Replies to E. Roussos' comments

1) Equation 1 is used to estimate radial gradients. However, N1 & N2 are count-rates, which are proportional to integral fluxes. Therefore, the estimated parameter is an "integral gradient". "Differential gradients" require to have differential flux measurements. For instance, it is my understanding that Gieseler & Heber (2016) estimate differential gradients, so comparison with the values obtained in this study should be reconsidered, even if values are similar.

Indeed, the data used in this study are counts that are proportional to integral fluxes. Differential GCR fluxes have not been yet extracted from the SREM data. Work is ongoing. In the manuscript, we now make it clear that our estimated parameter Gr is an integral gradient.

2) Both differential and integral gradients have an energy dependence. For the latter, which are more relevant to the present study, it matters above which energy fluxes are integrated. The used channel captures protons >49 MeV, however, from other SREM papers it seems that the geometry factor <100 MeV is rather low. So, I assume the estimated gradients have are for protons much above 100 MeV. Maybe folding the response function of the TS2 channel with a standard GCR spectrum can show which energies dominate.

The following plot show the SREM GCR response (the X-axis is the energy in MeV). We can see that TC2 is mostly sensitive to particles in the range [200-20000] MeV. We now indicate this range when we compare with previous results (see the updated section 3.2).

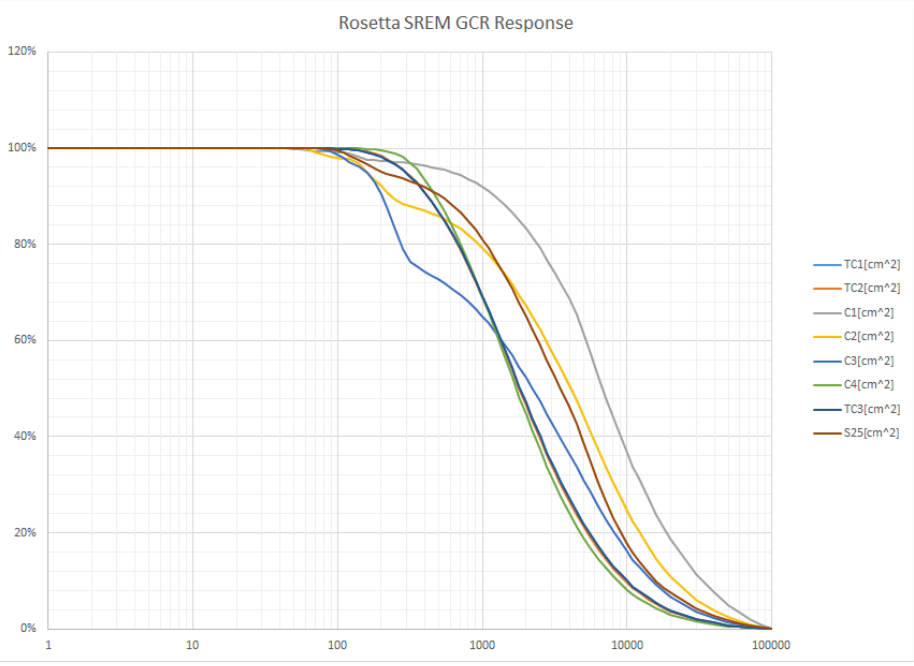

Figure 1: SREM GCR response

3) I am not sure how the HEND data are used in the study. In order for them to be compared with those from SREM, they have to be normalized to the INTEGRAL countrates, since SREM data are normalized to the INTEGRAL measurements. This means that in the y-axis of Fig. 3, one should used the INTEGRAL-normalized rates of SREM, not the raw SREM rates. I.e. this has to be a 2-step normalization. If that was actually done, its has to be clarified in the text.

This was actually done: we did a 2 step normalization: Rosetta to INTEGRAL and calibrated Rosetta to HEND. This is now clarified in the text.

4) After HEND data are normalized to SREM, they were not used in any part of the analysis. E.g. they may also be used to estimate radial gradients, which should be similar to those coming from the SREM/INTEGRAL ratios, otherwise they may be indicative of uncertainties in the gradient estimation, or, even better, of a radial dependence of the ratios. Instead, HEND are only mentioned briefly in lines 5-15 in p.11.

We found out (see the attached report, Thomas Honig's internship) that the HEND data set was not suitable for estimating the radial gradients. The data is too noisy. We used HEND in the analysis of the anticorrelation with interplanetary magnetic field and sunspot number (Annex 1). We have added more plots in this annex.

5) In addition to the comment above, it is clear that in the comet phase, where SREM sees a negative radial GCR gradient, the gradient between INTEGRAL/HEND is clearly positive, even if normalization may require an update (see comment 3). That further supports the possibility of a reduction of GCR fluxes around the comet. My suggestion is the following: a)Estimate the radial gradient between INTEGRAL/HEND for times during Rosetta's comet phase b)From this radial gradient, estimate what should have been the count rate of SREM c)Estimate the difference between the expected and the measured count-rate d)This difference may be estimated also by using in step (b) the average positive radial gradient as found from the data shown in Fig. 5 e) Then, the difference (estimated by any of the methods) could be organized as a function of heliocentric distance (essentially activity) or any other relevant parameter.

In fact, we applied this procedure (see attached report, internship report of Thomas Honig) with INTEGRAL. The steps were:

a) *Compute a radial gradient with the INTEGRAL and Rosetta data, for the time period covering the Rosetta cruise phase.*
b) *Assuming the same gradient for the comet phase, we simulated the Rosetta SREM count rate, from the INTEGRAL data, taking into account the correct distances.*
c) *When comparing the simulated and measured SREM count rates, we find this decrease in GCR count, see plot below.*

In order to make the article not too heavy, we did not explain this procedure, and we only included Figure 5 to illustrate the GCR "absorption". Following this comment and the referee's comments, we will now include a new figure (new figure 7):

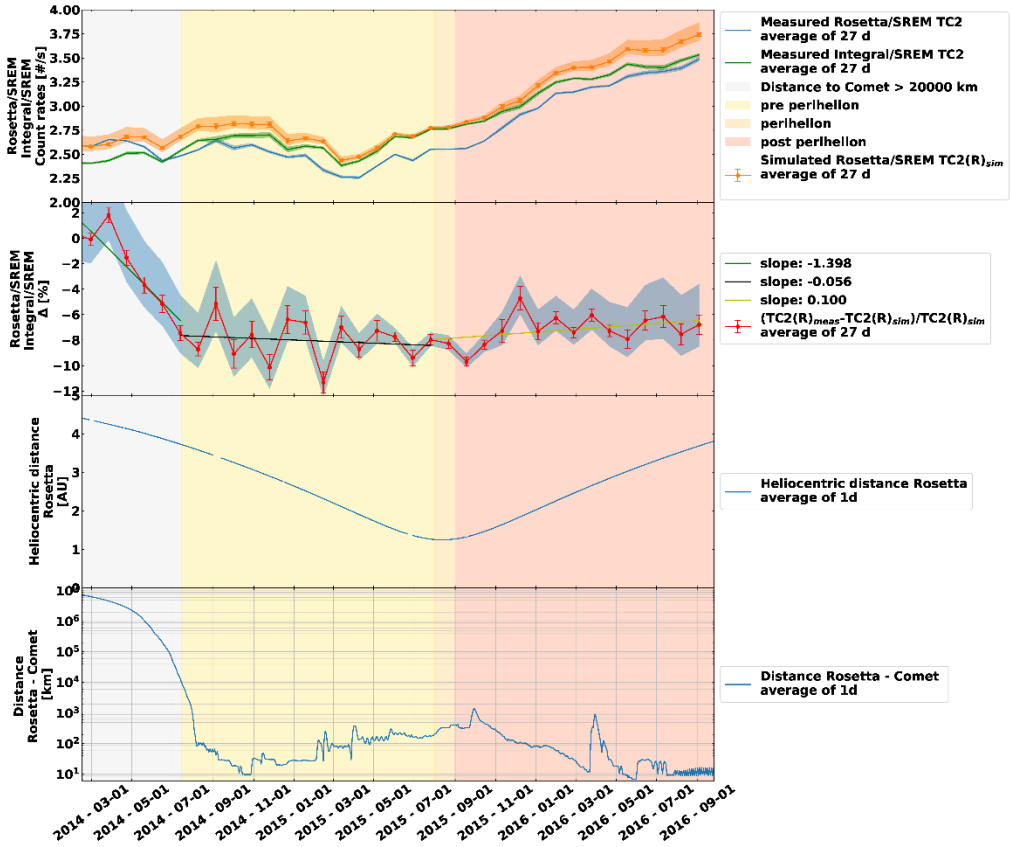

Figure 1: New Figure 7.

We have updated the text regarding the fact that the gradient between INTEGRAL/HEND is clearly positive (also following referee#2's comment).

It appears intriguing that in Fig. 6, the count-rate difference appears to maximize around mid-2015, close to perihelion, and tends to become zero again towards the end of the mission.

We looked into more details about the behaviour of the GCR counts during the Rosetta comet science phase (see attached report and the new Figure 7 above), in particular to see the effect of heliocentric distance (comet activity), Rosetta-nucleus distances etc...However, we did not find anything relevant (so far).

I hope the authors find these comments helpful.

We thank Elias Roussos for these very helpful comments.