Response to Referee #2:

We appreciate the very helpful feedback from the referee. The referee's comments are listed in *italics*, followed by our response in blue. New/modified text in the manuscript is in **bold**.

1. The introduction is quite vague with respect to previous satellite missions. For instance, to what "existing satellite instruments" (page 1, line 17) do you refer? TOMS? GOME? OMI? GOSAT? Please extend the description of existing instruments relevant for this study, and show the improvement of OCO-2 design in direct comparison to e.g. GOSAT.

Following the referee's suggestion, previous satellite missions that measure CO2 column abundance are included and compared with OCO-2. The sentences at page 1, line 16 are modified to:

"**To achieve its mission goal, OCO-2 was designed to measure the reflected sunlight in near infrared O_2 and CO_2 bands with significantly higher sensitivity, spectral and spatial resolution, and spatial coverage requirements than previous satellite CO_2 measurements. For example, the nadir resolution of OCO-2 is less than 1.3×2.3 km^2, much finer than those of SCIAMACHY (30×60 km^2) and GOSAT/TANSO-FTS (diameter of 10.5 km). The OCO-2 instrument aims to measure the column-averaged CO_2 dry air mole fraction, XCO_2, with uncertainties near 1 ppmv (0.25 % of current XCO_2) on regional-to-continental scales (Crisp et al., 2004; Crisp, 2008; Frankenberg et al., 2015), also significantly smaller than what achieved by SCIAMACHY and GOSAT (Buchwitz et al., 2005, Butz et al., 2011).**"

Also the "species measured by existing satellite instruments" (page 2, line 21) are quite general; please specify,

This sentence was modified to:

"**The retrieval accuracy requirement for OCO-2 (~0.25% for XCO2) is also much higher than those for the species measured in the UV/visible range (e.g., the required precision for air quality species is usually >10% (Zoogman et al., 2017)), so small ILS differences that may be tolerated in other instruments may jeopardize the XCO2 retrieval.**"

and note that OCO-2 is not the first instrument measuring CO2.

Two previous missions (SCIAMACHY and GOSAT) that measure column CO_2 have been added.

2. In section 3, various ILS parameterizations are listed which are applied in the following analysis. Later in section 5, the Super Gaussian is introduced and applied as well. Please introduce the Super Gaussian earlier and add it to the list of parameterizations from section 3 on.

Revised as suggested. The Super Gaussian is now defined in Section 2.2 with the other ILS function forms and included in the discussion from section 3 on.

3. Page 1, line 12: "induced"

Revised.