Dear editor,
thank you for your additional comments.

Comments of referee 2

- P31622, L2–5: Added a sentence "Remaining differences between the SWIFT model and the observations can be explained well by the measurement error of the Match and satellite data, which causes inconsistencies between the different time series that the model is fitted to (see the error bars on the Match measurements, which represent 1σ uncertainties)." to Section 3. Please note that there always will be an unexplained residuum between observations and model (in addition to the residuum caused by measurement error, which is easily explained). Even if we would know the reason for the differences (provided these are not only caused by measurement errors but by systematic deficiencies in the model formulation) and we would improve the model, there would still be an unexplained residuum and you could ask that question again. Since there is no such thing than a perfect fit, at some point it is not possible anymore to give a reasonable explanation for the differences.

- P31623, L5–6: Added some additional discussion in the conclusions and mentioned that other fast ozone schemes have some ability to model the effect of temperature changes in mid-latitudes. Note that we expanded both the discussion in the introduction and in the conclusions following the suggestions of reviewer 2 in the first revised version.

Specific comments

- L29–43: We assume here that there is common agreement in the modeling community that a GCM is defined as a model that only consists of the dynamical core, a transport model and parameterizations for the (physical) sub-grid processes, and that the chemistry module is not part of the GCM. We now explicitely state that in the introduction to remove any possible misunderstanding. Please have a look as well at lines 41–42 (of the first revised manuscript), where we inserted "in contrast to GCMs without a chemistry scheme" at the request of reviewer 2. Similarly, at the request of reviewer 2, we explicitely state in lines 46–50 (first revised manuscript) that in the majority of GCMs, ozone is prescribed, i.e. that most GCMs have no stratospheric chemistry model at all. We refer to the few models that use the fast schemes introduced here (Cariolle, Linoz, SWIFT) as "GCMs coupled to ..." to stay consistent.

- L48: Done.

- L49: Done.

- L160–162: "influence" does refer to "chemical processes" and not to "model" (if it would refer to "model", it should be "influences"). We rephrased the

sentence to "SWIFT models the chemical processes that influence lower stratospheric polar ozone. SWIFT calculates chemically induced ozone change rates." to remove this small ambiguity. We added "lower stratospheric" as suggested.

- L164: We have rephrased that sentence and hope that helps.
- L166–169: This sentence was confusing and not really necessary. Deleted the sentence.
- L170–172: See also reply to L29–43. L32 states that in existing CCMs (and not in a GCM coupled to SWIFT), dynamical fields provide input to the stratospheric chemistry module (of these CCMs, not of SWIFT). L170–172 states that in a GCM coupled to SWIFT, advection is done by the GCM. For two reasons, this is no contradiction: 1) The sentences do refer to two different types of model (CCM vs. GCM coupled to SWIFT). 2) The dynamical fields are provided as input to the stratospheric chemistry module of the CCM, but the stratospheric chemistry module does not do the advection with this input. Dynamical input fields as e.g. the temperature or pressure field are needed as input for the chemistry in the chemistry module. The GCM does still do the advection in a CCM.
- L199–200: Values are calculated for every level that the SWIFT model is running on. We now explicitely state that in this sentence. Since it is described in the preceding sentence how the levels are defined, it should be clear from the context that the sentence does not refer to all levels of the underlying GCM (which are not mentioned here).
- L203: Changed.
- L208–211: L208: Deleted "now". L210–211: See above. "SWIFT will be run ...": In our opinion, this sentence is easy to understand. However, I have difficulties to understand your suggestion how to change the sentence. It does not seem to be a grammatically correct sentence. Is there some part missing?
- L215–217: We have changed the sentence and have added the existing linearized schemes as additional possibilities.
- L533: Changed.
- L550: Done.