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Atmospheric Chemistry and Physics Discussions

Interactive comment on "On the roles of circulation and aerosols in the decline of mist and dense fog in Europe over the last 30 years" *by* G. J. van Oldenborgh et al.

Anonymous Referee #1

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Review of "On the roles of circulation and aerosols in the decline of mist and dense fog in Europe over the last 30 years" by G.J. van Oldenborgh, P. Yiou, and R. Vautard (ACP-2009-698)

This thorough analysis provides strong evidence that the observed decrease in fog frequency during recent decades over Europe is related to decreasing aerosol emissions. An examination of SLP, wind, and vorticity conditions associated with fog occurrence indicates that trends in meteorological conditions in recent decades can explain only a small fraction of observed fog decrease.

Major comments:

1) Bottom of p. 23994, top of p. 23995, and Fig. 4: I find it difficult to understand what Fig. 4 shows and how the authors calculated spatial correlation. It doesn't help that the x-axis has no title. As best I can tell, the authors calculate the rank correlation between visibility trends and emission trends in 2.5 grid boxes, then the correlation between trends aggregated in progressively larger grid boxes, with Fig. 4 showing how correlation varies with the size of the grid box. The authors should explain this more clearly in the text and refer to readers to prior work only to get specific details.

2) Lines 21-23 on p. 23998 and Fig. 11: The authors show that the number of days with dense fog is most highly correlated with precipitation 2-4 months previously and argue it is an effect of moist soil from previous rain providing sufficient moisture to form fog under subsequent clear conditions. I find it difficult to believe that rain 60-120 days earlier will provide sufficient evapotranspiration to the atmosphere for fog to form such a long time later. What is the timescale for positive soil moisture anomalies to decay away? Is it possible that there is "memory" in the large-scale atmospheric circulation (perhaps from ocean temperature anomalies) such that circulation anomalies producing spring precipitation tend to be followed by circulation anomalies producing summer fog?

Minor comments:

1) Lines 22-23 on p. 23988: I don't think it is quite the case that fog isolates the ground from upper atmospheric layers. Rather, fog often accompanies surface stratification, which is the cause of the isolation.

2) I don't think Fig. 3 and lines 14-22 on p. 23993 are necessary. I believe that it is well-accepted that increased aerosol concentrations contribute to greater optical thickness of fog. Also, Fig. 3 is ambiguous in that it does not demonstrate that the fog could not have formed merely by nighttime cooling whether irrespective of fireworks.

3) Line 12 on p. 23994: "monotonous" should be "monotonic".

4) The text size of the titles, labels, and legend in Fig. 5 is too small.

5) Line 19 on p. 23998: the authors should use a more specific and objective description than "beautiful day".

6) Line 1 on p. 24000: "Balkan" should be "Balkans".

7) Lines 4-5 on p. 24003: The meaning of "these numbers scale with the aerosol emissions" is not clear to me.

8) Outlook section: Another factor that could promote decreased fog in the future is the increase in downwelling IR radiation from more CO2 in the atmosphere that reduces surface radiative cooling.

9) Figs. 12, 13, 14, 15, 17, and 18: the largest positive and negative colors have values of +1 and -1 rather than (I assume) +10 and -10.

10) In the various figures and text that deal with the geostrophic wind and geostrophic vorticity, it would be helpful to clarify what elevation they correspond to (the surface?).

11) Fig. 16: Why not show meridional wind trend or SLP trend?

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 23987, 2009.