We thank the reviewers for their constructive and helpful suggestions. We have provided our responses to the reviewers' comments and believe that our manuscript is much improved as a result.

The main paper improvements are:

- Section 2. Method was revised;
- More details regarding the NIES TM and FLEXPART modelling;
- Figures 7 and 10 are updated;

The reviewer's specific comments (shown in blue) are addressed below.

Anonymous Referee #1

Received and published: 23 July 2016

The authors presented a very interesting approach for selecting the colocated satellite XCO2 retrievals according to the sensitivity footprint of each TCCON site. Overall the paper is well written, and should be published after minor revisions.

Major comments:

The authors used a trajectory model to calculate the sensitivity of a given TCCON observation (more exactly the boundary layer concentrations) to the emissions from neighbouring regions. Then they determined the 'footprint' of the TCCON site by choosing model cells with sensitivity above some predefined levels. My opinion is that such a simple definition may has some obvious issues:

1) Model cells with similar sensitivity do not necessarily make similar contributions to the observed TCCON column, because they can have some rather different emission/uptake strengths (for example one cell over ocean, and another may over land).

To take into account different emission/uptake strengths for different cell we use four types of a priori fluxes (anthropogenic, biosphere, and oceanic fluxes, as well as biomass burning emissions) optimized with the GELCA-EOF inverse modeling scheme (P5, L32).

2) The boundary layer concentrations are only part of the retrieved XCO2 columns. As a result, the satellite XCO2 observations selected according to the TCCON 'footprint' may still have large spread. I think as a result, there is no significant reduce in the standard deviation when compared to other approaches (Tables 4-8).

In this work we focused on study of the footprints of short-term variation in XCO2 observed by TCCON and GOSAT. This variation is mainly managed by change of CO2 concentration in boundary layer (Keppel-Aleks et al. 2012).

We think that the low accuracy of satellite observations (± 1ppm) is more important factor influenced on the results. Proposed method may have more benefits due to the use of more precise orbital instruments and improved retrieval algorithms.

Minor comments:

1. Line 2-3, Page 4: 'within ±30◦ longitude, ±10◦ latitude, ±5 days, and ±2 K of the selected TCCON location', As 5 days have been mentioned, 'location' may not be a proper word.

Revised as following:

“within ±30° longitude, ±10° latitude, and ±2 K of the selected TCCON location and within ±5 days window”

2. Line 11, Page 4: ’Limitations of the techinks !!! ’ Please delete it.

The paragraph “Bremen, Garmisch, Four Corners, JPL, and Izaña are influenced by local effects or complex terrain and are not included in averages (Kulawik ATM 2016). Limitations of the techinks !!!” was deleted.

3. Line 28, Page 8: ’dimensions of 2.5◦ × 2.5◦, ±5.0◦ × ±5.0◦, ...’, Change 2.5◦ × 2.5◦

Disagree. For case C5 we use small box with size of 2.5° × 2.5°.

4. Line 3, Page 11: ’...are within 0.81–0.93 ppm’, remove ’ppm’, as correlation coefficients have no unit.

Done

5. Line 13-15, Page 11: ’The dry season (May to September), the build-up season (high humidity, but little rain: October to December) and the wet season associated with tropical cyclones and monsoon rains (December to April).’

Not a complete sentence.

The paragraph revised as follows:

The Northern Territory of Australia has two distinctive climate zones: the northern and southern. The northern zone, including Darwin, has three distinct seasons: the dry season (May to September), the build-up season (high humidity, but little rain: October to December) and the wet season associated with tropical cyclones and monsoon rains (December to April). The average maximum temperature is remarkably similar all year round.