

Response to Ref #2

*To what extent can you exclude that the latitudinal dependent bias is not caused by the scaling approach you take (which can introduce seasonal and latitudinal variations) ?*

*Please also motivate the applied scaling approach as used in the manuscript.*

If I understand correctly you mean the scaling applied for tropospheric model bias in Fig. 3.

The start point of the work is that there exist a latitudinal gradient in the bias of the modelled total columns of CH<sub>4</sub>, as shown in Fig. 2. The purpose of the work is to determine whether the troposphere or the stratosphere contributes to that. The variations of CH<sub>4</sub> total columns include the contribution of tropopause variations. To separate the total column into the tropospheric and stratospheric parts., the air mass possessed by each layer must be taken into account except for the CH<sub>4</sub> mixing ratios. Similarly we must take the air mass into account when separating the model bias of the total column into separate layers.

The tropopause altitude influences the total and tropospheric columns of CH<sub>4</sub> and then its inaccuracy can contribute the corresponded model biases. However, the sensitivity test using several different definitions for the tropopause (AC2 supplement) reveals that the tropopause is not the reason to the latitudinal gradient in the tropospheric model bias.