Author's response

I don't think the authors have addressed my comment that this is not the first non-box model global study. They have now added the line: "Although global SF6 emissions can be well constrained by global box models, such as the AGAGE 12-box model (e.g., Rigby et al., 2013), and regional inversion systems have been used to estimate SF6 emissions in specific regions, there is no clear link between regional and global emissions and an updated, comprehensive top-down perspective of the global SF6 emission distribution is missing." However, this line still omits the previous global studies on SF6 (Rigby et al., 2010; 2011), but furthermore, I don't really know what it means to say that there is "no clear link" between the regional and global scales. I suggest citing the previous global studies in the first part of this sentence, removing the middle part, and saying that an update is needed.

We changed:

Although global SF6 emissions can be well constrained by global box models, such as the AGAGE 12-box model (e.g., Rigby et al., 2013), and regional inversion systems have been used to estimate SF6 emissions in specific regions, there is no clear link between regional and global emissions and an updated, comprehensive top-down perspective of the global SF6 emission distribution is missing. ->

Global total SF6 emissions can be well constrained by global box models, such as the AGAGE 12-box model (e.g., Rigby et al., 2013). While Rigby et al. (2010, 2011) presented global SF6 inversion studies and recent regional studies have estimated SF6 emissions in specific regions (e.g. Hu et al. 2024, An et al. 2024), an updated, comprehensive top-down perspective of the global SF6 emission distribution is needed.

In response to my previous question about the a priori uncertainty, when aggregated to the global scale, the authors say "We therefore base our uncertainty estimates also on the differences obtained when using different a priori inventories." I didn't realise this from the previous version of the paper and see that this has now been explained in the text of Section 3. However, this is important for readers to understand, so I also think it needs to be justified in Section 2, and included in the figure captions (which currently imply that it's the a posteriori uncertainty). Furthermore, I think it's misleading to describe these uncertainties as "1-sigma" in the figure captions and elsewhere, as this would imply that they represent one standard deviation over some PDF. But in reality, they are no longer tied to some known distribution. They are a somewhat arbitrary measure of the sensitivity of the results to the priors.

Agreed, we added to Sec 2.6:

In order to reflect the sensitivity of the results to the *a priori* emissions we define the uncertainty intervals of aggregated emissions as the minimum and maximum 1-σ uncertainty limits across the inversion results using the different *a priori* emissions.

In the figure captions, we changed:

A posteriori emissions are illustrated together with their respective 1-σ uncertainties (colored shadings). -> *A posteriori* emissions are illustrated together with their respective uncertainties (colored shadings, defined as the minimum and maximum 1-σ uncertainty limits across the inversion results for different *a priori* variations).