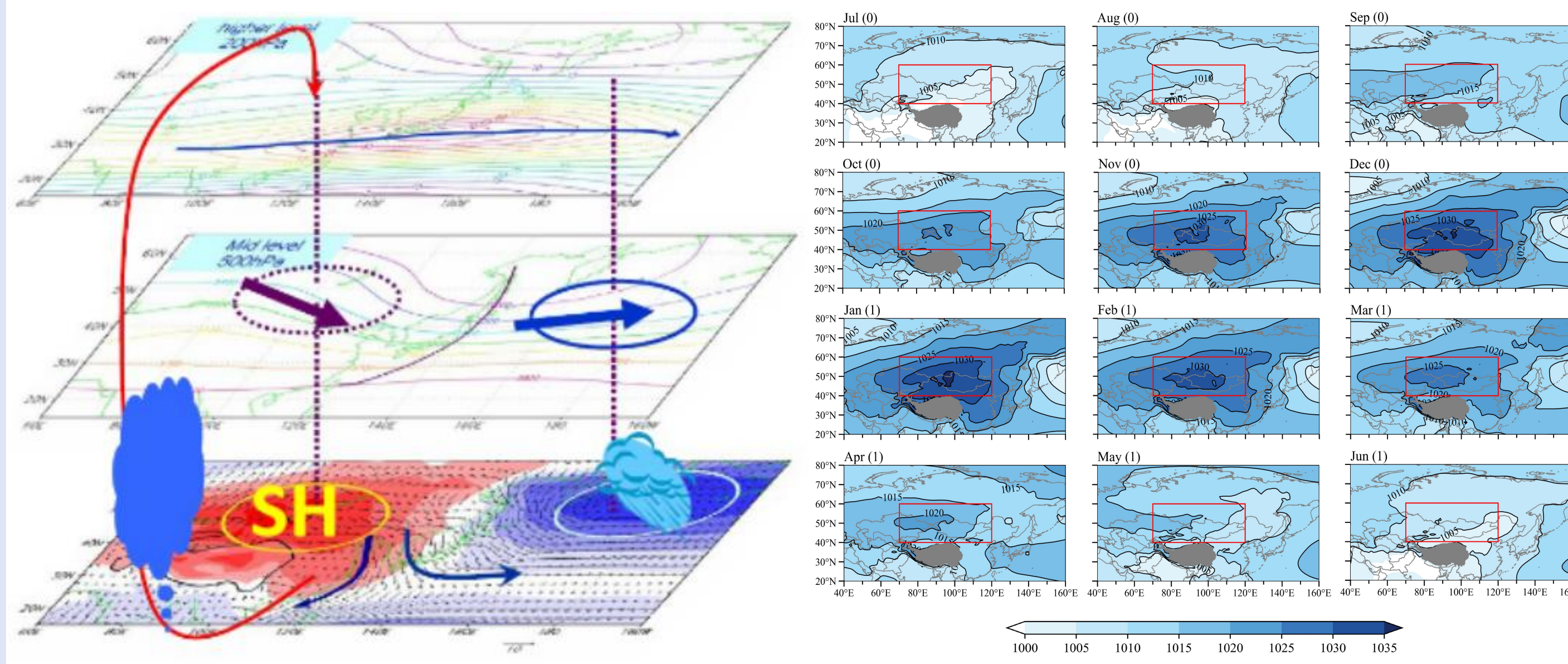


Introduction

East Asian winter monsoon (EAWM)

- Under the background of global warming, unexpected cold events occur frequently over East Asia, which is highly associated with the synoptic intensification of the EAWM system.



The EAWM system (Wei and Wang, 2011)

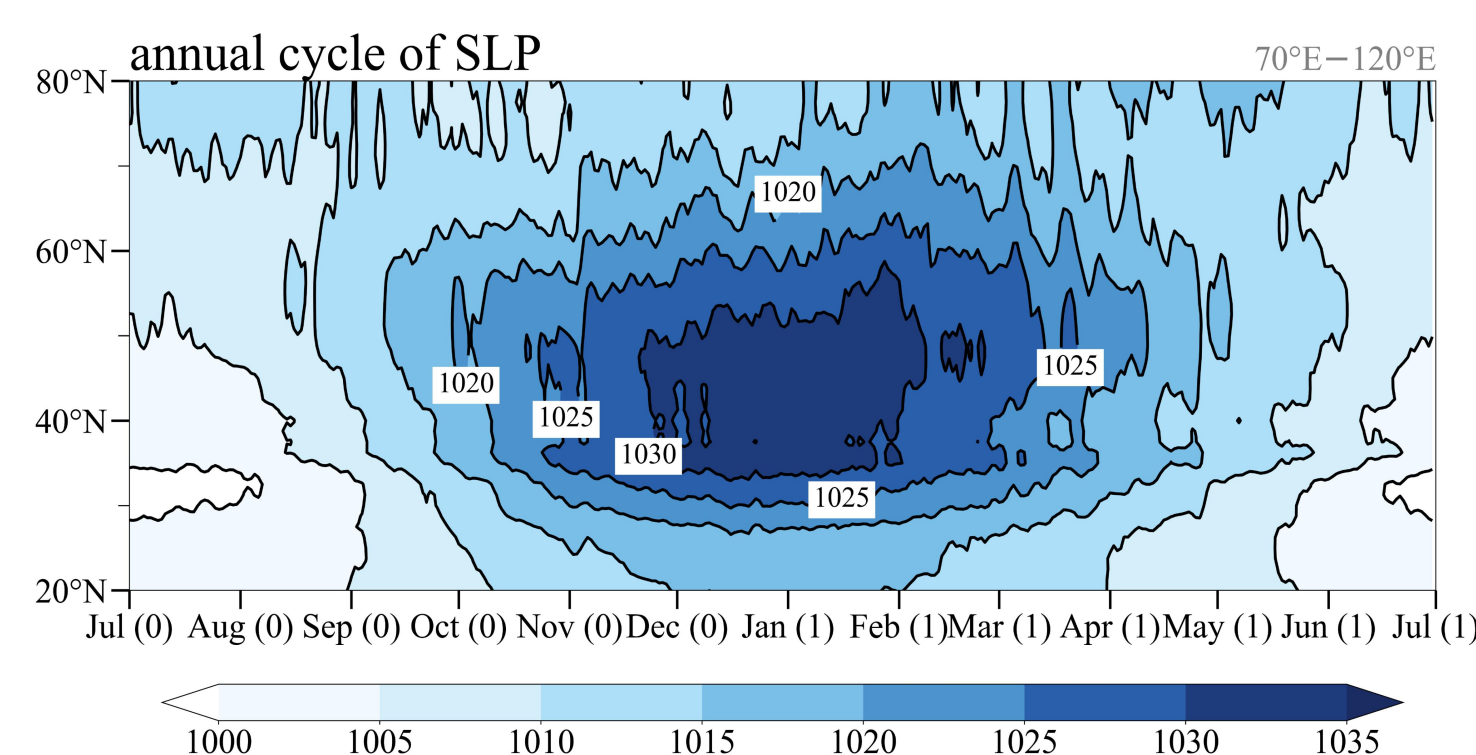
The climatology of monthly SLP

Siberian High (SH)

- Important member of the EAWM system that drives the EAWM flow;
- A shallow cold high that resides over Eurasia in winter;
- A semi-permanent atmospheric system that forms in autumn, peaks in winter, and demises in next April.

The annual cycle of SH

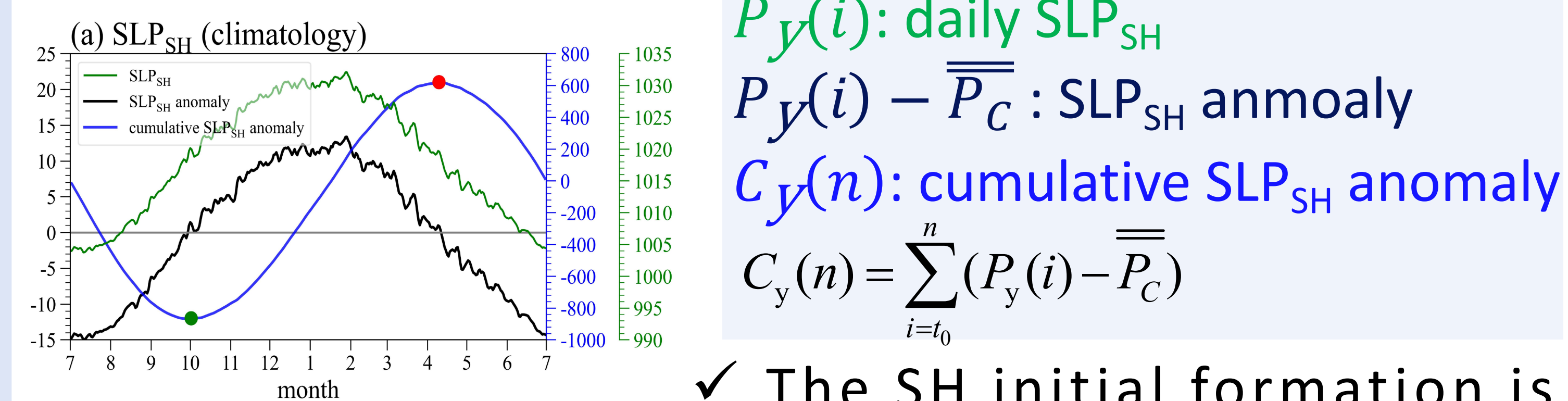
- The SH exhibits remarkable seasonality;
- Many previous studies focus on the SH in its peak phase;
- Less attention has been paid to the initial SH formation.



This work aims to study the processes and mechanisms associated with the initial formation of SH in climatology.

Results

Objectively detect the SH initial formation



Daily time series of the SLP_{SH}, SLP_{SH} anomaly, and cumulative SLP_{SH} anomaly.

$$P_{Y(i)}: \text{daily SLP}_{SH}$$

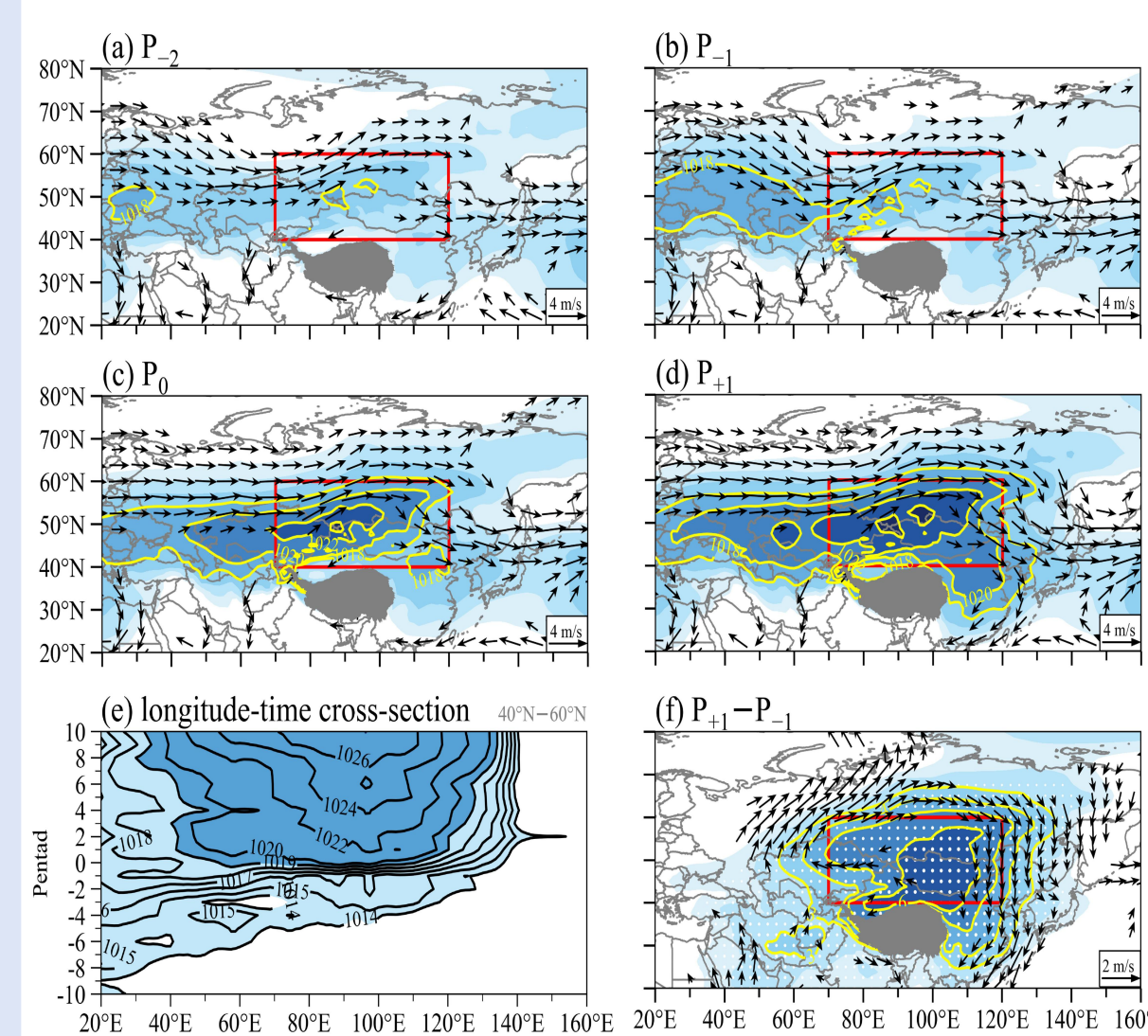
$$P_{Y(i)} - \overline{P_C}: \text{SLP}_{SH} \text{ anomaly}$$

$$C_{Y(n)}: \text{cumulative SLP}_{SH} \text{ anomaly}$$

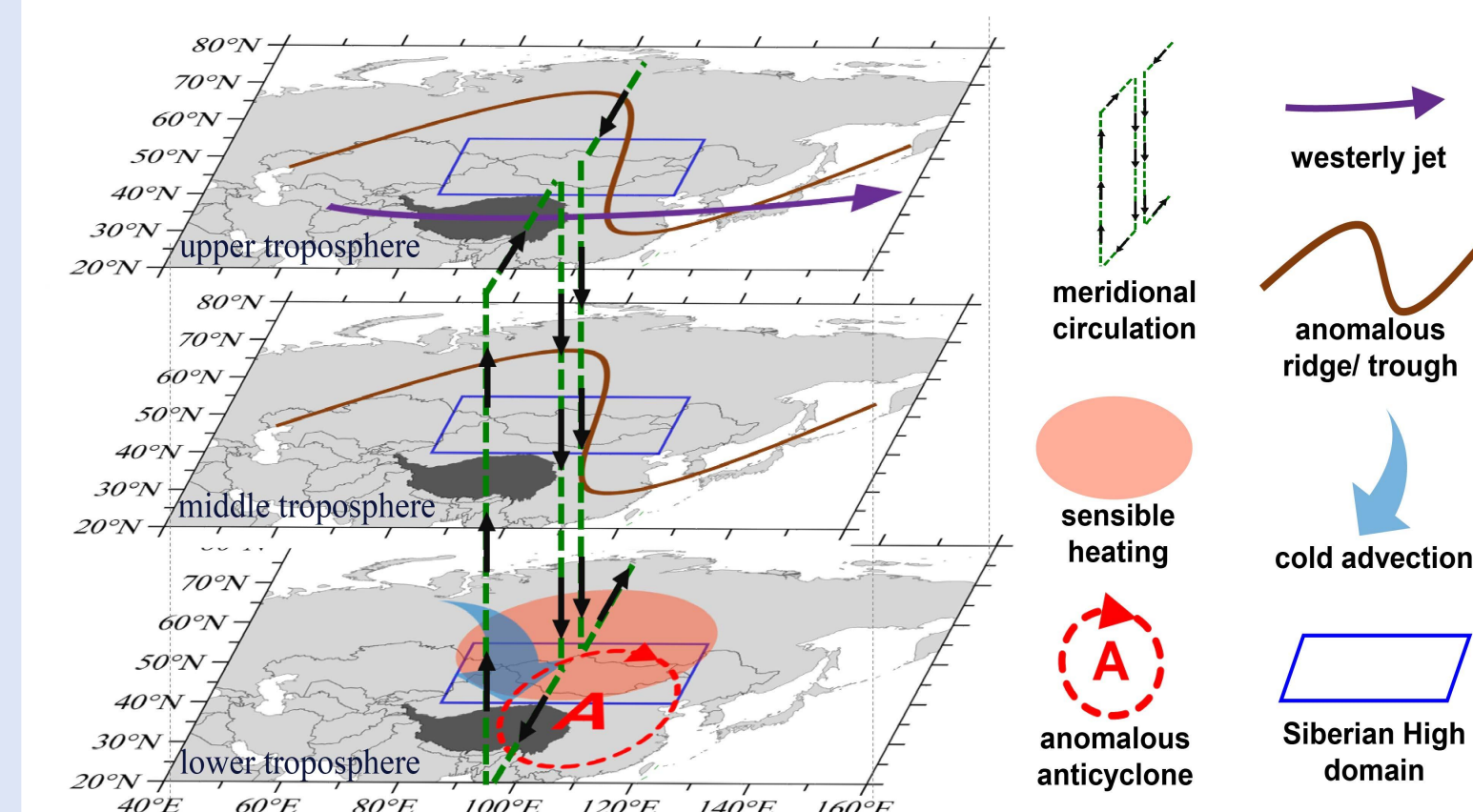
$$C_Y(n) = \sum_{i=l_0}^n (P_Y(i) - \overline{P_C})$$

- The SH initial formation is considered to occur on the day on which the SLP_{SH} stably exceeds its climatological annual mean ($\overline{P_C}$);
- Accumulation approach is used to objectively detect the date of SH formation.

Qualitatively reveal the thermodynamic processes associated with SH formation



Evolution of composited SLP and 850-hPa winds associated with the SH formation.



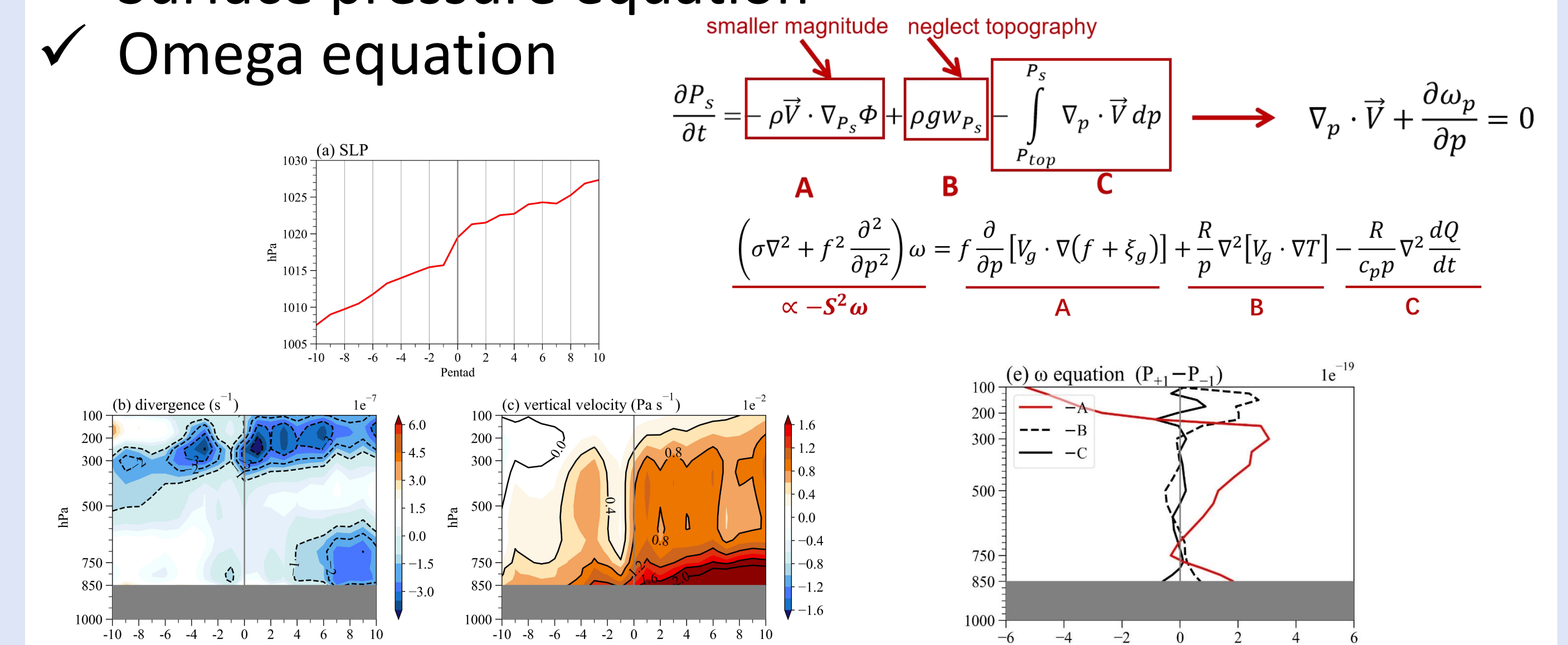
Three-dimensional circulation and thermal processes in association with the SH formation.

- Climatological SH formation date: October 1, 55th pentad;
- Notable changes in dynamic process: low-level anticyclone/mid-level intensified trough and ridge/ upper-level southward movement of jet;
- Little changes in thermal process.

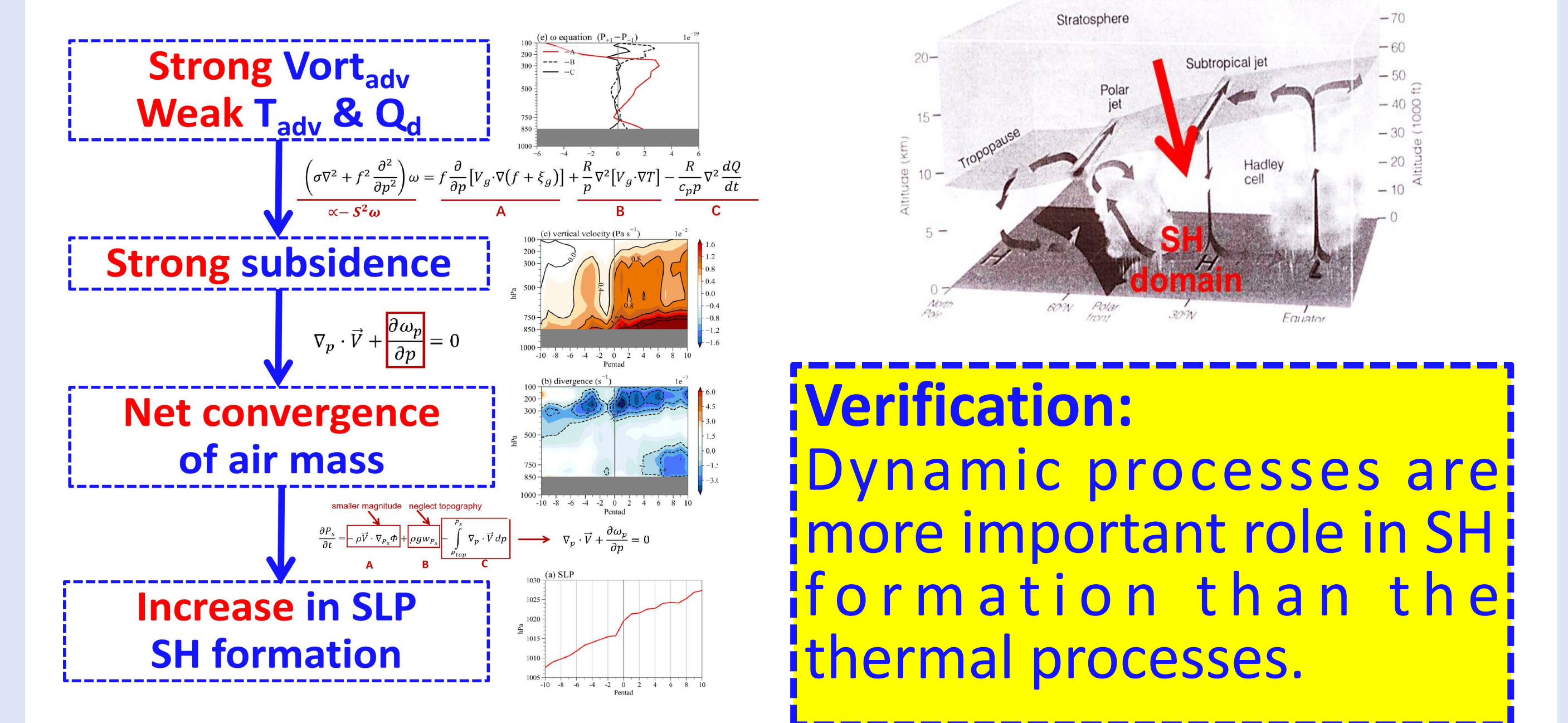
Speculation: Dynamic processes are more important in SH formation than the thermal processes.

Quantitatively diagnose contributions of the thermodynamic processes to the SH formation

- Surface pressure equation
- Omega equation



Physical process



Conclusion and outlook

- The SH forms in October 1, 55th pentad in climatology.
- Dynamic processes play a major role in SH formation.
- The variations of SH formation will be further studied.

Highlights

- Probably the first to propose the concept of SH formation.
- Objectively detect the initial formation of SH.
- The initial formation of SH may mark the onset of EAWM.