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The influence of model spatial resolution on simulated ozone and fine particulate matter for Europe: implications for health impact assessments

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S1 Seasonal and country level evaluation for O_3

We further analyse how the seasonality in O_3 concentrations simulated at the two resolutions varies seasonally and also geographically at the country level (Fig. S1). During winter, O_3 concentrations at southerly locations in Greece and Italy (Fig. S1 red box) show the largest differences between the two resolutions, with an overestimate of ~ 50 µg m^{-3} at the coarse resolution compared to EMEP measurements. In contrast to the majority of the sites during winter, simulated O_3 concentrations at the finer resolution are higher compared to the coarse resolution for several locations in Austria, Hungary and Slovakia (red circle). Similar to winter, O_3 concentrations at the same locations in Italy are also largely overestimated by both model resolutions in summer (~50 µg m^{-3}, Fig. S1c). In autumn, the largest overestimates of low O_3 concentrations at the finer resolution occur at northern European locations in the Netherlands and Belgium (Fig. S1d - red box).

In spring, summer and autumn, O_3 concentrations simulated at both resolutions in Malta are much higher compared to measurements (~ 40 µgm^{-3}; Fig. S1b, c and d -red circle). This is due to the fact that at both resolutions, the grid box covering the Maltese Islands is represented as ocean and not land. Deposition of O_3 is typically less over the sea than compared to over land, potentially leading to an overestimation in simulated O_3 concentration compared to measurements at this location.

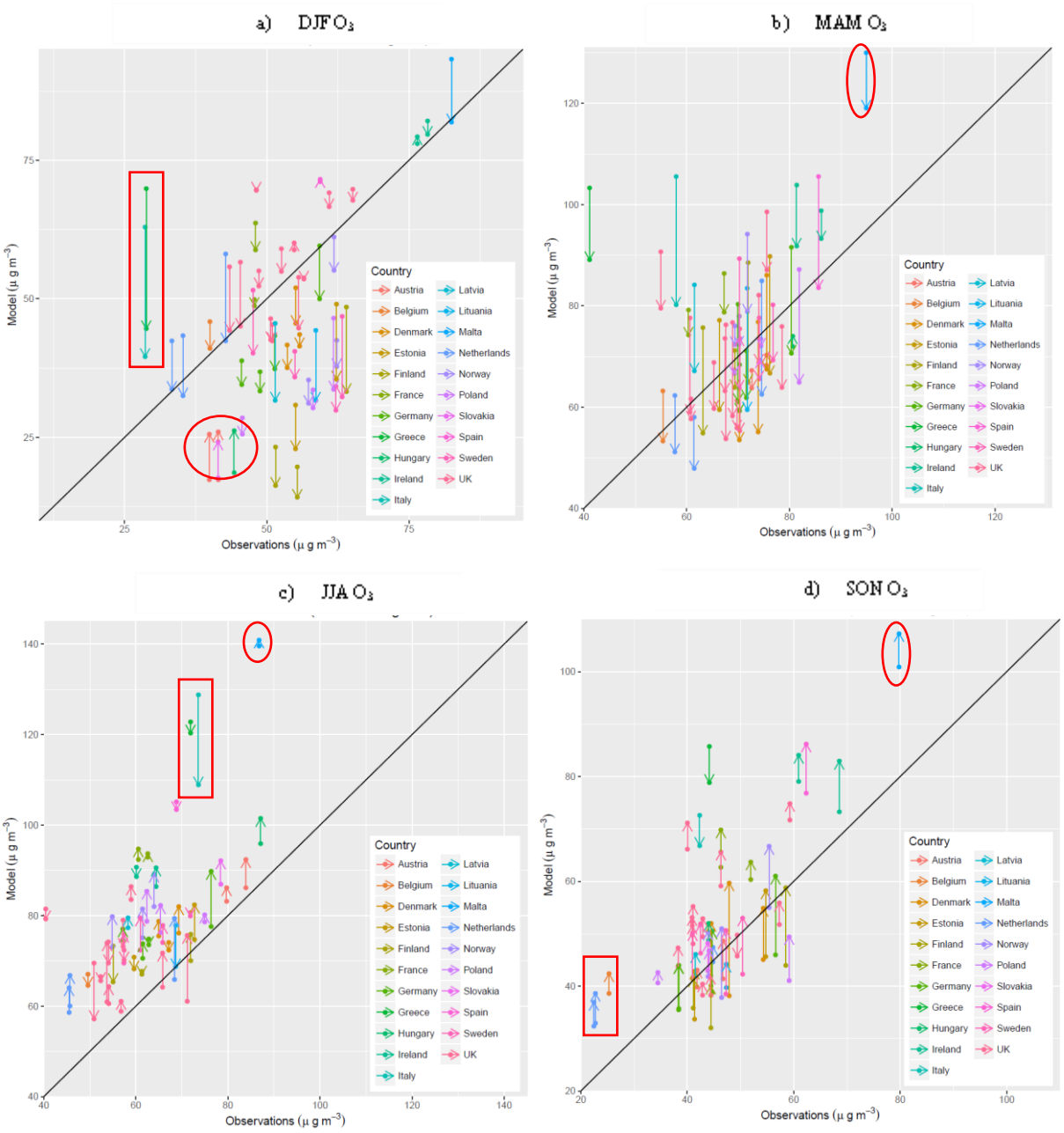

Figure S1: Modelled versus observed seasonal mean O_3 for a) DJF b) MAM c) JJA d) SON 2007 over a subset of 52 sites across the EMEP network as shown in Fig. 1. The arrow tails mark O_3 concentrations at the coarse resolution while the arrow heads represent the corresponding O_3 concentrations at the finer resolution.

S2 Additional figures on the impact of model resolution on pollutant concentrations

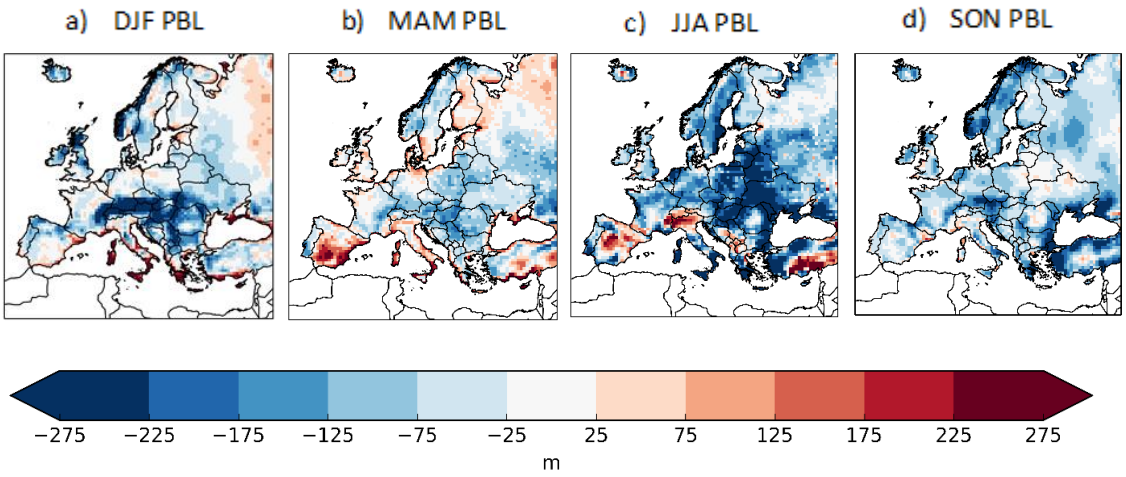

Figure S2: Difference between global and regional seasonal mean boundary layer height (PBL coarse resolution – PBL finer resolution) for a) DJF b) MAM c) JJA and d) SON for 2007

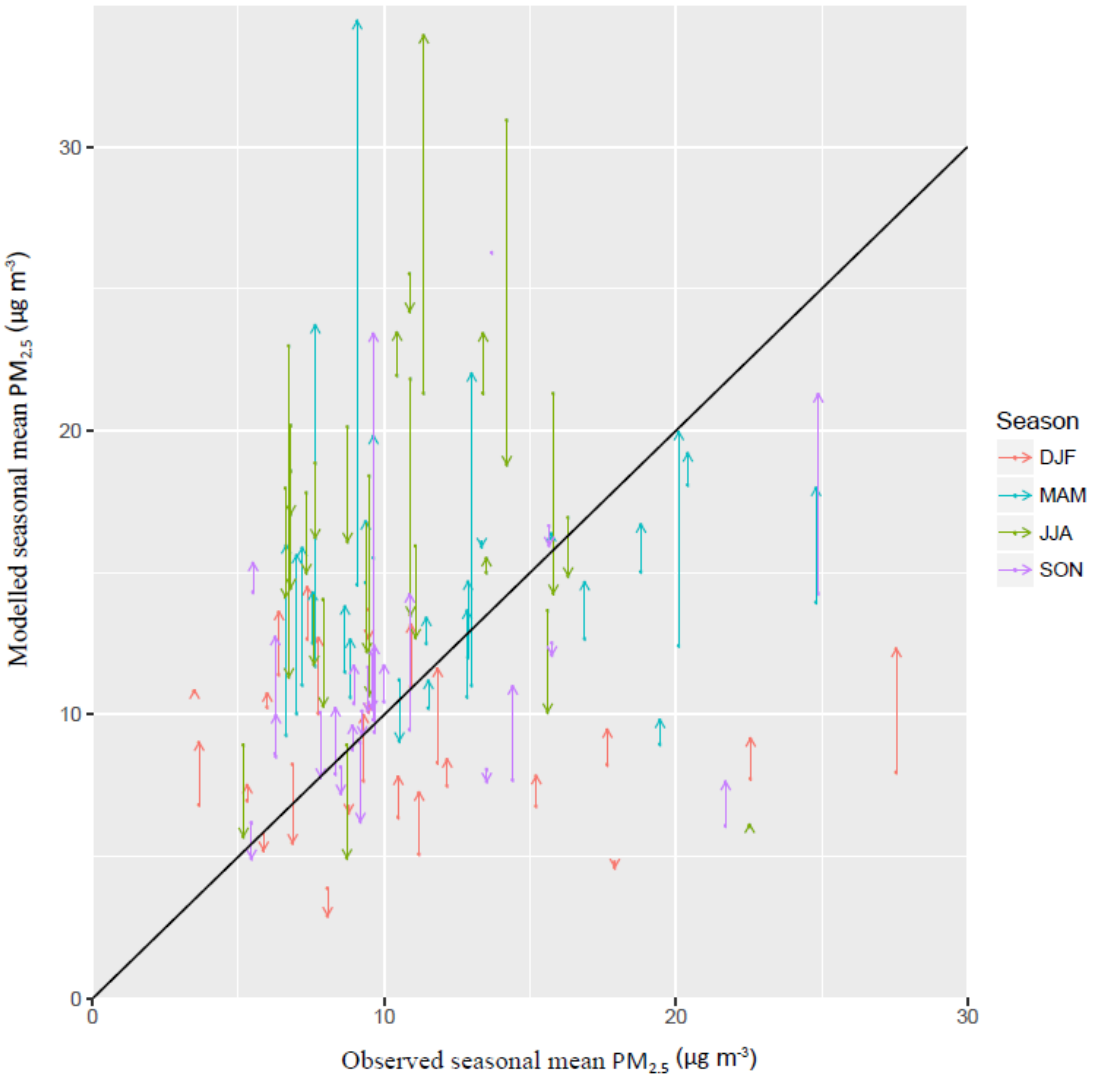

Figure S3 Seasonal mean modelled vs observed $PM_{2.5}$ for 25 sites across the EMEP network for the year 2007. The arrow tails mark $PM_{2.5}$ concentrations at the coarse resolution while the arrow heads represent the corresponding $PM_{2.5}$ concentrations at the finer resolution. The 1:1 line shows agreement between observed and simulated $PM_{2.5}$.

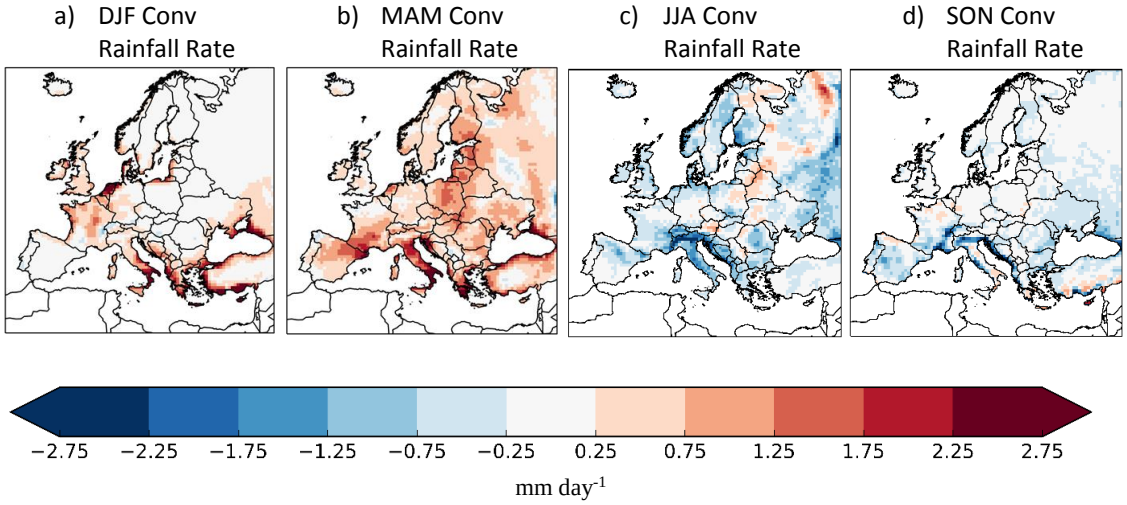

Figure S4: Difference between coarse and finer seasonal mean convective rainfall rate (mm day^{-1}) for a) DJF b) MAM c) JJA and d) SON for 2007

S3 Additional figures on the effect of applying population-weighting to pollutant concentrations

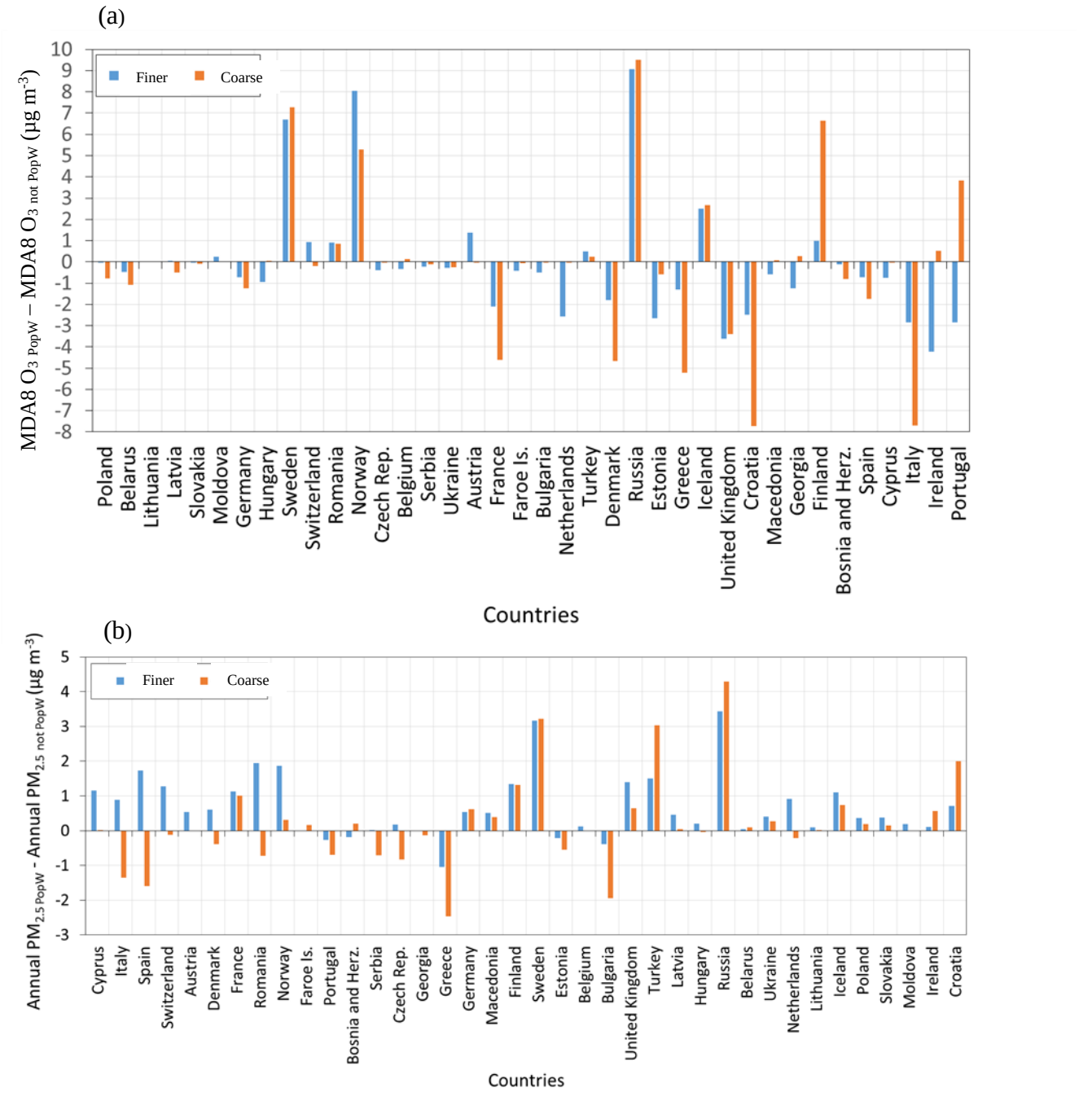

Figure S5: a) Difference between MDA8 O_3 concentrations with and without population-weighting as simulated by the coarse (orange bars) and finer (blue bars) resolutions b) same holds for annual mean $PM_{2.5}$ concentrations.