

Referee Comments

Manuscript: amt-2023-239

Title: AMV Error Characterization and Bias Correction by Leveraging Independent Lidar Data: a Simulation using OSSE and Optical Flow AMVs

Author(s): Hai Nguyen et al.

General Comments:

The manuscript explores the application of machine learning techniques to assess bias and uncertainty in the assimilation of atmospheric motion vectors (AMVs). The authors frame the problem by treating independent LIDAR wind observations as a dependent variable in a supervised learning machine model. The study utilizes an Observing System Simulation Experiment (OSSE) framework, with reference geophysical state data derived from high-resolution Weather Research and Forecasting (WRF) simulations.

The literature review is comprehensive, providing a strong foundation for the study. The motivation for the research is clearly articulated. However, it's crucial to note that the paper primarily serves as a proof-of-concept, a fact that becomes evident through the text. While the title implies a broader scope, the content remains focused on the proposed machine learning approach for bias correction in wind field assimilation.

The approach presented is sound, addressing and resolving issues identified in previous methodologies. The paper is well-structured, and the visual aids effectively support the discussion. However, there are opportunities to better depict certain concepts, as outlined below.

Specific Comments:

1. The authors should provide a more detailed explanation of their efforts to obtain accurate AMVs. Although they refer readers to another publication for details, as that reference is still "submitted for publication," a general explanation or summary is important for proper understanding.

2. Clarity regarding the connection between the proof-of-concept and the utilization of Lidar data is essential. It seems that certain errors associated with Lidar wind profiles were not considered, impacting the comprehensiveness of the study. Clarifying this aspect would strengthen the paper.

3. The presentation of optical flow could be improved for better interpretation. The right column in Figure 1, in particular, may benefit from replacing arrows indicating differences with a color-coded scale. Additionally, consider addressing potential confusion related to the arrows' direction by emphasizing differences in magnitude rather than implying directional changes.

4. While the paper is technically sound, providing a more explicit link between the proposed methodology and Lidar data considerations would enhance the manuscript's overall coherence and contribute to a more comprehensive understanding for readers.

Technical Corrections:

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| The first abbreviation of Observing System Simulation Experiments should appear in Line 49 . | <i>"Observing System Simulation Experiments (OSSE) (Cordoba et al., 2017)"</i> |
| Line 52: Use the abbreviation of Observing System Simulation Experiment. | "OSSE framework" |
| Line 58: Use the abbreviation of Atmospheric Motion Vectors. | <i>"uncertainty of AMVs derived from cloud movement ..."</i> |
| Line 427: No need to repeat almost the exact same sentence as in Lines 43-45 . | "For instance, Staffell and Pfenninger (2016) found that NASA's MERRA and MERRA-2 AMVs tend to overestimate wind output by 50% in northwest Europe and underestimate it by 30% in the Mediterranean." |