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Assessment of isoprene and near-surface ozone sensitivities to water stress over the Euro-Mediterranean region

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Table S.1. Plant Functional Type classes (PFTs) in the Community Land surface model version 4.5 (CLM4.5, Oleson et al., 2013).

PFT name
1. Bare soil
2. Needleleaf Evergreen Tree - Temperate
3. Needleleaf Evergreen Tree - Boreal
4. Needleleaf Deciduous Tree - Boreal
5. Broadleaf Evergreen Tree - Tropical
6. Broadleaf Evergreen Tree - Temperate
7. Broadleaf Deciduous Tree - Tropical
8. Broadleaf Deciduous Tree - Temperate
9. Broadleaf Deciduous Tree - Boreal
10. Broadleaf Deciduous Shrub - Temperate
11. Broadleaf Evergreen Shrub - Temperate
12. Broadleaf Deciduous Shrub - Boreal
13. C3 artic grass
14. C3 grass
15. C4 grass
16. Crop 1
17. Crop 2

Table S.2. Summary of observation-based data-sets used in the present study.

Dataset (version)	Variable	Units	Spatial res.	Period	Temporal res.	Reference
E-OBS v20e	Surface air temperature	$^{\circ}$C	0.25°	1950–2018	Daily Mean	Cornes et al. (2018)
	Precipitation rate	$\mathrm{mm\,day^{-1}}$	0.25°	1950–2018	Daily Mean	Cornes et al. (2018)
CLoud property dAtAset using SEVIRI, version 1 (CLAASv1)	Fractional cloud cover	%	0.05°	1991–2015	Monthly Mean	Stengel et al. (2014)
FLUXCOM remote-sensed (RS) product)	Latent heat flux	$\mathrm{MJ\,m^{-2}\,d^{-1}}$	0.50°	2001–2015	Monthly Mean	Jung et al. (2019)
European Space Agency Climate Change Initiative (ESACCIv4.04) COMBINED product	Volumetric surface soil moisture	$\mathrm{m^3\,m^{-3}}$	0.25°	1978–2015	Daily Mean	Dorigo et al. (2017)
Ozone Monitoring Instrument (OMI-L3 vQA4ECV)	Formaldehyde (HCHO) column concentration	$10^{15}\,\mathrm{molec\,cm^{-2}}$	0.25°	2005–2015	Monthly mean	De Smedt et al. (2018)
European Air quality Database (AirBase)	Mixing ratio	ppbv		200*–200*	Daily mean	

Table S.3. For each soil layer in RegCM4.7, inferior bound and thickness.

Soil layer number	Soil inferior bound (m)	Soil thickness (m)
1	0.0175	0.0175
2	0.0451	0.0276
3	0.0906	0.0455
4	0.1655	0.0750
5	0.2891	0.1236
6	0.4929	0.2038
7	0.8289	0.3360
8	1.3828	0.5539
9	2.2961	0.9133
10	3.8019	1.5058

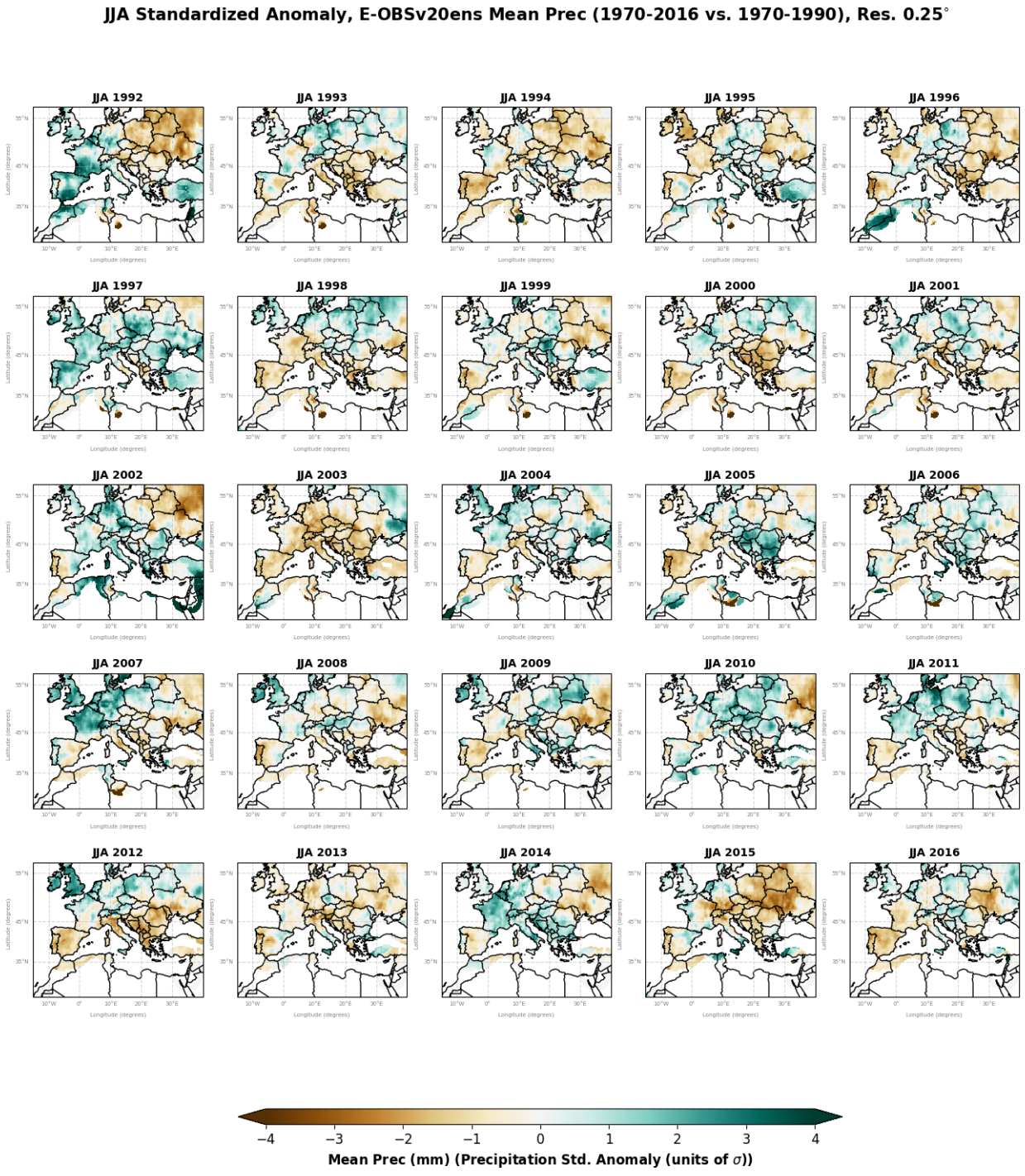

Figure S.1. Precipitation standardized anomalies (units: standard deviation, σ) computed over the summers (June-July-August, JJA) between 1970 and 2016 using the E-OBSv20e data-set and referring to the 1970–1990 precipitation and temperature climatology.

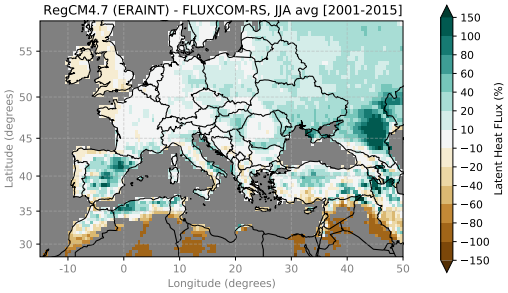

Figure S.2. Spatial distribution of summer percentage biases (units: %) in latent heat fluxes between the RegCM4-CLM4.5 model and the FLUXCOM data-set (Remote-Sensed product) over the period 2001–2015. For comparison, model output have been remapped onto the FLUXCOM grid.

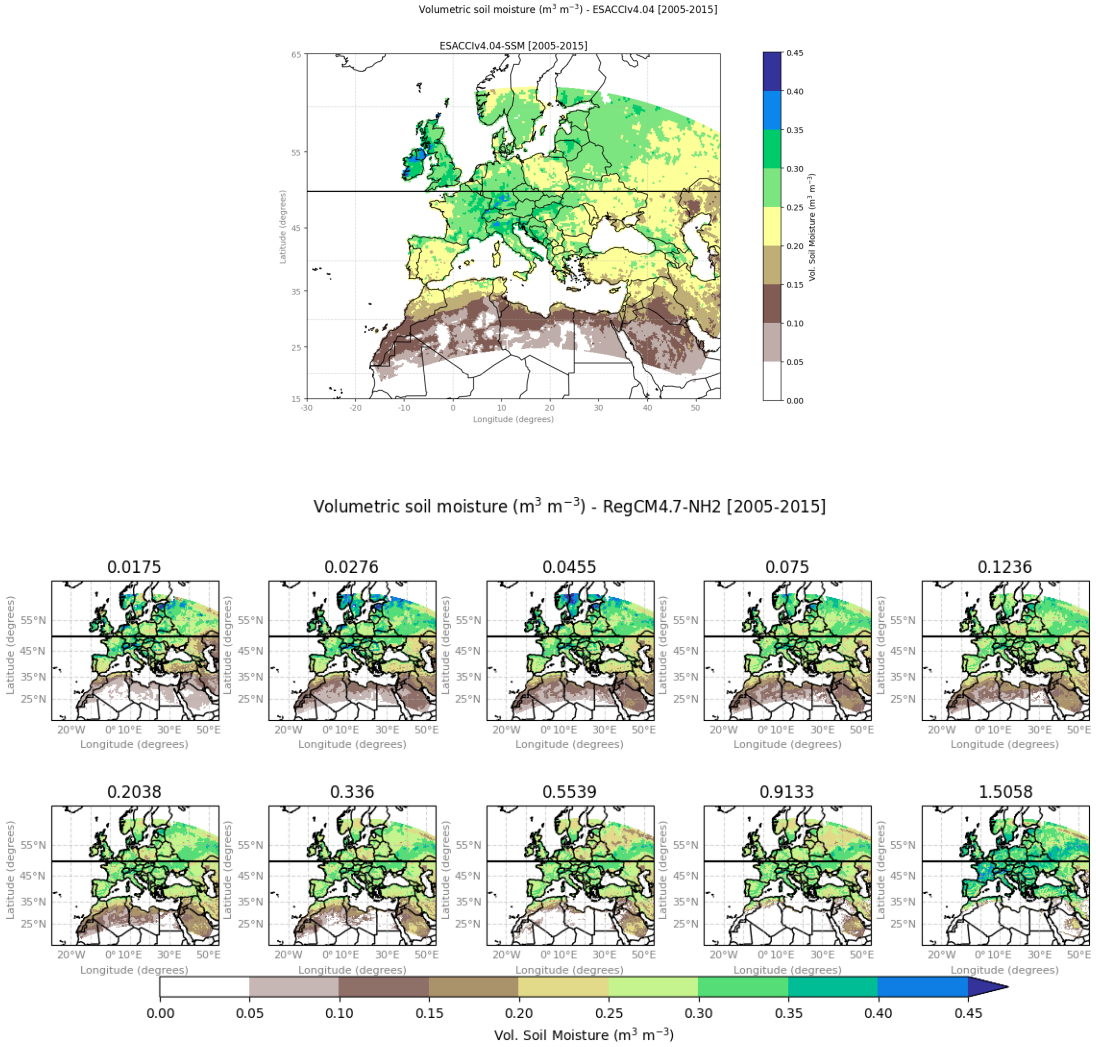

Figure S.3. Comparison of volumetric soil moisture (m^3 m^{-3}) between the ESACCIv4.04 data-set and the RegCM4-CLM4.5 model over the period 2005–2015. For comparison, model output was remapped onto the ESACCI grid.

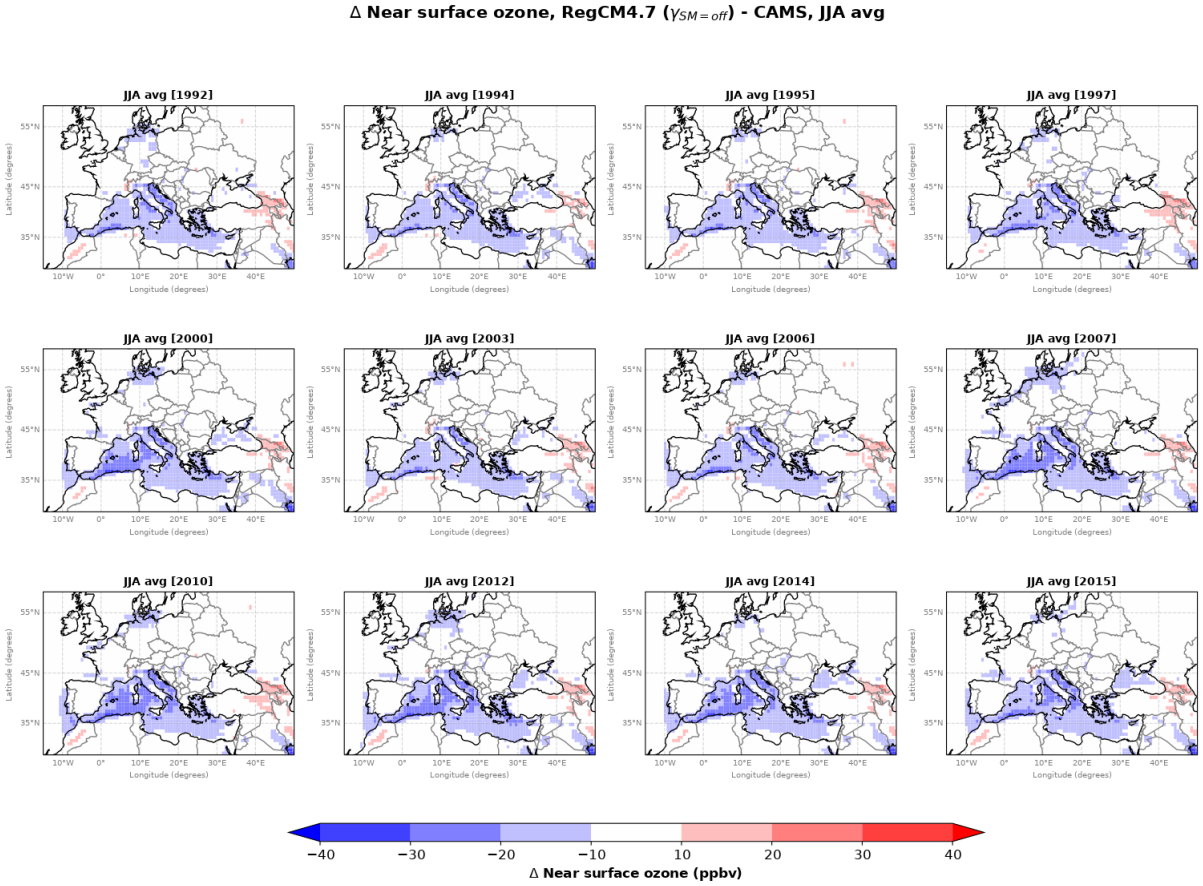

Figure S.4. Spatial distribution of summer-averaged differences in ozone (O3) volume mixing ratio at 1000 hPa (units: ppbv) between the RegCM4-chem model and the CAMS re-analyses.

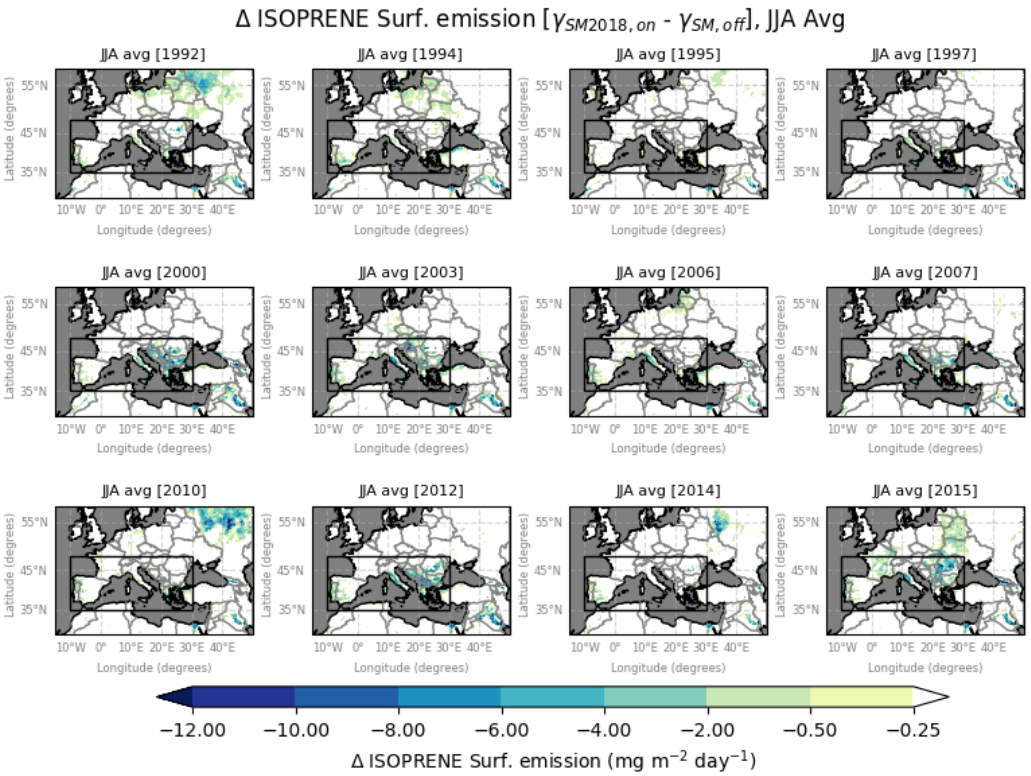

Figure S.5. Spatial distribution of summer-averaged absolute changes in isoprene emissions (units: $\mathrm{mg\,m^{-2}\ day^{-1}}$) as simulated by the RegCM4chem-CLM4.5-MEGAN2.1 model across the selected summers over the period 1992–2016. Absolute changes were computed as the difference between summer averages (JJA) of model output from the GAMMA-SM2018on and the GAMMA-SMoff simulations. Black boxes highlight the Euro-Mediterranean region selected for analysis.

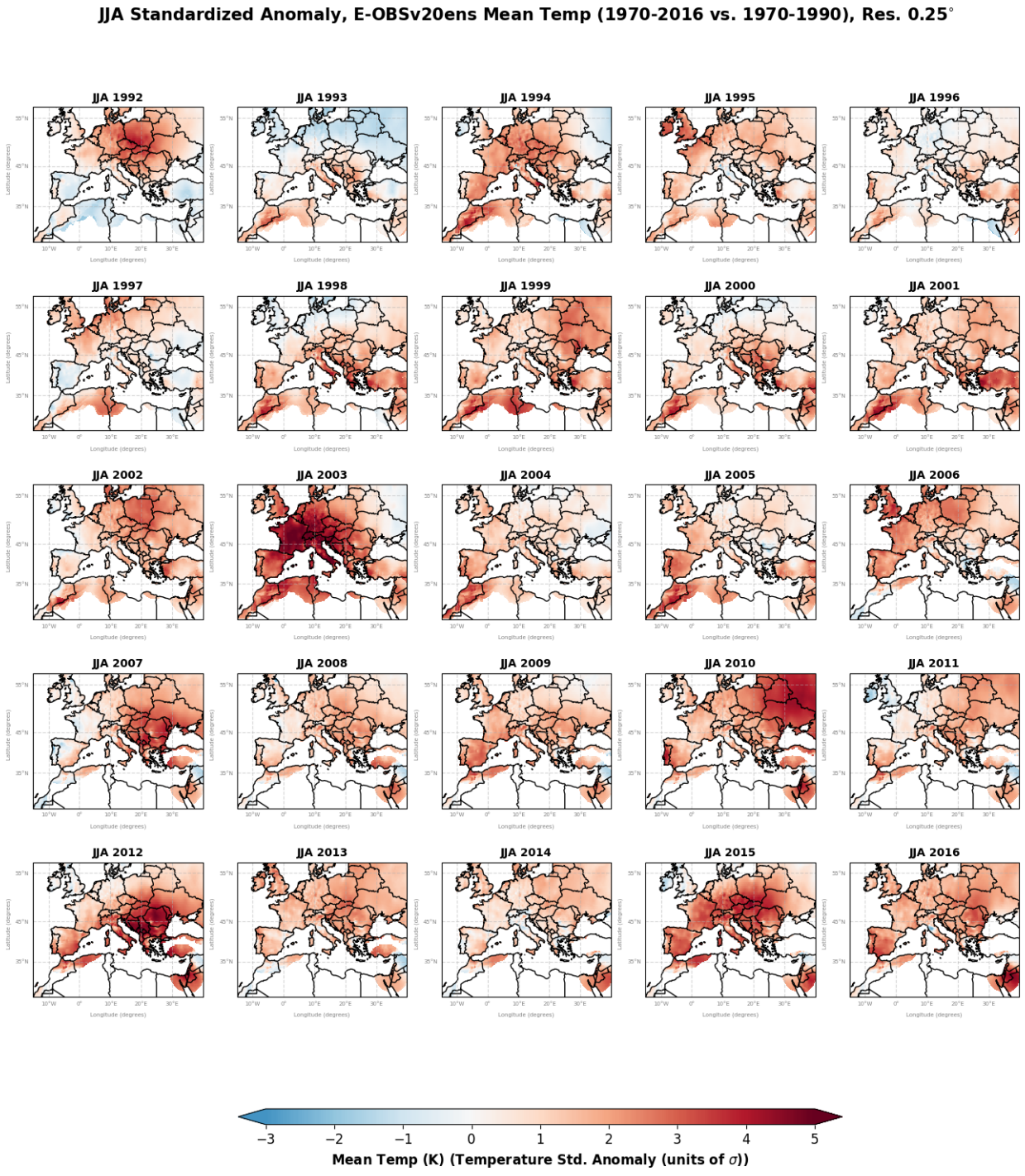

Figure S.6. Standardized anomalies (units: standard deviation, σ) in mean surface air temperatures computed over the summers between 1970 and 2016 using the E-OBSv20e data-set and referring to the 1970–1990 precipitation and temperature climatology.

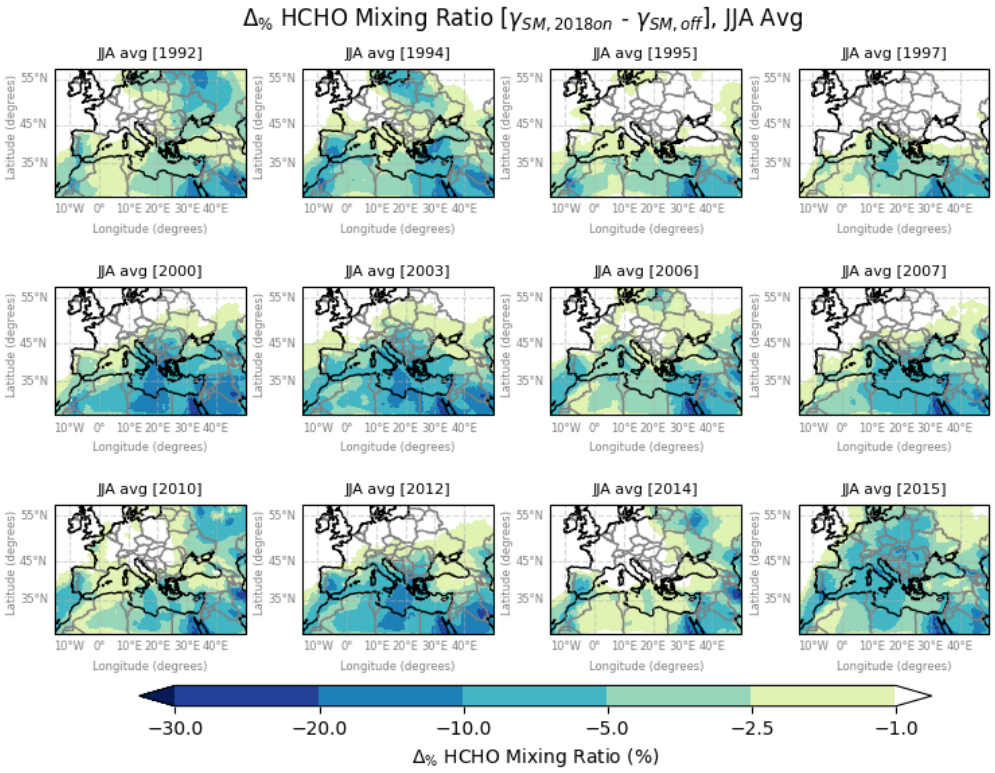

Figure S.7. Spatial distribution of summer-averaged percentage changes in formaldehyde surface mixing ratio (units: %) as simulated by the RegCM4chem-CLM4.5-MEGAN2.1 model across the selected summers over the period 1992–2016. To compute percentage changes, the difference between summer averages from the GAMMA-SM2018on and the GAMMA-SMoff simulations was divided by the reference simulation, GAMMA-SMoff.

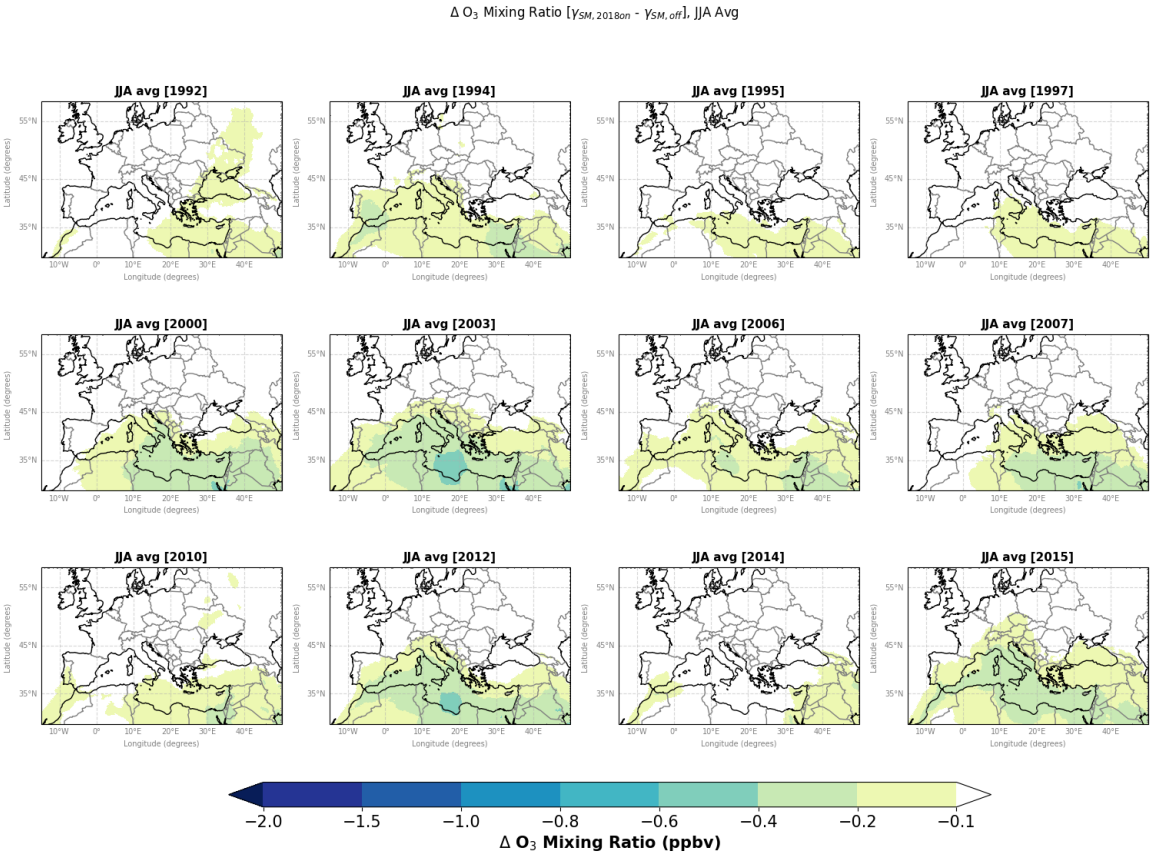

Figure S.8. As Figure S.7, spatial distribution of absolute changes in ozone mixing ratio at 1000 hPa (units: ppbv).

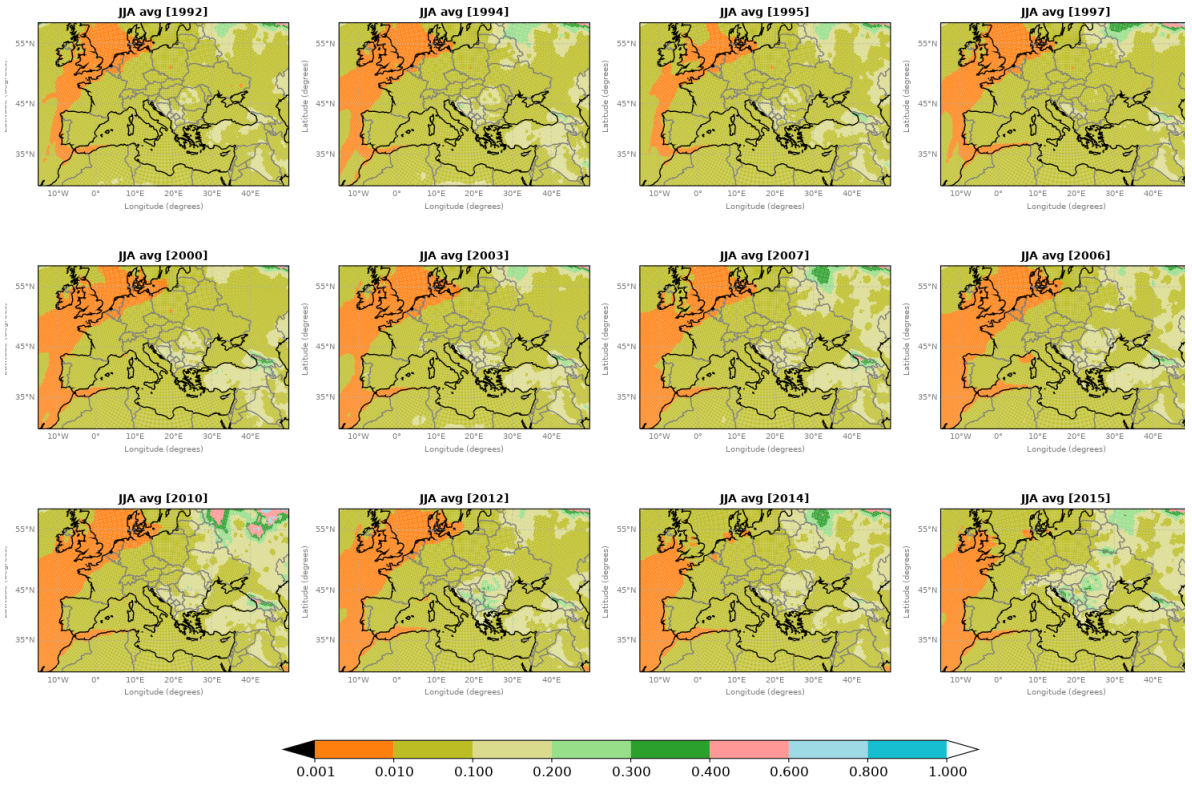

Figure S.9. Spatial distribution of the ratio between formaldehyde (HCHO) and nitrogen di-oxide (NO2) mass mixing ratios at 1000 hPa as simulated by the RegCM4-chem model. The HCHO/NO2 ratio results lower than 1 over the whole domain, indicating that the model reproduces a VOC-limited regime, based on Duncan et al. (2010).