**Table 1:**

|  |  |  |
| --- | --- | --- |
| **Inversion name** | **Intervention description** | **Intervention mechanics** |
| True | The true boundary condition is used for the entirety of the inversion. No intervention is applied so that all information from the observations may be used to correct the fluxes. | None |
| Standard | No intervention is applied. A boundary condition perturbation may be applied. | None |
| Correction | One or more elements corresponding to the boundary condition are corrected as part of the inversion. If multiple boundary condition elements are used, they may correspond to spatial divisions (e.g., optimizing the northern, eastern, southern, and western boundaries) and/or temporal divisions (e.g., optimizing the boundary condition seasonally). | The state vector is expanded to include the boundary condition elements. This requires corresponding adjustments to the prior error covariance matrix and additions to the Jacobian matrix. |
| Buffer | The fluxes in a grid cell of arbitrary size at the edge of the domain are allowed to vary significantly to “absorb” any biases from the boundary condition. In a real inversion, these grid cells would be excluded from analysis. | The prior error in the buffer grid cell is set to be many times larger than the prior errors in other grid cells. |
| Combination | Both the correction and buffer approach are simultaneously applied. | Both the correction and buffer approach mechanics are used. |
| Sequential | The boundary condition elements and flux elements are updated sequentially in two inversions. The first inversion optimizes the boundary condition elements (as described under the “correction” inversion) and the second optimizes the flux elements. | After solving for the boundary condition elements, the boundary condition is updated to match the posterior solution prior to solving for the flux elements. |
| Covariance | Off-diagonals of the observing system covariance matrix, which includes errors from the instrument and the transport model, are defined to better represent the covariance in the boundary condition errors. | A simple first order decay model is used. |



**Figure 1: [Explain why this doesn’t do well, cite Daniel Varon’s figure of DOFS per TROPOMI observation]**

A graph of a sword

Description automatically generated with medium confidence**Figure 2:**

A screenshot of a computer screen

Description automatically generated

**Figure 3:**

A screenshot of a computer screen

Description automatically generated

**Figure 4:**

**A group of lines on a black background

Description automatically generatedFigure 5:**

A screenshot of a computer screen

Description automatically generated

**Figure 6:**

Grid cells 1 through end:

A diagram of different types of error

Description automatically generated with medium confidence

A comparison of different error lines

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