



## ***Interactive comment on “EC-Earth3-AerChem, a global climate model with interactive aerosols and atmospheric chemistry participating in CMIP6” by Twan van Noije et al.***

### **Anonymous Referee #2**

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The paper by Noije et al describes the new EC-EARTH aerosol and chemistry version. The description of the model used for CMIP6 is very well written, special thanks on that. I definitely think the paper should be published after adding some discussion as suggested below.

#### General comments:

The description of the aerosol part is quite complete, thanks for that. However, it invites for even more questions. How do you justify the choices made? I believe it would be good to have a discussion paragraph on this. How to test which of the many aerosol

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parameterisations is really important for the aerosol ERF?

I find the chemistry description a bit short.

I understand that a more detailed evaluation of the model may be out of scope, but the comparison to EC-Earth3 could be more detailed. That version has quite a different aerosol prescription, so what is the conclusion on having a more complex and more simple aerosol in the same ESM? Do you understand the difference? What are the differences? Why is the ECS higher in EC-Earth3.

The spurious interdecadal variability is striking in the PI control. However, does it really explain the negative GSAT anomaly in the 70s?

The small change in net TOA flux ( $0.5 \text{ W m}^{-2}$ ) between historical and hist-piNTCF leads to almost 1 K difference (Figure 7). That would imply a large TCR in that period. Can you comment on possible reasons for that?

#### Small comments:

L753-755: “surface air and water temperatures may be very different” over the ocean? “a more robust blend of air and water temperatures also from the model” would be better => I wonder if this is more confusing then helpful. I thought the GISTEMP uses SST as a proxy but still pretends that the anomalies reflect SAT also over the ocean. Is Cowtan 2015 suggesting that one should rather use SST from obs and model? Is the result really more meaningful?

L57-58: A little confusing: You simulate methane and ozone, ... although they are not fully described. please rewrite.

Figure 1: Sea spray factors as a function of SST . not sure this detail is needed. Why this figure and not others on parameterisation details?

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