This manuscript describes a novel framework for the implementation of reactive tracers into the ICON model. The framework takes advantage of the commonly used KPP software and implements it into the ICON model in a way that allows for the run-time implementation of complex chemical mechanisms. The presented work significantly enhances the current ICON-ART system. The implementation of additional state variables and associated chemical reactions into the ICON model requires a high level of programming expertise and poses an obstacle to its usage that should not be underestimated. The presented model development is an elegant solution that will allow a wide user range to implement different chemical reactions into the model.

Besides the description of the technical enhancements, the authors present a wide range of sample applications ranging from short term NWP calculations with a simple ozone chemistry to long term climate runs with life time bases chemical reactions. I have to say that although the manuscript is quite long I enjoyed reading it and can support publication in GMD.

However, there are several, mostly minor issues that need to be addressed:

1) My main complaint is that most of the evaluation is based on qualitative comparison. I am missing quantitative measures (e.g. bias, error). Especially in section 5.2 it would make sense to give the model bias for alternative model runs.

2) Make sure to explain all abbreviations, even those that might seem trivial.

   P1 L10: AMPI

   P2 L13: Here you need to introduce the abbreviation NWP. And it would also make sense to give the ECHAM abbreviation here.

   P10 Figure 2: SSO

   P18 Table 2: SST/SIC

3) Thoroughly check that all values are given with a unit

4) I suggest to combine Figures 8 & 9 as well as Figures 10 & 11.

5) Minor issues:

P2 L5: … the same dynamical core ….

As you know (and state later in the text) this is not the case for ICON (and I am not sure which other model has actually reached that ideal).

P2 L22: Here you should mention that the development is based on COSMO-ART. Maybe I am wrong but people do know COSMO-ART. In this case add a few sentences to clarify any differences between the ART in COSMO-ART and ICON-ART

P7 L6: Here I got lost: prognostic and diagnostic state. Maybe you can clarify what this means?

P7 L25: Any reason for the continuation? That would even work in f77 in a single line.

P8 L17: Technical work has been done to ensure….. As this is a GMD article, I think it would be appropriate to briefly state how you implemented this.

P10 L7: Before both routines are called, the tendencies are updated.

This is unclear. What does it mean to update a tendency? Do you mean that the tendencies are applied before these routines are called?

P11 L16: Probably should read c_{O3} instead of c.

I am not sure how you decide on the line breaks. I suggest to write the formula in a single line or use a single line for each part/process.

But more importantly you need to define the P and L terms. Otherwise it remains unclear how the derivative of P-L is derived.

P12 L12: You need to give units for all variables. Moreover, I would suggest to add the formula for the relative vorticity. This might seem pedantic but it ensures the reproducibility of your work.

P12 L20: Multiplication of both. This is ambiguous. It could refer to PV or to the area.

P12 L20: Use zonal wind instead of westerly (as you do in L22). Or *absolute zonal* wind if you want to be super precise.

P12 L32: middle atmosphere: Please be more precise.

P13 L10 & L15: You need to add units to these equations. And I do not get where the 7x is coming from.

P13 L12: Please define the mean age of air.

P13 L22: … in models and observations. Maybe I am ignorant but what does that have to do with observations?

P14: Again give units!

P14 L15-17: Please clarify what exactly do you do here? Do you override the default tracer before the microphysics calculation?

P14 L22: composition ???

P15 L11: 40km does this refer to a triangle side length? Maybe give the grid cell average area for a better comparison to traditional grids.

P15 L26: How do the 400DU compare to observations?

P16 L1: … losses are positive … This is very difficult to follow. I would suggest: losses are higher in that region.

P16 L2: by the chemical mechanism. The plural of chemistry sounds wrong.

P16 L2: Passive and reactive tracers. (I think chemical is not the correct word here)

P16 L4: And you do not consider additional loss terms (e.g. halogens)

P16 L6: negative ozone loss. Is this identical to ozone production? If o it would be better to understand than the double negative formulation.

P23 Figure 10: The caption is not correct.

P23 L10-15: Please be more precise. Do you mean an absolute decrease or lower values?

e.g. Absolute values of -2E-7 does makes no sense as absolute values are always positive.

P28 L6: Age increase of ….. years. It would be nice to give a number here.

Appendix: Are all species transported? Or how do you treat e.g. O^{1D}. It would be interesting to see the definition for such a short lived species.

6) Language:

P1 L16: The age is a measure …

P4 L6: (thermos-)dynamics

P4 L 18: provide the foundation

P5 L2: for XLM file reading.

P5 L31-33: That sounds like ozone was hardcoded into two routines. Probably it should read:

In our example, ozone appears in two different….

P7 L18: is stored in as

P8 L21: reaction~~s~~ schemes

P8 L32: shows a~~n~~ schematic

P10 L9: computationally

P11 L9: ansatz

P11 L21: ansatz

P12 L21: is given This sentence needs to be corrected

P15 L4: atmospheric composition

P15 L18: the TOMS instrument

P15 L27: Check this sentence

P20 L12: hemispheric

P21 L11: zonal is double here

P22 L2: Here, ~~the~~ ERA

P27 L3: older than in the control

P27 L31: different chemical mechanisms

P27 L31: extended by additional chemical reactions

P28 L1: In the second part

P28 L6: Base climatology of ICON

P28 L7: climatology of temperature