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http://dx.doi.org/10.2151/jmsj.2014-603

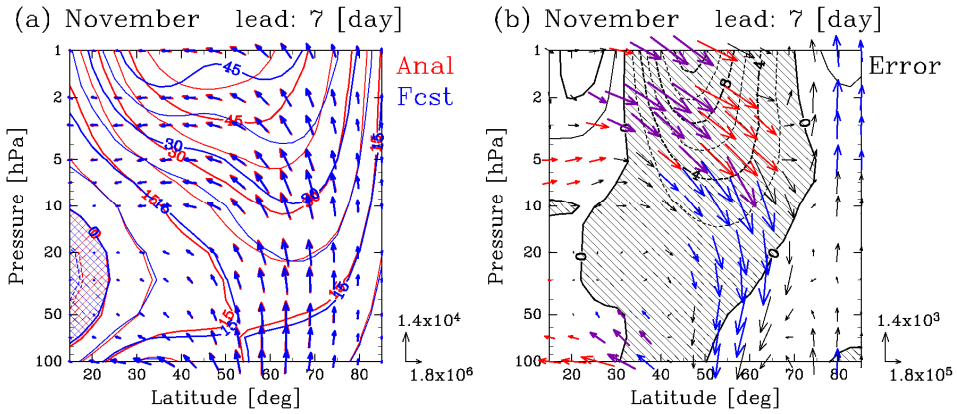

Figure 1. Latitude-height cross section of zonal-mean zonal wind (contour interval is 7.5 m s^{-1} in Fig. 1a and 2.0 m s^{-1} in Fig. 1b) and E-P flux vector (arrows, unit: $hPa^{-0.5}$ kg s^{-2}). The E-P flux vector is scaled by the inverse of the square root of the pressure. (a) Blue contours and arrows are the ensemble mean of the predicted zonal wind and E-P flux vector at 7-day lead time averaged over forecasts starting from November. Red contours and arrows are the observed values averaged over all verification dates for the corresponding forecasts. (b) The systematic error defined by the difference of the predicted values from the observed ones. When the systematic error of the meridional component, the vertical component, or both components of E-P flux is significant at 99 % confidence, the corresponding arrows are colored by red, blue, or purple, respectively.

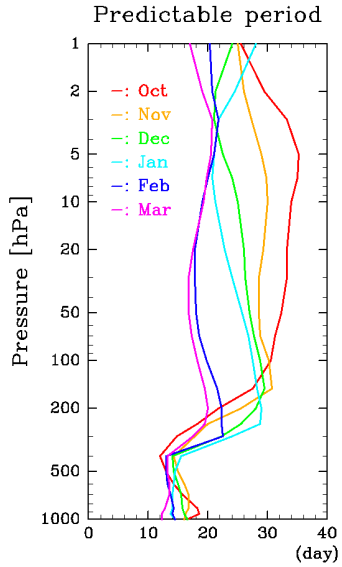

Figure 2. The predictable period at each pressure level estimated by the use of the logistic equation to the ensemble spread of the north pole temperature averaged over each month. Red, orange, green, aqua, blue, and magenta colored lines show the parameters for October, November, December, January, February, and March, respectively.

- The predictability variation of the stratospheric polar vortex in the northern hemisphere winter is examined based on the systematic error and the ensemble spread using a seven-year archive of the operational ensemble one-month forecast dataset provided by the Japan Meteorological Agency.
- In early winter, the north pole temperature in the stratosphere has a significant warm bias due to the significant underestimation of the equatorward propagation of planetary waves in the upper stratosphere (Fig. 1).
- An upper bound of the predictable period of the north pole temperature is assessed by applying the logistic equation, which describes the evolution of small initial errors proposed by Lorenz, to the monthly averaged ensemble spread.
- The estimated predictable period in the stratosphere attains a maximum value of 35 days in early winter, gradually decreases with the seasonal march to 20 days in late winter, which is considerably longer than that in the troposphere (Fig. 2).