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Interactive comment on "Comparison of CSES ionospheric RO data with COSMIC measurements" *by* Xiuying Wang et al.

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First of all, we thank the reviewer for his careful reviewing of our paper, and for his suggestions on the improvement of this paper.

We think the reviewer completely get the idea behind this paper. As the reviewer points out, good correlation between CSES and COSMIC indicates "CSES provides reliable observations at the level of COSMIC". The reliability of COSMIC can be proved by many prior studies of comparing COSMIC observations with different measurements. Based on this logical relation and error propagation rules, we can deduced the reliability of the CSES observations.

As to the problems pointed out by the reviewer, we explain one by one.

(1)L8 to inverse electron density related parameters. Maybe to retrieve of to infer.

We will follow the suggestion, and modify the inappropriate word used in the abstract.

(2)L13,17 what is NmF2s and hmF2s ? Not explained

NmF2s and hmF2s are the plural forms. As we know, we obtained over 700 co-located RO events, we therefore can get over 700 NmF2 and hmF2 data points, and therefore plural forms are used here.

(3)L30 for both the 3-D earthquake observation and geophysical field measurement.

This expression is from the brochure of CSES. My understanding: There are different earthquake observation network systems distributed on the ground in China. CSES satellite is the first system to observe possible earthquake-related quantities from space. Combing the ground-based and space-based systems together, a 3-D observation system is formed.

Geophysical field measurement, as mentioned in the paper, there are 8 payloads onboard CSES. All of these observations can be regarded as the extent of geophysical observations on the ground. CSES has a short revisiting period, this ensures that the observations time intervals are short. Observations from many times circular orbits are helpful to create the background (field).

(4)P2 L32 show that the CSES RO NmF2 data are generally consistent with data from other measurements. What does this mean "consistent" to which extent? – a quantitative

This conclusion is from the paper referenced in our paper. There is no clearly quantitative conclusion and application suggestion in that paper. That is why we conduct the comparison work of this paper, and application suggestion is given based on our quantitative work. We think the quantitative comparison and application suggestion is very important before the CSES data is shared for scientific community.

(5)P2 L38 from vertical ionosondes Incorrect term. “Ionospheric vertical sounding” exists.

We will follow the suggestion, and modify the incorrect usage. Many thanks for the careful review work.

(6)P2 L41 most located on inland and fewer in the oceans. Ground-based ionosondes of ionospheric vertical sounding are located on the continents and islands in the oceans but not in the oceans.

We will modify this mistake in our paper.

(7)P3 L15 to check the consistency and reliability of CSES profiles except for NmF2 and hmF2 parameters. How to understand this phrase? NmF2 and hmF2 are the main ionospheric parameters and the authors do not want to check them?

‘Except for’ here means ‘besides’, both COSMIC and CSES have similar retrieved data, this convenience enables the validation of the NmF2 and hmF2. Moreover, it also enables the validation of RO profiles as well.

Sorry for the poor expression. We will improve our expression in the modification version.

(8)P3 L27 to inverse Maybe to retrieve or to infer

We accept the suggestion and will modify it.

(9)P5 L6 it should be pointed out here that RO retrieved electron density profiles cannot be interpreted as actual vertical profiles because both the LEO and GPS are in motion during the occultation process. If RO Ne(h) profiles are not real ionospheric electron density profiles (this has been formulated by Schreiner et al. (2007) then how these RO observations can be used for ionospheric investigations? If RO Ne(h) profiles are not real then any comparisons with ground-based NmF2 and hmF2 observations are senseless.

This sentence means that the RO profiles are not identical as the profiles obtained by ionosonde vertical sounding or by incoherent scatter radar. For the latter case, the observation point is fixed, the profile indicates the data observed at different altitude of the same point. For RO profile, the location of the profile is not fixed, therefore data from the same profile means different locations. We also draw the projection track of the profiles from the co-located profiles, as following Fig. 1.

Sorry for the inappropriate expression. We will try to improve the expression and make it clearer.

(10)P6 L6 The ionospheric spatial correlation distance depends on geophysical conditions (McNamara, 2009) - solar minimum or maximum, magnetically quiet or disturbed conditions. At middle latitudes for practical applications during quiet conditions may be used ïAËŻÂ£ 500 km in latitudes and ïAËŻÂ£ (700-1000) km in longitude. So 2 x 6 deg correlation distances selected by the authors may be considered as reasonable.

We also plot some figures to ascertain the selection of this correlation distances, as shown above is one of these figures. Many thanks to the reviewer to ascertain this work.

(11)P5 29 NmF2 appearing below 150km The height of 150 km is unreal for F2-layer. Even under the deep minimum of solar activity in 2008-2009 daytime hmF2 according to ISR observations never was lower than 200-210 km. Therefore all RO hmF2 lower than 200 km should be considered as erroneous ones.

We will eliminate the points where NmF2 appears below 200km according to the suggestion.

(12)P6 L7 the over a year temporal segment Poor style

Sorry for the poor English. We will improve the English of this paper during the modification work.

(13)P6 L12 Special attentions should be paid on the local time issue when CSES and

COSMIC RO data are combined together. The phrase is not clear.

As mentioned in the paper, the CSES local time is about 14:00 during the day or 2:00 during the night. RO data local time is around the two local time. Therefore, if we want to combine the data from the two missions, COSMIC data with similar CSES local time must be selected out. We will make this sentence clearer after the modification revision.

(14)P6 L29 The RO Ne(h) profiles very often are not smooth at all. How such cases were developed?

As the altitude of CSES is 507km, CSES RO data is below this altitude. These special altitudes are selected just for simple. To get the electron density data at these altitudes, we calculate the average density between Altitude-10km to Altitude+10km, as mentioned in the passage following the one mentioned by the reviewer. After this calculation, data fluctuation is erased and one single data is obtained. By this way we can compare all the data pairs at one altitude together, as it is shown in Section 3.3.

(15)P7 P13 also L13 as hollow circles Open circles

We accept the suggestion and will change it.

(16)P8 L15 This is usual MRD (mean relative deviation) –there is no need to invent new definitions.

We accept the suggestion. We will delete the equation and use MRD. Many thanks to the reviewer for this suggestion.

(17)P9 Table 1 Hardly real accuracy of NmF2 determination requires 5 digits.

This is not an indication of precision, but to maintain the same number of significant digits.

(18)P9 L27 There is another point to point out. Poor style.

Sorry for the poor English. We will improve the English of this paper during the modification work.

(19)P10 L6 CSES RO derived peak values are in very good agreement with COSMIC and ground based measurements. No comparisons with ground-based NmF2 observations are done in the paper.

This conclusion is based on the high consistency between COSMIC and CSES data, and on the COSMIC validation work conducted using ground-based ISR and ionosonde measurements, as discussed earlier in this passage. According to the error propagation rule and correlation transitive rule, we can get this conclusion.

(20)P10 L 28 As we know, the nighttime data has a more complex spatial distribution pattern compare to daytime data although daytime data are affected by solar radiation during day time. Not "although" but namely due to solar ionization NmF2 variations are smoother during daytime hours.

Sorry for the mistake usage of the conjunction. We will improve the English carefully.

(21)P10 L36 They suggested that COSMIC measurements are acceptable under geomagnetic disturbed conditions when comparing COSMIC RO data with observations from Sanya, a lower latitude ionosonde in China. Hardly one can agree with this statement. The equatorial anomaly introduces a spatial asymmetry especially during storm periods. This asymmetry should affect RO results.

Part 3.2 and Table 2 indicate excellent results RMSE <15 km This is a difference within the RO method obtained by two similar devices. But it should be stressed that the difference between RO hmF2 and real hmF2 may be different. The most accurate hmF2 provide ISR observations and only such comparisons may give a real estimate of RO hmF2 accuracy.

COSMIC measurements are acceptable under geomagnetic disturbed conditions. This conclusion is from the reference paper by Hu et al. (2014) using data from 2008-2013 in Sanya Station, China. This conclusion may need more validation work. However, since it is published, we can reference its conclusion.

We are completely agree with the reviewer's opinion that the most accurate hmF2 is from ISR. We are now collecting ISR data, validation of CSES RO data using ISR observations is under preparation.

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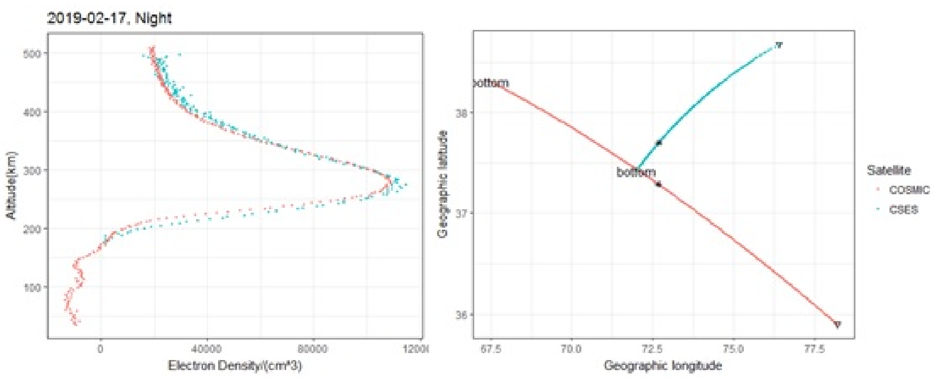

Fig. 1.