C8/M80A

Predictability of Northern Winter Stratospheric Conditions Using JMA One-Month Ensemble Predictions for 2001/02-2010/11

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◆MOTIVATION and QUESTIONS

☐Extensive studies have been investigating SSWs in terms of dynamics, and associated circulation anomalies including tropospheric impacts.

☐On the other hand, SSWs remain relatively unexplored in predictability, whereas existing studies show predictability variations of SSWs.

This situation (and our preliminary analyses) leads to the following questions:
How does predictability of major SSWs (MSSWs) in reality vary by events?
How do we understand the variability?

We analyze 1-mo. ensemble predictions (EPs) of Japan Met. Agency (JMA).

◆CONCLUSIONS (ANSWERS to the QUESTIONS)

The predictability of MSSWs largely varies by events.
We here relate the variability to two factors according to lead time.

(1) When EPs are initialized before about 10 days or more of MSSWs,
The variability is related to time change in the analysis zonal wind:
it is easier to predict MSSWs if the zonal wind changes linearly in time.

(2) When EPs are initialized before 5 days or so,
The variability is related to predicated wave activity in the lower stratosphere:
it is easier to predict MSSWs if larger eddy heat flux is predicted.

◆Data

We examine predictability of MSSWs by comparing EPs to analysis data.

☐JMA operational one-month EPs (Fig. 1)

☐JMA GANAL analysis data (Fig. 2)
LonxLat = 1.25x1.25˚
L23 with top level of 0.4 hPa

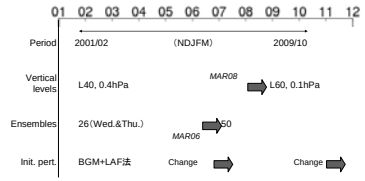

Fig. 1: Features of JMA 1-month EP system.

◆Analysis Method

☐Identification of MSSWs in GANAL
Key days of MSSWs are:
when [U]@60N, 10 hPa <0 firstly in each NDJF period.
⇒8 MSSWs in the 10 winters (Fig. 2)

☐Prediction index, P, of MSSWs (Fig. 3)
P(%) = members of [U] <0 / all members defined for each set of EPs:
$P = P_{\text{initial date}}(\tau) = P_{\text{initial date}}(t)$,
τ : forecast day, t: calendar dates.

☐Two indices related to P
1. U_{SD}(m/s) = std. dev. of [U]@60N,10hPa about linear (in time) change in GANAL
2. R_{HF}(%) = members of $HF_{fcst} > HF_{anal}$ /all
HF = [V*T*] @40-80N, 100hPa

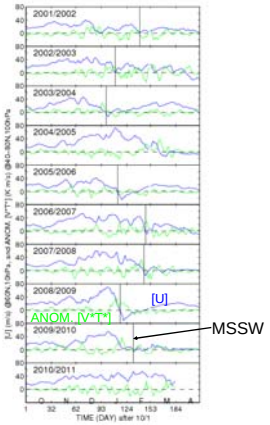

Fig. 2: [U] @60N,10hPa and anom. [V*T*] @40-80N,100hPa in GANAL data.

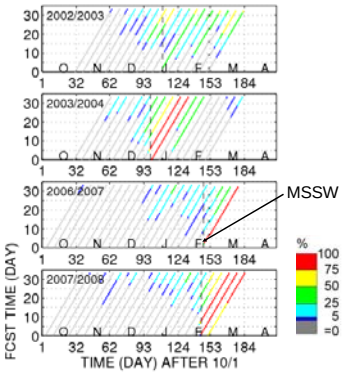

Fig. 3: Index P (%) for 4 NH winter seasons.

◆Results

☐The index P largely varies by events.

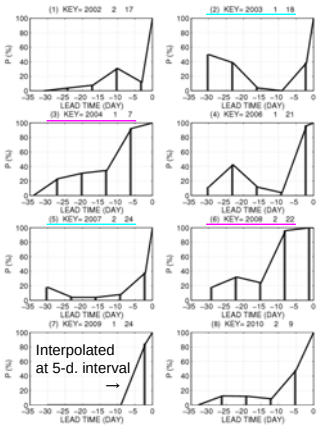

Fig. 4: Index P (%) for 8 MSSWs (black bars).

☐The P variability is correlated with U_{SD} for lead time -25 to -10 day, R_{HF} for lead time -10 to -5 day.

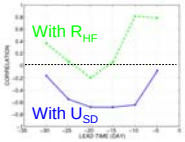

Fig. 5: Correlation of P with U_{SD} and R_{HF} for 8 MSSWs.

☐The correlations are seen in scatter plots.

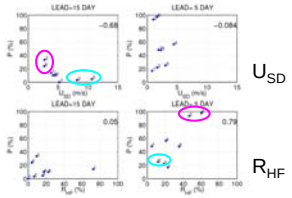

Fig. 6: Scatter plots between (top) U_{SD} and P, and (bottom) R_{HF} and P.

☐Higher P values are related to smaller U_{SD}, when EPs are initialized before 10 days or more.

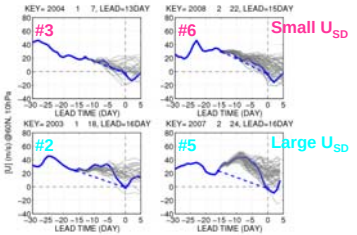

Fig. 7: [U]@60N,10hPa for 4 MSSWs. (blue) GANAL, and (gray) EPs.

☐Higher P values are related to larger R_{HF}, when EPs are initialized before 5 days or so.

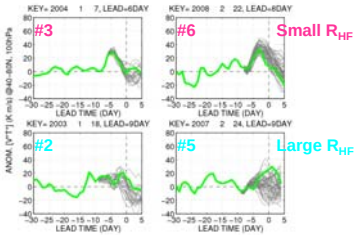

Fig. 8: [V*T*]@40-80N,100hPa for 4 MSSWs. (green) GANAL, and (gray) EPs.