Referee # 1

We thank the referee for his/her helpful comments. Our response to referee #1 is below. Items in bold and italics are the referee comments.

L30: ". . .with the largest benefit occurring over land in remote regions", explain remote from what? Sources?

We mean regions far away from important CO sources. We will rephrase this in the revised version.

L60-68: several sensors are listed but all references are from the MOPITT team. Please add references for the relevant sensors.

We add additionnal references in particular for AIRS and IASI CO in the revised version.

L81-103 paragraph: In the discussion of S-5, S-4, and S-5P, etc, please list the timeframe of these missions. Since OMI and SCIAMACHY are discussed, as well as S-5P, this should be a good place to introduce TROPOMI. Among the sensors/missions discussed in this paragraph, which ones have CO, since it's the topic of study here?

- We will mention the time frame for S-4. S-5 and S-5P time frames are already mentioned (see lines 92-94).

- We will mention TROPOMI in this paragraph but note we describe the instrument characteristics and show how the the S-5P simulated measurements are generated in section 2.2.

- We will replace GOME-2 by IASI which measures CO and has the same revisit local time.

L99-101: "The S-5P LEO platform will address the challenge of limited revisit time from LEOs by providing unprecedented high spatial resolution of 7x7 km, and improved sensitivity in the Planetary Boundary Layer (PBL), allowing resolution of, e.g., derived CO emission sources at finer scales than hitherto." How?

We will clarify this point in the revised version by adding information on source inversion.

L223: ". . .the NR has a realistic representation of the CO diurnal cycle." Does COhave diurnal cycle? Also, describe the ground measurement methods. Is it in situ or radiometric?

- At air surface usually carbon monoxide exhibits a diurnal variation, generally with two peaks, one in the morning and the second in the evening.

- Ground station measurements are real in situ observations taken from AirBase data set. We will mention this in the revised version

L232-233: ". . .the behaviour of the CO time-series from the CR compared to the NR,is similar to the behaviour of the NR CO time-series compared to the Airbase data." Not clear, are the differences similar? You might want to add the difference 100*(NRCR)/NR.

We likely are in the configuration where the NR is between the GS data and the CR with similar behaviour that means in our assimilation we may need a similar correction for the CR to obtain the NR or for the NR to obtain the GS. We will rephrase this in the revised version.

L237-242: TROPOMI should have been introduced in the Introduction.

See previous answer.

L308: "Over sea, . . ." should probably be "Over the ocean, . . ."

We will correct this.

L387: ". . .different to . . ." to ". . .different from . . ."

We will correct this.

L391: ". . . the OSSE will more realistically simulate. . ." to ". . . the OSSE will simulate more realistically . . ."

we will correct this.

L392: "This follows our guiding principle to . . ." to "This allows us to . . ."

we will correct this.

L394-395: "As mentioned in Sect. 2.3, we use the MOCAGE model to generate the CR. In this OSSE study, the CR is a free model run." to "In this OSSE study, the CR is a free model run using MOCAGE."

we will correct this.

L409: ". . . and about 800 m in the neighbourhood of the tropopause . . ." to ". . . and approximately 800 m near the tropopause . . ."

we will correct this.

L417: . . . as they are a priori not known." To ". . . as their a priori is not known."

We will correct this.

L420: ". . ., helping to differentiate the CR from the NR." To ". . ., which helps to differentiate the CR from the NR."

we will correct this.

L420: "As for the NR, . . ." to "Similar to the NR, . . ."

We will correct this

L435-436: add "the"

we will correct this.

L453-454: ". . . for the B-matrix: Lx and Ly are . . .; Lz is constant and . . ." to ". . .for the B-matrix, where Lx and Ly are . . .; and Lz is constant and . . ."

we will correct this.

L459: ". . . (see Fig. 3 in Sect. 3.1)." should be Fig. 5

We will correct this.

L504: Should be Figure 5, not Figure 3

We will correct this.

L564-570: The reasons the AR are not performing well over fire emissions are not explained correctly in this paragraph, as suggested by L670-676. Should move part of L670-676 to this part of the paper to properly explain why AR did not work well over fires.

We will take into account this suggestion.

L642: "Figure 11 shows that the AR . . ." would be better to "The AR . . ."

We will correct this in the revised version.

L651: ". . . (iii) an area in the Easter part of the study domain, . . ." should name the location/country/regions.

We will correct this in the revised version.

L662-665: same issue explaining MOCAGE assimilation over fires.

We will rephrase this paragraph and give more details.

Fig. 5. Legends and labels are not legible when overlap with dashed lines. Should redo with care and use larger fonts.

We will improve the quality of this figure in the revised version.