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Validation of Atmospheric Motion Vectors (AMV) using wind profiler radar data over a tropical location (10N, 76.33E)

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Wind measurements are essential for producing weather forecasts and predicting climate conditions. Wind Profiler radar is an accurate and efficient equipment in atmospheric sciences, regarding their ability to continuously monitor wind speed and direction values as a function of altitude up to the extent of the troposphere without any breakpoint or gap. However, in-situ and ground-based remote sensing methods have significant disadvantages, such as extensive cost, coarse vertical resolution, massive power consumption, and difficulty collecting data over oceanic regions. Satellite remote sensing techniques have overcome these limitations to an extent and are evolving further to improve data accuracy. Winds measured using satellites are called Atmospheric Motion Vectors (AMV). To derive AMV, cloud movements and water vapour gradients are tracked through sequential geostationary satellite imagery. The validation of AMV is of utmost importance as they are critical components of Numerical Weather Prediction (NWP). They provide crucial wind information for NWP, including data over regions where conventional wind data is sparse [1,2]. The present study has evaluated the quality of three years (2017-2019) of AMV data from Indian Ocean Data Coverage (IODC) Climate Data Records (CDR) over Cochin (10.04° N, 76.9°E), a tropical location, using data from a 205 MHz wind profiler as a reference for the first time. The wind profiler radar has been operational since 2017, and it provides three-dimensional wind profiles for an altitude range of 315 m to 20 km. The radar is situated in a pivotal area characterized by various weather conditions and circulations of altering strengths. This study provides the error characterization of IODC AMV profiles using three years of Stratosphere-Troposphere (ST) radar data. The analysis primarily shows that the upper-level (pressure (P) < 400 hPa) satellite wind is more accurate than measurements over the middle (400 hPa < P <700 hPa) and lower levels (P > 700 hPa) of the atmosphere.

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2. J. Sears and C. S. Velden, “Validation of satellite-derived atmospheric motion vectors and analyses around tropical disturbances”, *Journal of applied meteorology and climatology*, 51, October 2012, pp. 1823–1834, doi: https://doi.org/10.1175/JAMC-D-12-024.1