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Interactive comment on "Intercomparison of FY-3 and AIRS Gravity Wave Parameter Extraction Based on Three Methods" *by* Shujie Chang et al.

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Referee #2 We thank Referee #2 for his/her comments and useful remarks. In the following we include our answers point-by-point.

General comments Overall, the English in the paper is not accurate and scientific at all, making the review task very difficult. Yes, you are right. I apologize for the confusion that the English in the paper is not accurate and scientific. This, as you pointed out, may cause the readers hard to understand. Following your suggestion, in order to increase the readability of the paper, foreign experts have been asked to do further modify this manuscript. Thanks. The context does not warrant a publication in AG with little physics or any new insights on gravity waves. The filtering and background remov-

ing are very common techniques to analyze GWs in temperature profiles. Sorry for this. This work does not involve complex scientific issues (such as physical mechanisms), but mainly focuses on the application of technology. This study is aimed to examine the applicability of the latest Chinese satellite observations in gravity wave studies. The most difficult aspect of this work is the use of Chinese satellite observations. The precious first-hand data from Chinese advanced satellites has been rarely used for further studies. This study introduces the Chinese second generation satellite observed data and compares it with those well-known data set, which will help those studies based on observational data. We have modified the concentration on this. The abstract has been modified to "Abstract. Two types of temperature profile products from the FY-3 (FengYun-3) satellite system, GNOS (The Global Navigation Occultation Sounder) and VASS (The Vertical Atmospheric Sounder System), together with AIRS (The Atmospheric Infrared Sounder) operational Level 2 temperature profile product, are used to compare and analyze gravity wave parameters. The advantages and disadvantages of these three types of temperature profile data for gravity wave parameter extraction are determined, based on three extraction methods: vertical sliding average, double-filter and single-filter. By comparing the three methods, the conditions under which each dataset can be applied are obtained. Accurate gravity wave disturbance profiles cannot be obtained using the vertical sliding average method. The double-filter method can extract gravity waves with wavelengths of 2 to 10 km. The single-filter method can obtain gravity wave disturbances with vertical wavelengths less than 8 km. For all three gravity wave parameter extraction methods, the GNOS temperature profile product shows a stronger signal than VASS and AIRS, for both buoyancy frequency and gravity wave potential energy in the lower layer (5–35 km). From 35 to 65 km the gravity wave signal obtained by AIRS is better than GNOS. The vertical resolution of VASS is lower, but larger vertical scale components are retained." (L 15- L 29) In section 1 introcustion "Atmospheric gravity waves are small-scale or meso-scale disturbances that can propagate vertically (Holton, 1983). . . . . .Second, considering the subgrid effects of stratospheric gravity waves is important for constructing the parameterization

scheme itself (Fritts and Alexander, 2003; Kim et al., 2010)." has been modified to "Atmospheric gravity waves are small-scale or meso-scale disturbances that can propagate vertically (Holton, 1983). . .. . .On the one hand, it is essential for improving the accuracy of atmospheric circulation models and the numerical weather prediction; on the other hand, it is an urgent requirement for flight safety."(L 32- L 62) "During aircraft flight, since the scale of the gravity waves is similar to the typical aircraft size, stratospheric gravity waves have a strong influence on the aircraft, and can periodically cause it to vibrate. . .. . ." has been modified to "By using data obtained from various observation methods, information about stratospheric gravity waves can be extracted, and their distribution characteristics analyzed. . .. . .. In summary, it is possible to extract good gravity wave signals from temperature profiles retrieved by AIRS." (L 63- L101) "This study is aimed to examine. . .which will help those studies based on observational data." a new paragraph has been added. (L 132 –L 138) In section 2 "2.1 AIRS Level 2 data" has been modified to "2.1 AIRS Level 2 temperature profile product" (L 140) "2.2 FY-3 temperature profile" has been modified to "2.2 FY-3 temperature profile product" (L 165) In conclusions, "In order to further investigate the advantages and disadvantages of FY-3. . .. . .The vertical resolution of VASS is lower, but larger vertical scale components are retained." has been modified to "This study examines the applicability of the latest Chinese satellite observations in gravity wave. . .. . .but larger vertical scale components are retained." (L 484- L 504) Thanks Some detailed comments: 1. line 24: "the GNOS temperature profile product performs better..." What does "better" mean here? Should be more specific. This problem is all over the paper. Line 25: "the AIRS temperature profile product is better than GNOS". Yes, you are right. Those have been modified. ". . .the GNOS temperature profile product performs better in the lower layer of 5–35 km" has been modified to "the GNOS temperature profile product shows a stronger signal than VASS and AIRS, for both buoyancy frequency and gravity wave potential energy in the lower layer (5–35 km)." (L 25-L 27) "the AIRS temperature profile product is better than GNOS" has been modified to "From 35 to 65 km the gravity wave signal obtained by AIRS is better than GNOS" (L 27- L 28) "the temperature profiles

here are poor" has been modified to "the temperature profiles here are inaccurate" (L 261) ". . .the height of the maximum is not accurate" has been modified to ". . .the height of the maximum fluctuation is not accurate" (L 316) ". . .the height of the maximum is not accurate." has been modified to ". . .the height of the maximum fluctuation is not accurate."(L 328) "AIRS is better than GNOS" has been modified to "the gravity wave signal obtained by AIRS is better than GNOS" (L500) Thanks 2. How the weighting function of AIRS impacts the vertical resolution of temperature profiles? Sorry for the confusion. Now, this has been introduced in section 2 "The weighting functions are used to transform correlative measurements to AIRS effective resolution and are used to assess and derive the vertical resolution of temperature and moisture retrievals in different atmospheric conditions (Maddy and Barnet, 2008). . .. . .(More details can be seen at https://disc.gsfc.nasa.gov/ datasets/AIRS2RET_NRT_006/summary, 2019)." (L 151-L 158) "Maddy, E.S., and Barnet, C.D.: Vertical resolution estimates in version 5 of AIRS operational retrieval, IEEE TGARS, 46, 2375–2384, doi: 10.1109/TGRS.2008.917498, 2008." (L 607-L 608) Thanks. 3. Is GNOS radio occultation? If so, would COSMIC a better validation? Sorry for the confusion. GNOS is radio occultation which is one of the remote sensing instruments on the FY-3 satellite. If the study is aimed to examine just the applicability of GNOS in gravity wave studies, COSMIC would a better validation. However, the study is not only aimed to examine the applicability of GNOS, but VASS in gravity wave studies, both of which are the latest Chinese satellite observations. The AIRS covers a wide band of observation the brightness temperature: 3.74 μm to 4.61 μm, 6.20 μm to 8.22 μm, and 8.8 μm to 15.4 μm, totally in 2378 channel. Comparing with other hyperspectral measurements, AIRS contains more channels, which forms a high spatial resolution.

Thanks again for your careful review. Hopefully our response can enable a further review of the manuscript. We will fix all these points in the final version following your suggestions. Many thanks for your work so far and best regards, Shujie Chang and Co-authors. Please also note the supplement to this comment.

Please also note the supplement to this comment:
https://www.ann-geophys-discuss.net/angeo-2019-130/angeo-2019-130-AC2-supplement.zip

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