

Reply to Anonymous Referee 1:

We would like to thank the reviewer for taking time to review this manuscript thoroughly and for their comprehensive comments received. We have addressed all comments in turn below:

Specific comments:

1. Please provide details of the global model and resolution of the data which is used for the forcing?

The SAMBBA LAM was driven by the global NWP GA3.1 configuration of the Met Office Unified Model (Walters et al., 2011) with a horizontal resolution of N512 (25km) and 70 vertical levels with the model lid at 80km References:

D.N. Walters, M.J. Best, A.C. Bushell, D. Copsey, J.M. Edwards, P.D. Falloon, C.M. Harris, A.P. Lock, J.C. Manners, C.J. Morcrette, M.J. Roberts, R.A. Stratton, S. Webster, J.M. Wilkinson, M.R. Willett, I.A. Boutle, P.D. Earnshaw, P.G. Hill, C. MacLachlan, G.M. Martin, W. Moufouma-Okia, M.D. Palmer, J.C. Petch, G.G. Rooney, A.A. Scaife, and K.D. Williams, The Met Office Unified Model Global Atmosphere 3.0/3.1 and JULES Global Land 3.0/3.1 configurations, *Geosci. Model Dev.*, 4, 919-941, 2011.

We have added,

“Meteorological boundary conditions for all runs (3 hourly) are provided by the global operational NWP model (global GA3.1 configuration of the UK at N512 (25 km); Walters et al., 2011). In the PROG, the BBA is free-running for two days, with spin-up of BBA from the beginning of August.”

to the paper text.

2. Did you assimilate any data using 3DVar on the global forcing? If it is the case, which data should be assimilated?

The global model is initialised using a continuous 6-hourly cycle of four-dimensional variational data assimilation (4D-Var) (Rawlins et al., 2007). But the LAM itself has its own 6 hourly 3D VAR assimilation (Lorenc et al. 2000) where the u, v winds, potential temperature, density, pressure, and moisture variables are assimilated on a 6 hourly cycle. In the runs we analyse in this paper, the 2 day 00Z forecast is spun up from an assimilated start dump and then free running and is forced 3 hourly at the boundaries by the global model forecasts.

Rawlins, R., Ballard, S., Bovis, K., Clayton, A., Li, D., Inverarity, G., Lorenc, A., and Payne, T.: The Met Office global fourdimensional variational data assimilation scheme, Q. J. Roy. Meteorol. Soc., 133, 347–362, doi:10.1002/qj.32, 2007.

3. Did you considered the spin up time for the model, when you considered the 48 hr forecast?

The prognostic aerosol in the two-day forecasts are initialised rather than being a “cold-start”. The forecast chain was spun-up from the beginning of August, which is more than enough time to spin-up the modelled aerosol.

4. CLIM performance is not well captures the phenomena’s as compared to PROG simulations at all the observational sites, what is the initial and boundary conditions is used for the CLIM simulations??

All the simulations such as NOA, PROG and CLIM have the same initial and boundary conditions driven by global UM model. Any differences between NOA, PROG and CLIM are due to their different representations of the aerosol.

5. Page 18894, line -27: Please mention the level of aerosol layer?

Fig. 6a shows aerosol layer up to 500hPa. We have included in the revised manuscript (MS).

“500hPa”

6. Page 18896, line-11: “ The inclusion of aerosols improves the surface temperatures biases at T +12 and T + 24 h”. It would be great if you could explain about the comment.

Figure 9 in the MS shows a verification plot of model error and RMSE in surface temperature against ground observations for the SAMBBA period as a function of forecast lead time. The aerosols (i.e. PROG or CLIM compared with NOA) generally improve the surface temperature biases and reduce RMSEs, most notably at S3 and S4. This is in fact not only at T+12 and T+24 so we now state,

“The inclusion of aerosols tends to improve the surface temperatures biases in forecasts”

Technical comments

In page No. 18893, line No.5: Please check whether word ‘a’ before ‘around’ is meaningful??

We removed in the revised MS.

In page No.18894, line no. 5: Please remove surface word which is written twice

We removed as suggested by Reviewer 1 and 3 in the revised MS.