Lagrangian mean vertical wind velocity deduced from chemical constituent data

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   This is to validate the Lagrangian-mean vertical velocities in the stratosphere deduced from chemical constituents. The vertical velocity is calculated from tracing air masses along the constant constituent mixing ratio by using CTM output, and this trace analysis method is compared with the dynamical analysis. The equivalent latitude coordinate has been widely applied for the trace analysis in previous works. In this study, first, the mean vertical velocity of the trace analysis is compared between the equivalent and conventional equivalent latitudes coordinates, to evaluate the ability of the equivalent latitude for use in the trace analysis. A significant difference between two coordinates is found around the Arctic polar vortex particularly during formation period of the vortex, while the difference is very small in the southern hemisphere owing to zonally symmetric structure of the Antarctic vortex. Second, the availability of the trace analysis is examined by comparing with the dynamical analysis. The trace analysis was found to be in good agreement with the dynamical analysis inside the Antarctic polar vortex, but it misses the particular feature of the downward velocity maxima at the equatorial side of the Antarctic vortex edge. It is concluded from the results that the trace analysis without considering the eddy transport term tends to underestimate the vertical velocity.