The authors have worked diligently to address my questions and comments, leading to a much improved manuscript. The article has greater focus and structure. I still have a few concerns, however, outlined below.

General Comments
I previously inquired about the final condition number of the R matrix and in response learned that it is around 8E6. I understand that the authors took care to ensure that the inverse of R was properly computed. However, with such a large condition number I worry that the IASI observations could be strongly down-weighted, and I wonder how the cost function in RfullExp compares to that in RdiagExp. Is it possible to include a plot of the cost function versus iterations for a cycle of RfullExp and RdiagExp, either in the response or in the revised article?

Both the other referee and I raised concerns about statistical significance in these experiments. I do not feel that an adequate response was given. To claim that results are "significant" requires a statistical analysis, for example, computing a confidence interval around the difference between the zonal averages of two experiments.

Specific Comments:
Page 2 line 24 and elsewhere: There is another recent work that can be cited here, Bathmann and Collard 2020. It might be worthwhile and relevant to include this reference as the authors also examined IASI error correlation matrices over land and sea, and assimilated IASI ozone channels.

Page 9 last paragraph and first paragraph of page 10: Where do you remark that the estimated standard deviation is proportional to the radiance values? I think the larger standard deviations in the SST channels (compared to ozone channels and in general) can probably be attributed to greater sensitivity to emissivity and cloud detection error, as well as greater representivity error.

Section 4.3 The conclusion that I can draw from this section is that larger error variances increase the convergence rate of the minimization algorithm. It is mentioned that the diagonal matrix pulls the analysis solution closer to the observations, and I think the discussion can refer back to Fig 1. The errors are generally larger in RfullExp, so these observations are being downweighted in RfullExp.

Section 4.3 The discussion about the number of iterations that are necessary for the minimization to converge is a little confusing and I wonder if the results are robust. In the first paragraph, it is stated that it converges in 90 iterations if a non-diagonal R is used. Then in the second paragraph, it is stated that it takes more than 100, 60 and 70 iterations to converge with the 1st, 2nd and 3rd estimates of R. Where did 90 come from? Also, are these numbers of iterations averaged over multiple assimilation cycles, or are they just from one cycle?

Page 16 line 8: How many ozonesonde observations are available in the high latitudes? Are there enough to quantify the significance of these results?

Technical Comments:
Page 1 line 5: “adopted in some” should be “adopted in many”
Page 1 line 16: “and in the climate” should be “and in climate”
Page 1 line 23: “component of the observation’s network” should be “component of an observational network”
Page 2 line 4: after the colon, this sentence is not grammatically correct. Furthermore, parameters and climate change are not applications. Estimation of parameters and climate change studies are applications.
Page 2 line 5 and elsewhere: change MetopA to Metop-A
Page 2 line 7: can “stratosphere layer” be changed to “stratosphere”?
Page 2 line 9” change “construct more accurate” to “construct a more accurate”
Page 2 line 12 and elsewhere: change “chemistry transport model (CTM)” to just “CTM”. CTM was introduce at line 8.
Page 2 line 23: change “some Numerical Weather Prediction (NWP) systems” to “many Numerical Weather Prediction (NWP) centers.”
Page 3 line 5: this should say “using the Desroziers method”
Page 3 line 6: abbreviate CTM
Page 4 line 6: change “the TOVS instrument” to “TOVS instruments”
Page 4 line 10: “The radiative transfer…” multiple verb tenses are used in this sentence. It should probably only be in past tense.
Page 4 line 28: change “the Skin Surface Temperature (SST) and the ozone” to “Skin Surface Temperature (SST) and ozone”
Page 5, line 14 remove the last access statement
Page 6 line 1: change “transmitting continuously” to “continuously transmitting”
Page 6 line 11: change “section of the results” to “the results section”
Page 6, line 22: change “examine here exclusively” to “exclusively examine” and “as already reminded in the introduction and in the conclusion” to “as mentioned in the introduction”
Page 6 line 23 change “and correlation” to “and a correlation”
Page 7 lines 8-10. “The systematic error…” This sentence is redundant with the one that comes after it.
Page 8 line 5: change “have used the channel” to “used IASI channel”
Page 8 line 7: change “for the long” to “for a long”
Page 8 line 8: measurements should be singular
Page 8 line 12: change “we were used” to “we used”
Page 8, line 15 delete “also”
Page 8 lines 16-17: IASI is not an ozone instrument
Page 8 line 18: change “analyses’” to “analysis”
Page 8 line 22: change “accounted by” to “accounted for by”
Page 8 line 26: change “statistics of error” to “error statistics”
Page 9 line 1: “which may not always be the case” In practice it is almost never the case.
Page 9 line 15: change “from 3D-Var experiment that uses” to “from a 3D-Var experiment that used” and “1st” to “the 1st”
Page 9 line 22-23: “The differences…” there are mixed verb tenses in this sentence
Page 10 line 4-5 You can delete the date on this personal communication.

Page 12 line 10: change “the estimation and potential account of” to “estimating and accounting for”
Page 13 lines 11-13 “When the observation error…” This sentence should be in past tense.
Page 14 line16-17, Fig 5 “provided by… that of the RdiagExp and that of RfullExp” provided by the RdiagExp and RfullExp analyses, correct?
Page 15 line 6 Negative values indicate an improvement in the experiment over the control, right?
Page 16 lines 13-14: Change “In spite of its” to “In spite of the” and “remains always advantageous” to “remains advantageous”
Page 16 line 15: Delete “in this section”
Page 16 line 21 extra space before )
Page 16 line 24: “We have also discussed”. Examined may be a more appropriate word since a lot of the discussion was removed.
Page 19 line 1: change “assimilate efficiently” to “efficiently assimilate”
Page 19 line 4 “from IASI ozone sensitive channels” and other channels as well
Page 19 line 17 Probably should remove “always” or at least move it before the verb
Page 19 line 23 “It should also note” this sentence is not grammatically correc
Page 19 line 27-28: “On the other hand…” This sentence seems a little awkward, perhaps it could be combined with the next one?