Accuracy of ECMWF and MERRA (re-)analyses in the deep Tropics

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The accuracy of horizontal winds and temperature in the equatorial lower stratosphere is

evaluated in different (re)analyses (European Centre for Medium-Range Weather Forecasts (ECMWF)

operational analysis, ERA Interim, and Modern-Era Retrospective Analysis for Research and Applications)

using an independent data set collected by the long-duration balloon flights of pre-Concordiasi in the boreal spring of 2010.

The three analyzed wind products are found significantly less accurate than in the extratropics, with periods of disagreement with the observations that reach 10 m/s and that last several days. To highlight the dynamical context in which the major disagreement events occur, case studies are carried out. The events are shown to be related to an improper representation of large-scale equatorial Kelvin and Yanai wave packets with vertical wavelengths smaller than 5 km. Such events can induce large errors on trajectories computed with analyzed winds relatively to the actual (balloon) trajectory: 4000 km separation after 5 days of calculation. Reasons for these errors in the analyses are discussed. The vertical resolution of the underlying model likely plays a role, but the main factor responsible for deficiencies appears to be the lack of wind observations. Indeed, errors in analyzed winds during the campaign have a strong longitudinal structure, with root-mean-square errors twice as large over the Indian Ocean and western Pacific, poorly covered by radiosounding stations, as over the Maritime Continent or South America. For the ECMWF analysis, this structure mirrors that of the analysis increments, which have largest amplitudes over observed regions. We argue that the reported events are more likely to happen during maximum shear phases of the quasi-biennial oscillation.