

## ***Interactive comment on “Importance of reactive halogens in the tropical marine atmosphere: A regional modelling study using WRF-Chem” by Alba Badia et al.***

### **Anonymous Referee #1**

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The authors have completed an enormous amount of work, but unfortunately the paper does not currently meet the requirements for publication in ACP. This paper can be published after addressing the following major comments:

- The authors must provide a justification as to why they have not included chlorine cycling in the model. Even if there are no measurements of chlorine, the authors cannot focus on bromine and iodine cycling without some description of chlorine chemistry. The authors cannot simply ignore chlorine especially in the remote marine boundary layer. See for example Schmidt et al. (2016).
- A more complete description of heterogeneous chemistry already included in the

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model is needed. If the authors used the model as described, ClNO<sub>2</sub> is formed on aerosols via reactions of N<sub>2</sub>O<sub>5</sub>. However, once formed ClNO<sub>2</sub> is treated as an inert species. This should be updated prior to publication.

- As already pointed out by the other reviewer, Equation 2 is not an acceptable treatment for reactions on aerosols. This equation ignores the fact that reactions are limited by the rate at which gases can diffuse towards the aerosol surface (diffusion limitation). There are clear descriptions of how to treat this correctly in the literature, for example in Schwartz (1986).

- While this paper was not submitted to Geoscientific Model Development (GMD), this is the first paper that describes a new model development. The paper should be held to the GMD standard for publication. For example, the subroutines that have been updated to perform the study should be included in an electronic supplement and/or the code used in the study should be provided as an electronic supplement.

The authors have attempted to study the influence of bromine and chlorine cycling in the tropical marine atmosphere. This can be an important study and hopefully the authors will make the effort to address these major comments so that the paper can be published in ACP.

#### References:

Schwartz S.E. (1986) Mass-Transport Considerations Pertinent to Aqueous Phase Reactions of Gases in Liquid-Water Clouds. In: Jaeschke W. (eds) Chemistry of Multiphase Atmospheric Systems. NATO ASI Series (Series G: Ecological Sciences), vol 6. Springer, Berlin, Heidelberg.

Schmidt, J. A., et al. (2016), Modeling the observed tropospheric BrO background: Importance of multiphase chemistry and implications for ozone, OH, and mercury, *J. Geophys. Res. Atmos.*, 121, 11,819–11,835, doi:10.1002/2015JD024229.

2017.

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