

## ***Interactive comment on “ICON-ART 1.0 – a new online-coupled model system from the global to regional scale” by D. Rieger et al.***

### **Anonymous Referee #3**

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This paper describes a new model capability, ICON-ART 1.0, which is designed to simulate the evolution of trace gases and aerosol particles from the global scale to the regional scale. It couples the recently developed meteorological model ICON with the chemistry module ART. As presented in the paper, the complete ART model is not implemented yet; the authors show three examples that illustrate the implementation so far: (1) simulation of short-lived bromocarbons, (2) simulation of an ash plume of the Eyjafjallajökull eruption, and (3) simulation of annual sea salt emissions.

I agree with the other reviewers that ICON-ART has the potential of being a powerful new model capability, which could lead to very interesting new scientific results. However, I don't think that the current paper, as presented, meets the standards for publication in GMD.

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#### Major comments:

1. I have concerns about the research contribution of the presented work. Both the ART model and the ICON model are described elsewhere. The equations presented in section 3, 4 and 5 are largely standard. The volcanic ash source function is new, but its presentation is not well-motivated. What was wrong with the old source function? This could be strengthened by comparing the new treatment to the old treatment and by quantifying the improvements (if any).

2. I assume that this paper falls in the category of “Model Description paper” as described on the GMD website [http://www.geoscientific-model-development.net/submission/manuscript\\_types.html](http://www.geoscientific-model-development.net/submission/manuscript_types.html). The paper falls short on several criteria listed here:

- Code availability and licensing: The text mentions that ART can be obtained from the Institute for Meteorology and Climate Research at KIT. What is the license (e.g. GPL, BSD, CC-NC)? What about the ICON part?

- Verification and validation: The three application examples are examples at best. I'm sure that large amounts of work went into this part, but for a manuscript in the category “model description paper”, I would expect more comprehensive and rigorous V&V, using appropriate quantitative metrics. For example for the comparison with the ERA-Interim analysis, more than one particular day should be used, and the agreement/disagreement should be quantified with the usual error metrics. The authors may want to think about if they rather focus on one case study rather than doing three.

#### Minor comments:

- It would be helpful to know the computational resources that are required to perform the simulation, especially if this could be compared to existing models. How does coupling of ART to ICON impact the scalability of the ICON model?

- Equation 10: There should be a factor of  $\pi/6$  relating the third moment to the volume

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(and mass).

- Table 3: Are these bin centers or bin edges?

Typos:

I suggest avoiding the use of “get”, and use for example “obtain” instead. This occurs several times in the paper.

p. 581, line 15: should be “a one-dimensional”

p. 582, line 3: should be “In the cases of. . .”

p. 583, line 2: should be “size and terminal fall velocity are small”

p. 586: “Realisation”: do you mean numerical implementation?

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Interactive comment on Geosci. Model Dev. Discuss., 8, 567, 2015.