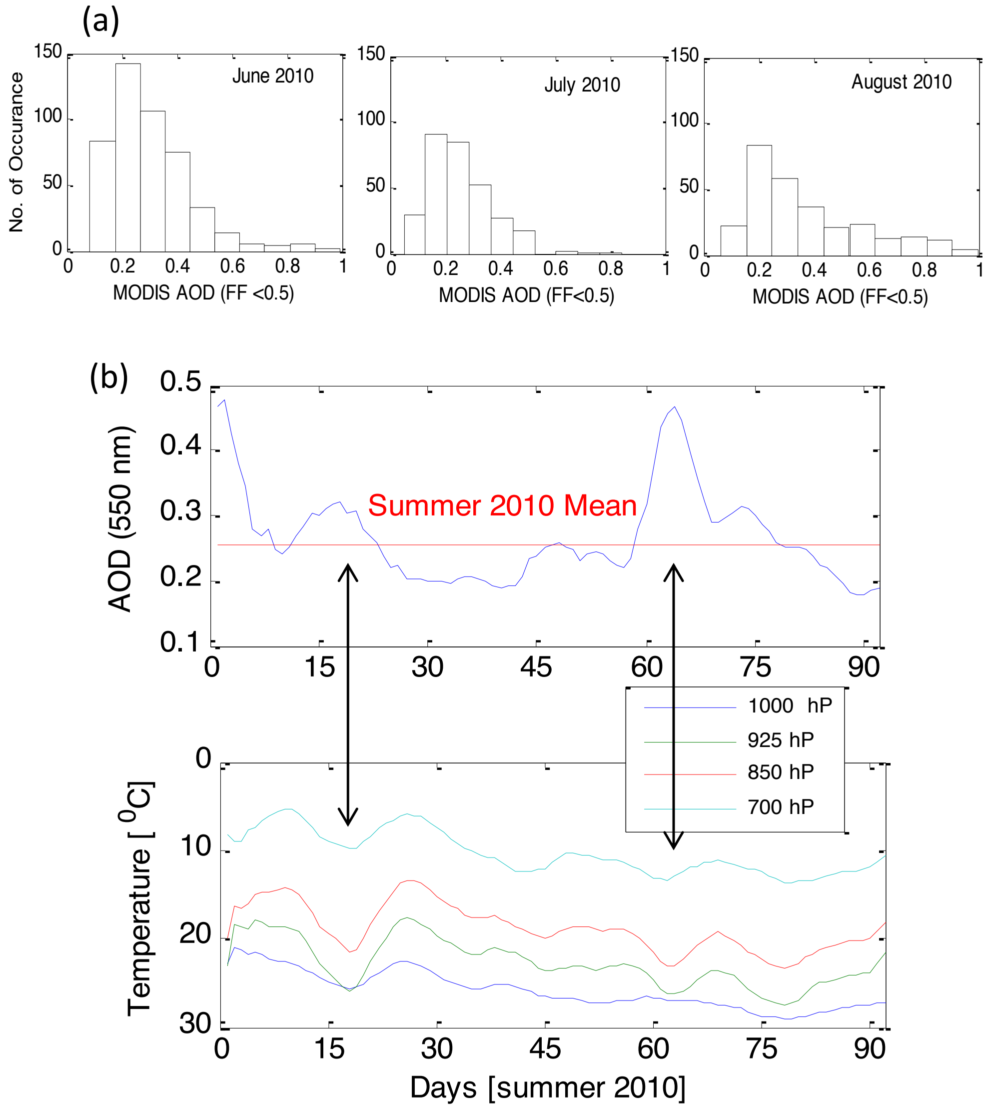

Fig. S4 (a) Occurrence frequency of MODIS AOD for ff<0.5 case during June – August, 2010, and (b) 7-day running mean of daily averaged AOD (upper panel) and atmospheric temperature at 4 pressure levels over the ROI. Fig. S4a shows that the AOD occurrence associated with large particles is maximal in June as compared to other two later months or in other words June month is highly impacted by dust events as compared to rest of season. Also the mean temperature climatology shows a gradual increase as days progressed from June to August. The daily mean values of AOD did not show any definite pattern with temperature except few events in June and August (marked as double headed arrow). All above mentioned analysis suggest that the coarse particles (dust events) dominant in early summer season which is also characterized by slightly lower atmospheric temperature. This could be a plausible reason of slightly lower atmospheric temperature in case of coarse particles (ff<0.5) than that in fine particle case (ff>0.5) in Fig. 10a.

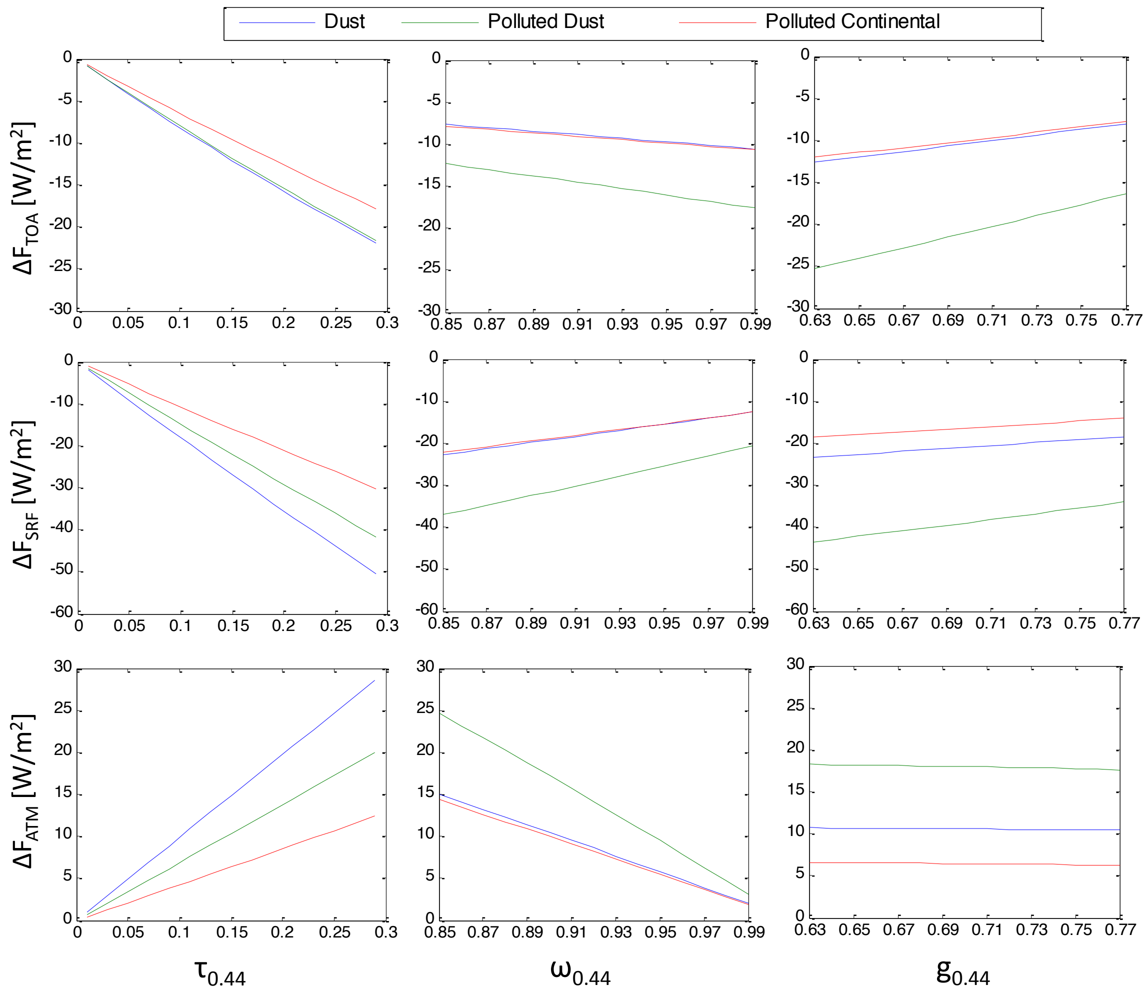

Fig. S5 Dependence of aerosol radiative forcing (integrated over the solar spectrum (0.25-20 μm and SZA = 60^0) on aerosol properties [AOD ($\tau_{0.44}$), SSA ($\omega_{0.44}$) and asymmetry parameter ($g_{0.44}$) at 0.44 μm] for different absorbing aerosols calculated from SBDART radiative transfer calculation. For each aerosol property the upper panel denotes forcing at top of the atmosphere (ΔF_{TOA}), middle one present forcing at surface (ΔF_{SRF}) and the lower one shows forcing in the atmosphere (ΔF_{ATM}).