

## Responses to Referee 1

- **Comment 1:**  
A clarification addressing this comment has been provided in the AC1 reply file.
- **Comments 2 & 3:**  
Additional explanation has been included in *Section 3.2* to address these points.
- **Comment 4:**  
An equation and expanded explanation have been added in *Section 5.2*.
- **Comment 5:**  
The atmospheric layer separation has been revised in *Section 3.2*. We now adopt a 50%/50% partitioning, where the lower 50% of the atmosphere represents the tropospheric layer and the upper 50% represents the upper tropospheric/stratospheric layer.
- **Minor/Technical Comment 1 & 2:**  
The requested clarification is provided in the AC1 reply file.
- **Minor/Technical Comment 3:**  
We added text explaining that all variables used in the manuscript's equations are given in linear scale, and that the distributed netCDF data files also provide all variables in linear scale.
- **Minor/Technical Comment 4:**  
Legends have been added to *Figure 12* in the updated manuscript.

## Responses to Referee 2

- **Comment 1:**  
We added appendices with additional figures:
  - *Figure B1*: VMR profile averaging kernels
  - *Figure A1*: Kalman gain profilesAdditionally, *Figure 5* has been expanded to include partial column amount kernels for low, middle, and high latitudes.
- **Comments 2 & 3:**  
We added *Figures 7 and 8* to illustrate the response of the combined product to tropopause uncertainty and boundary layer increments.

Furthermore, *Figures C1–C3* have been added in the appendix to detail the impact on total and partial columns.

- **Comment 4:**

A workflow schematic has been added as *Figure 2*.

- **Comment 5:**

An updated discussion of the observed dislocation error patterns has been added in *Section 5.2*.

- **Comments 6 & 7:**

Because we now adopt a 50%/50% partitioning of the atmosphere, we avoid the representation of data for the very fine tropospheric layers, which resulted in artificial DOFS patterns. With this adoption, the DOFS patterns show no artificial dependence on the surface pressure, instead they depend on the IASI constraints, which we discuss in the revised manuscript.

- **Comment 8:**

The requested clarification is provided in the AC2 reply file.