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Future climatic drivers and their effect on PM_{10} components in Europe and the Mediterranean Sea

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Supplementary Information

S1: Comparison of historic simulations to EEA stations for certain species

Since we are using historic simulations and not hindcast simulations as the reference for our future scenarios, they are not directly comparable to measurements, since they are prepared with climatological meteorological inputs and not reanalyzed meteorological inputs. Also, the emissions in our simulations don't change and are always ECLIPSE CLE 2010 emissions, which could also produce discrepancies. Therefore, a yearlong profile was prepared from an average of historic simulations between the years 1996 and 2005. Another annual profile was prepared with all available EEA e-reporting stations for key species for the period of 2005-2015. These two profiles were compared in annual and monthly comparisons, the results for which are provided in figures S1 fig.1 and S1 fig.2 for O_3, NO_2, PM_{10} and $PM_{2.5}$. The results shown below were filtered to only include rural and remute stations. Table S1 shows statistic information for these comparisons.

	Mean_S	Mean_M	% Bias	Sd_S	Sd_M	R
O3	65.4	61.9	5.9	20.6	12.2	0.69
NO2	6.9	11.3	-38.9	7.8	4.3	0.55
PM2.5	9.5	11.9	-20.7	8.2	3.9	0.49
PM10	12.5	18.9	-33.5	7.2	4.6	0.34

Table S1. Statistical parameters for the comparisons performed using EEA stations and our historic simulations. A monthly profile of EEA data covering the period of 2006 to 2015 is compared to a monthly profile of historic simulations covering the period of 1996 to 2005. Mean_S and Mean_M show simulation and measurement averages respectively, Sd_S and SD_M show the standard deviation of simulations and measurements respectively. R is the correlation coefficient for each component.

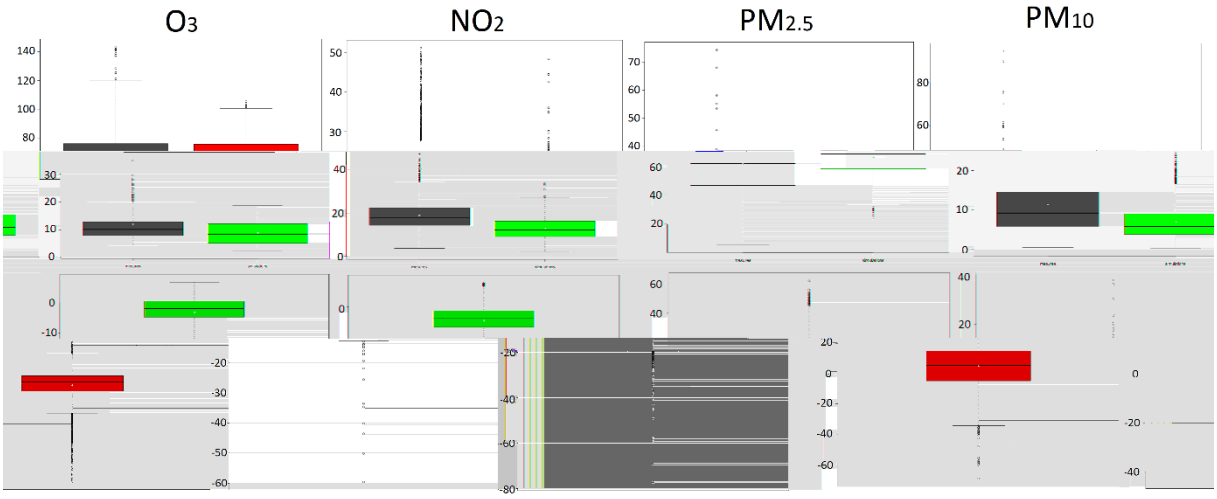

Figure S1. *Comparison of the same data introduced in table 1 to historic simulations. First row shows the average of the comparisons in black for measurements and in red for historic simulations. Second row shows the boxplot for the biases between the two.*

S2: 2D temperature images for different seasons

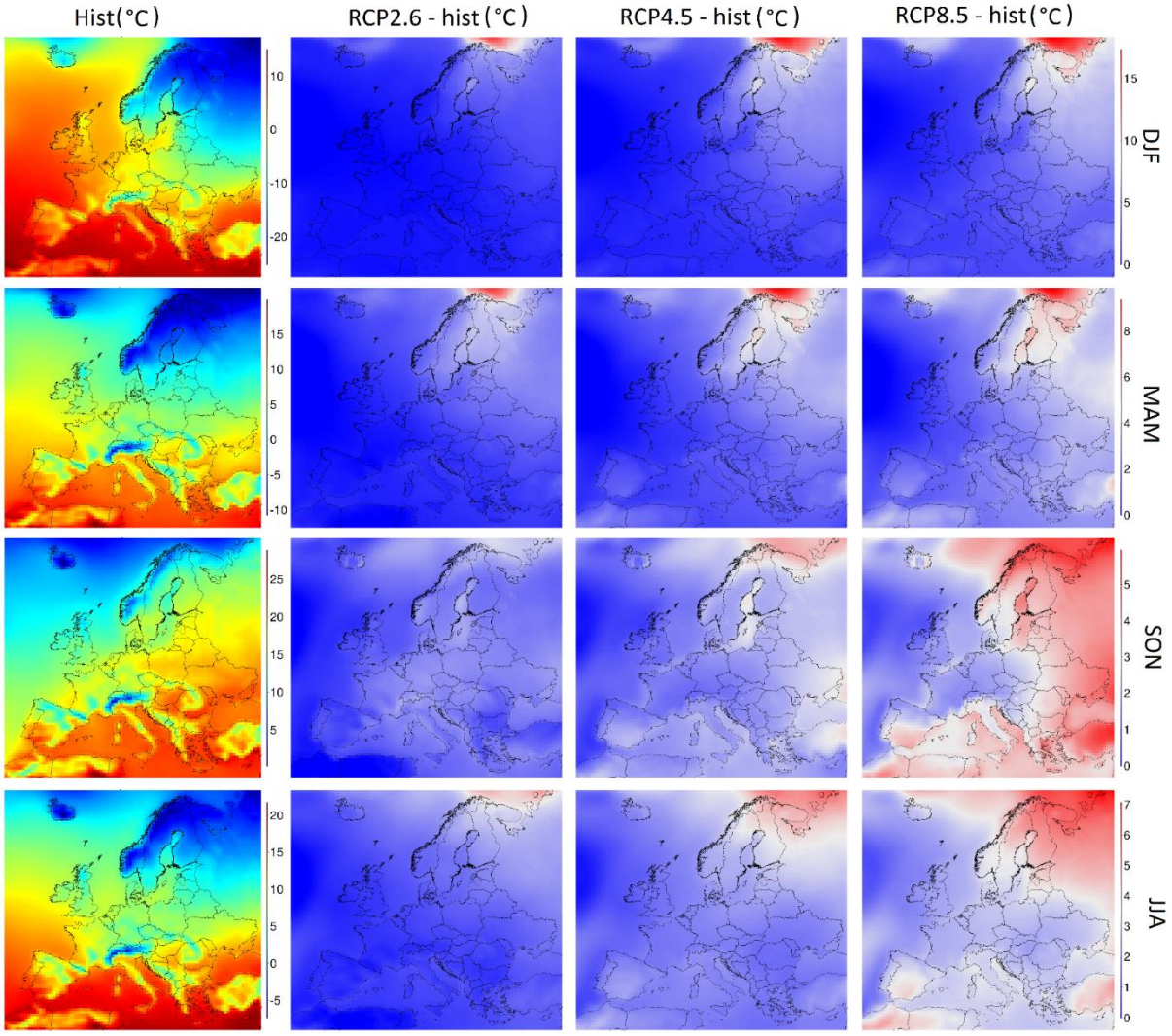

Figure S2. *Seasonal temperature maps for historic simulations (in °C, first column from the left), and the difference between RCP2.6, RCP4.5 and RCP8.5 (in °C, second to fourth columns from the left). Each row shows one season, from the top DJF, MAM, SON and JJA respectively.*

S3: Meteorological parameters for different scenarios for MEDW and MEDE sub-domains

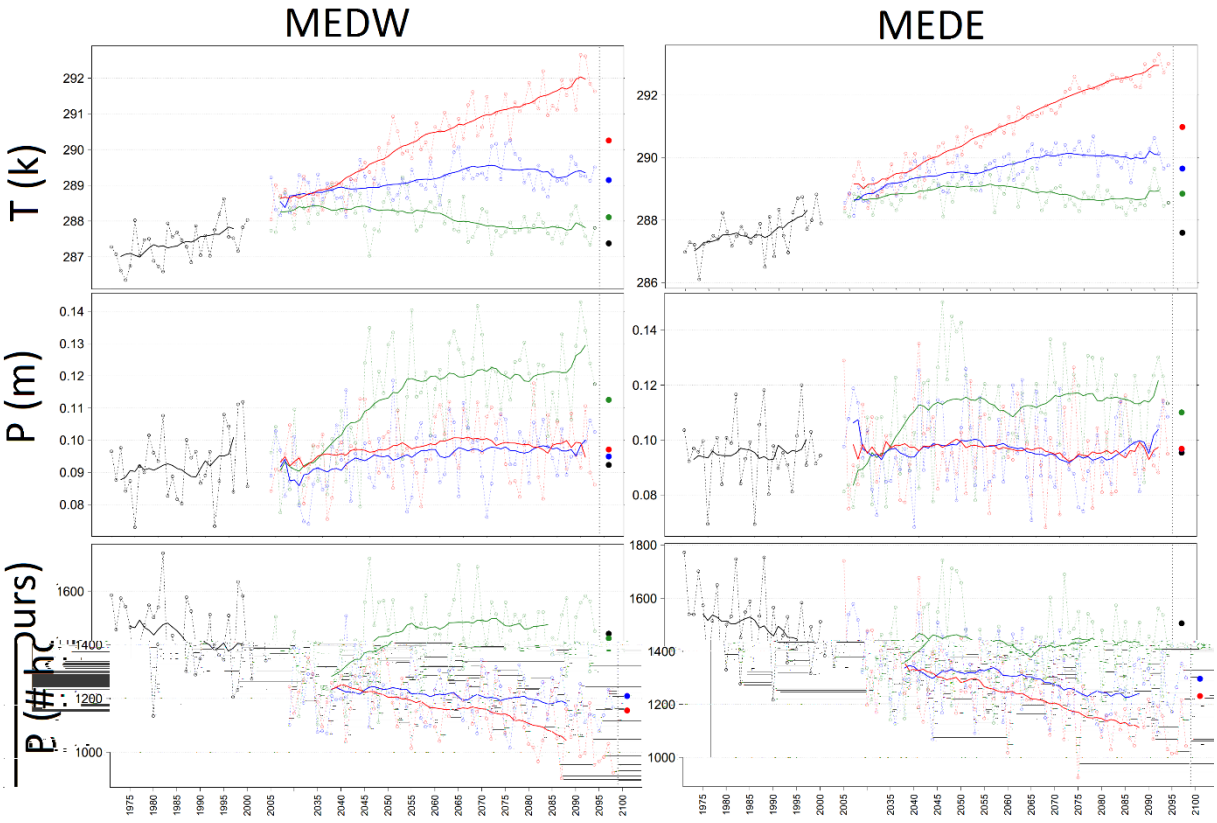

Figure S3. *Same as figure 2, but for MEDE and MEDW.*

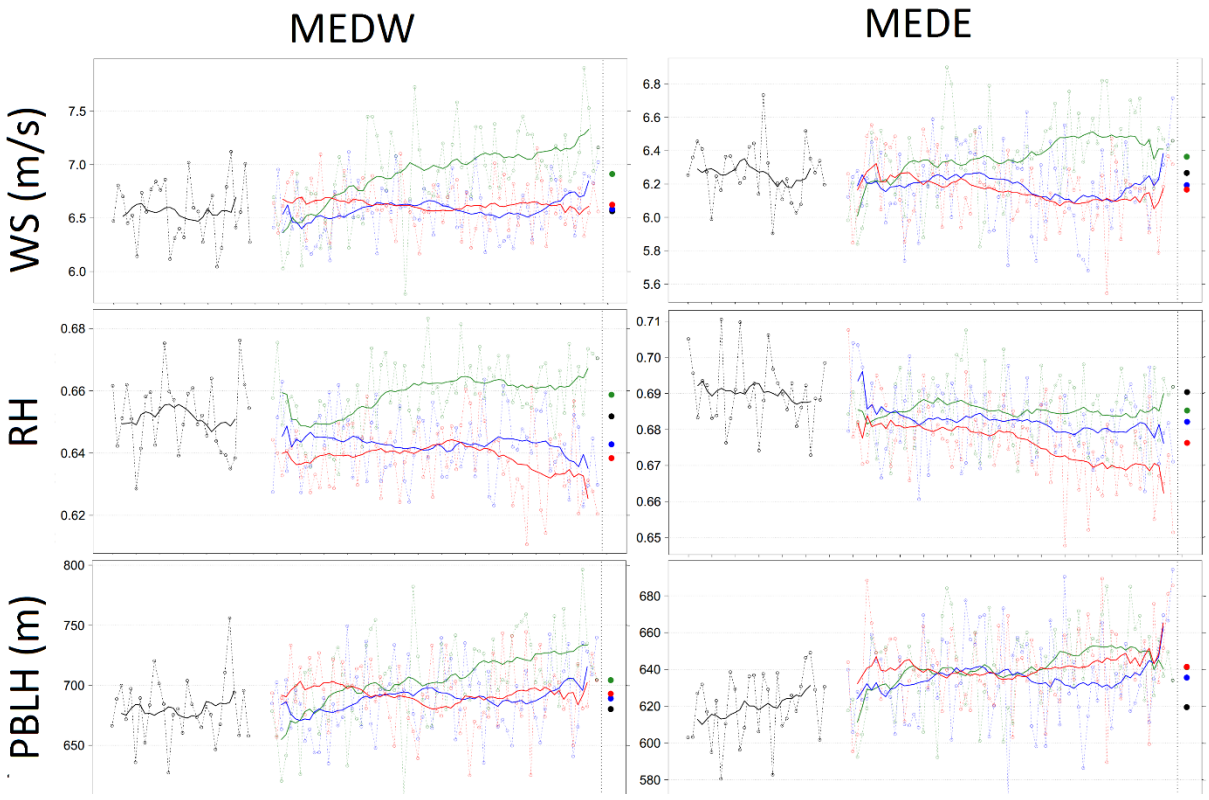

Figure S4. *Same as figure 2, but for MEDE and MEDW.*

S4: Correlations of meteorological parameters to each other

EUR

	T	P	RH	WS	PBLH	SWRD
T	1	0.05	-0.03	0.09	0.37	-0.72
P	-0.28	1	-0.26	0.76	0.72	0.26
RH	-0.40	0.60	1	-0.60	-0.60	-0.21
WS	-0.55	0.72	0.30	1	0.94	0.01
PBLH	-0.33	0.33	-0.38	0.64	1	-0.18
SWRD	0.50	-0.75	-0.80	-0.62	-0.05	1

MED

	T	P	RH	WS	PBLH	SWRD
T	1	-0.55	0.53	-0.28	-0.66	-0.01
P	0.36	1	-0.70	0.62	0.80	-0.19
RH	0.01	0.38	1	-0.80	-0.95	-0.34
WS	-0.01	0.76	-0.61	1	0.77	0.30
PBLH	-0.01	0.53	-0.95	0.70	1	0.14
SWRD	-0.43	-0.60	-0.38	-0.18	0.17	1

Table S2. Correlations of meteorological parameters to each other, red values show the correlation for winter and green values for summer, on the left for EUR and on the right for MED.

S5: Information regarding to $PM_{2.5}$

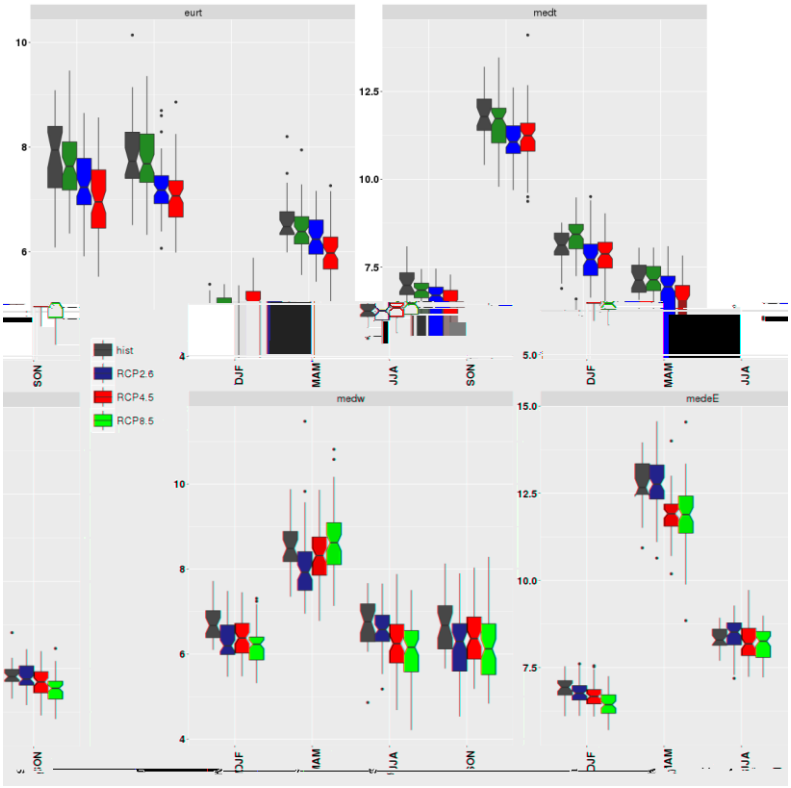

Figure S5. *Seasonal concentrations of $PM_{2.5}$ for all subdomains.*

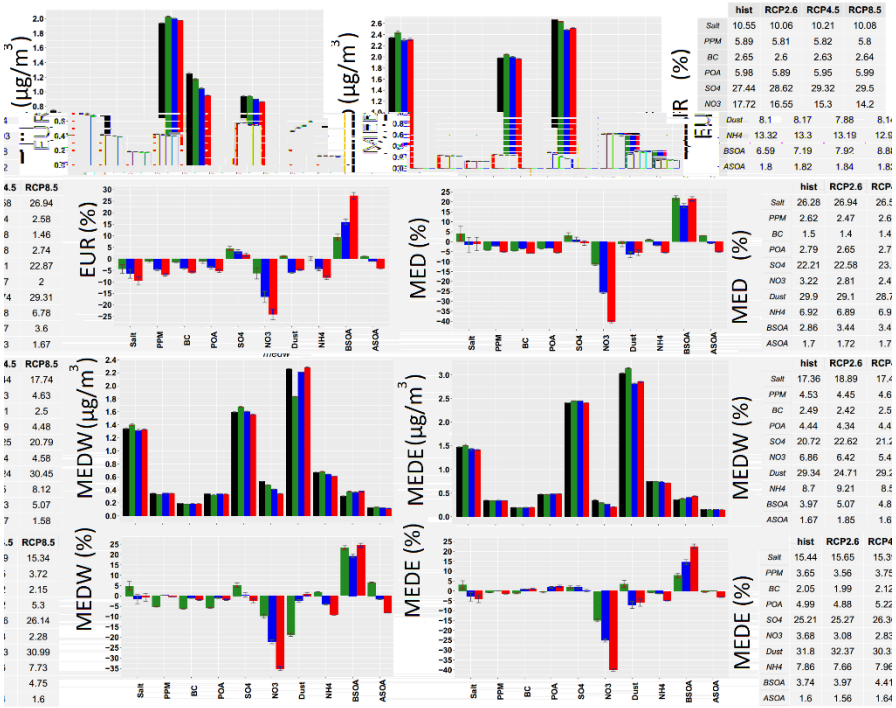

Figure S6. *Same as figure 7, but for $PM_{2.5}$*

S6: Regressions for different seaosns and different components

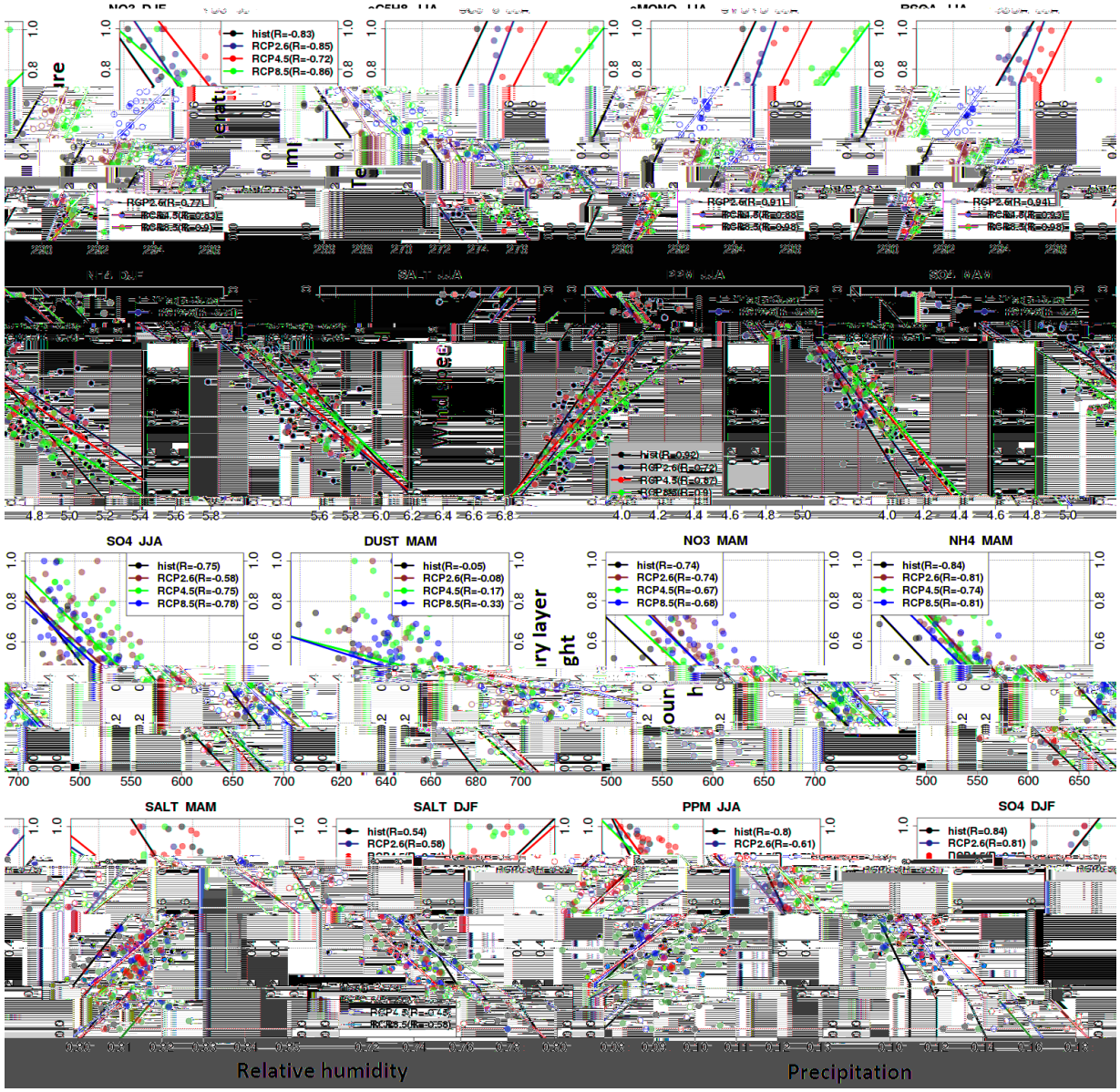

Figure S7. *Individual correlations for all scenarios with different components for EUR sub-domain: the name of the component, season and the meteorological parameter is written on each figure.*

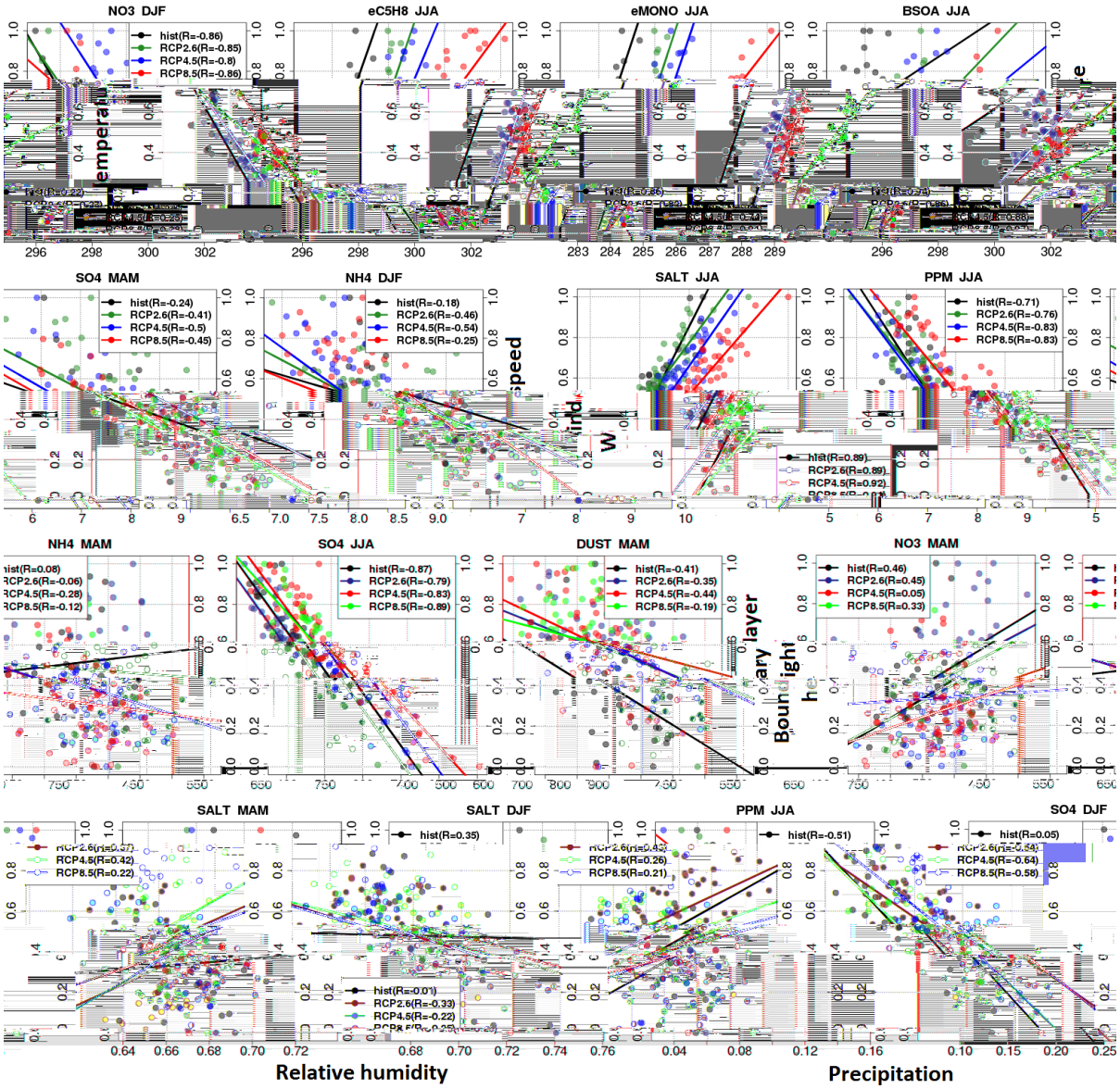

Figure S8. *Individual correlations for all scenarios with different components for MED sub-domain: the name of the component, season and the meteorological parameter is written on each figure.*

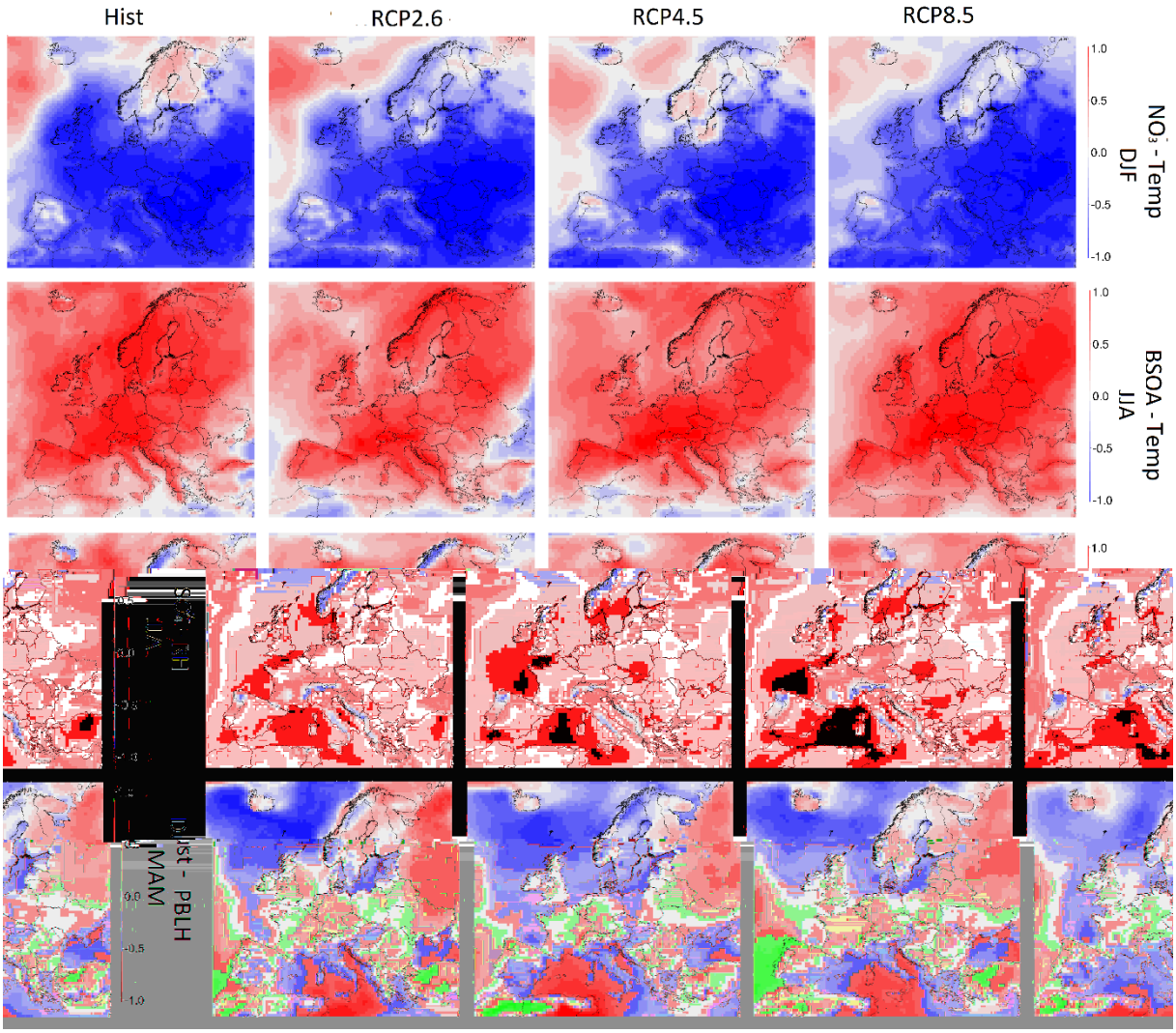

Figure S9. *Correlations of historic and future scenarios for BSOA, nitrate, sulfate and dust with temperature, temperature, relative humidity and PBL height respectively for the season in which the concentration of the pollutant is highest. Each column corresponds to one scenario (name above column). Each row shows the correlation of one pollutant with one meteorological parameter on a scale of -1 to 1.*

S7: Seasonal absolute and relative

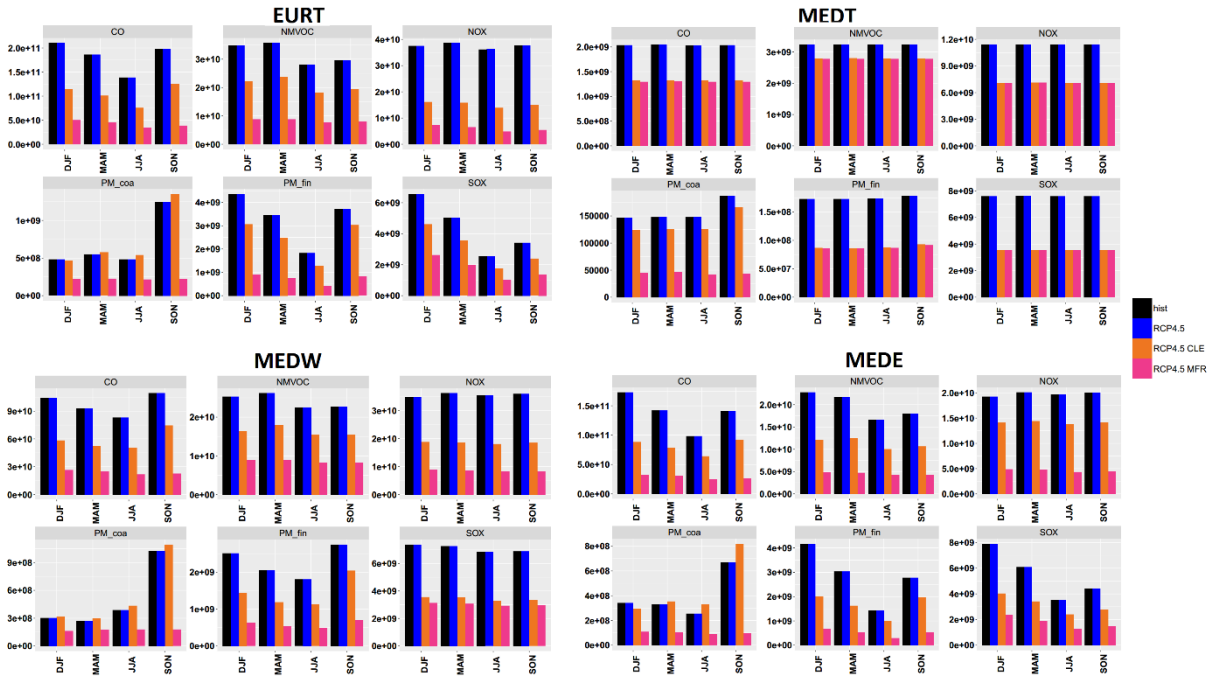

Figure S10. *Anthropogenic emissions for CLE-2010, CLE 2050 and MFR 2050 emissions*

S8: Seasonal comparison for the impact of each driver on PM_{10} components

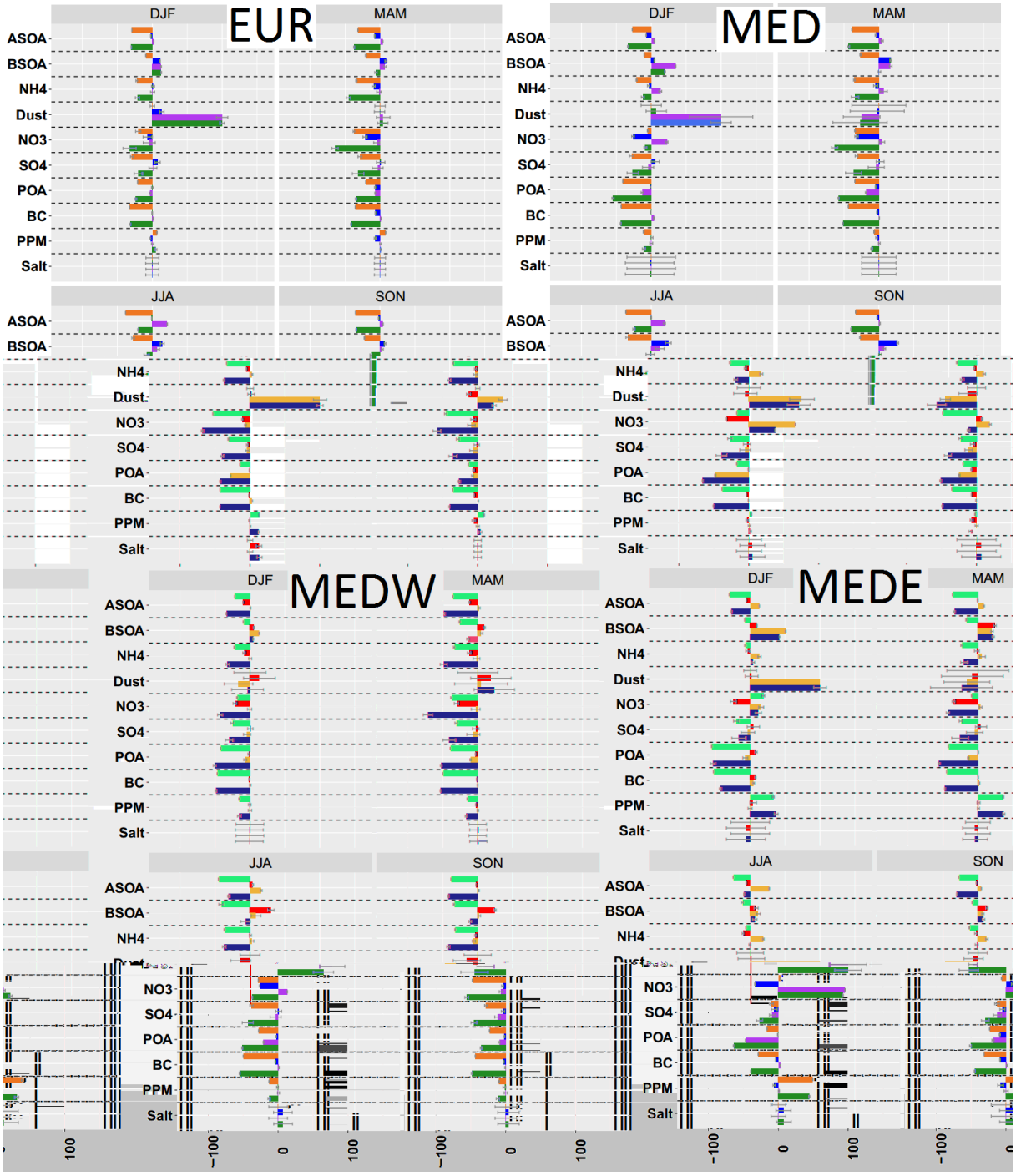

Figure S11. *Seasonal relative impact of climate, BC and emission drivers on PM_{10} components for different sub-domains, the name of the sub-domains is written on each panel. Each sub-panel shows one season. Error bars show the confidence interval calculated by annual averages.*