Validation of Aeolus L2B Wind Product with ECCC Short-Range Forecasts and ERA5 over the Arctic

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Abstract

In August 2018, the European Space Agency launched the Aeolus satellite, the first spaceborne Doppler Wind Lidar, that measures global horizontal line-of-sight (HLOS) wind profiles by analyzing the Doppler frequency shift of backscattered signal from air molecules (Rayleigh) and aerosol and cloud (Mie). This mission has the potential to improve numerical weather prediction over the Arctic where wind observations are sparse. In this study, the Aeolus Level-2B wind product is compared to the ECCC's short-range forecast (ECCC-B) and the reanalysis product, ERA5, from the ECMWF in the Arctic during the early FM-A (2018-09 to 2018-10), early FM-B (2019-08 to 2019-09), and mid-FM-B periods (2019-12 to 2020-01). Notably, consistency is found in the Rayleigh channel from the troposphere to the stratosphere and in the Mie channel from the PBL to the lower stratosphere. The correlations between the analyses and observations are greater than 0.7 and their RMSD are within one normalized standard deviation in the higher atmosphere for Rayleigh winds and lower atmosphere for Mie winds. The reprocessed product, 2B10, has no significant improvement compared to the near-real time product, 2B06. Nevertheless, this reprocessed product does not need further model-based bias correction which could ease the inter-comparison of experiments across different weather centers. ECMWF's estimated error product for Aeolus is found to be coherent with the differences between Aeolus and the other datasets, and thus can be used as a guide for expected consistency. Thus, the new Aeolus product provides a valuable addition to current wind products in regions such as the Arctic Ocean sector where few direct wind observations have been available to date.

Keywords: Aeolus, validation, Arctic, ECCC, ERA5, wind observations

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