



# Diurnal and Semi-diurnal Variations of Rainfall in Southeast China

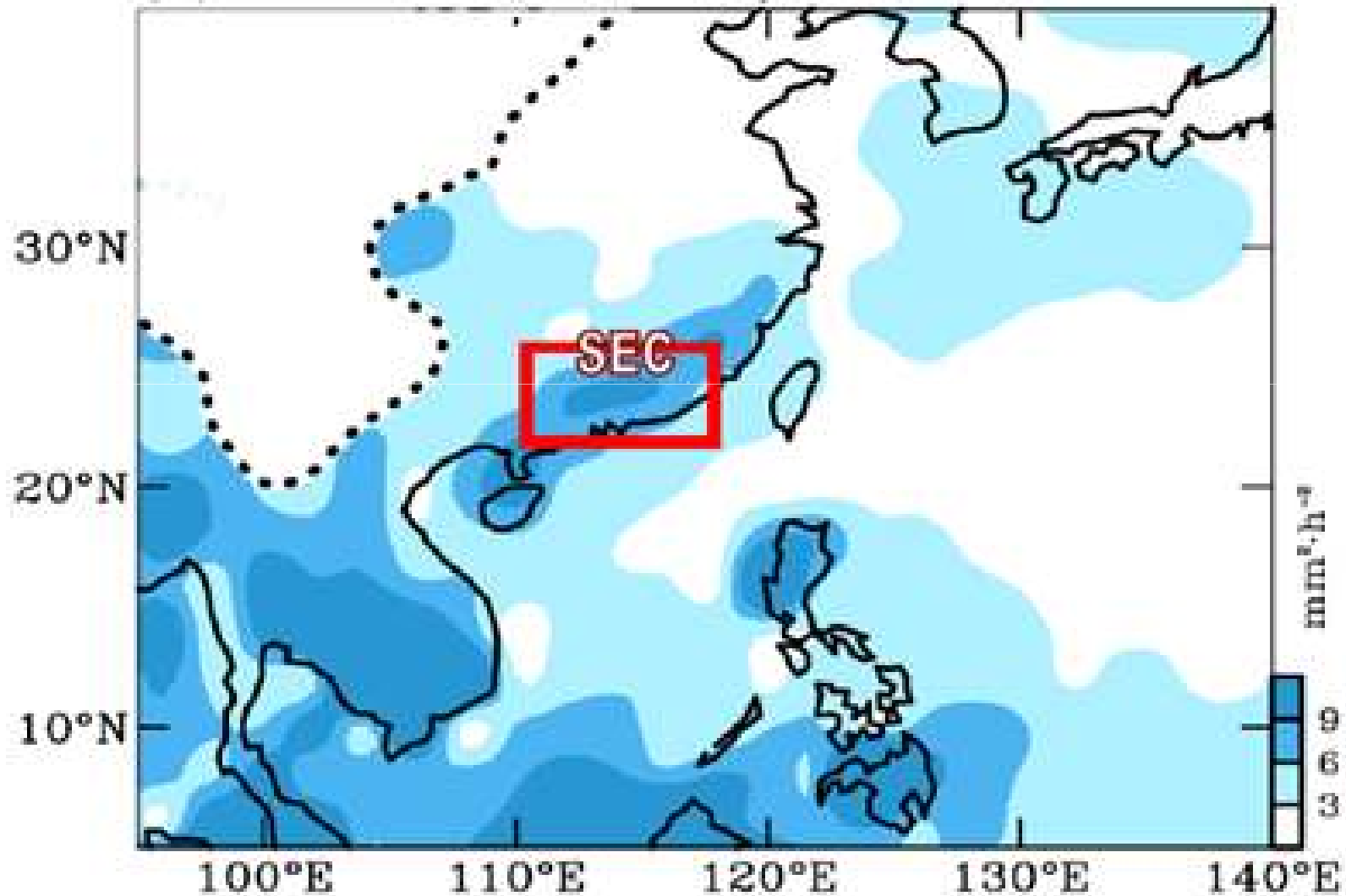


**Judy Huang and Johnny Chan**

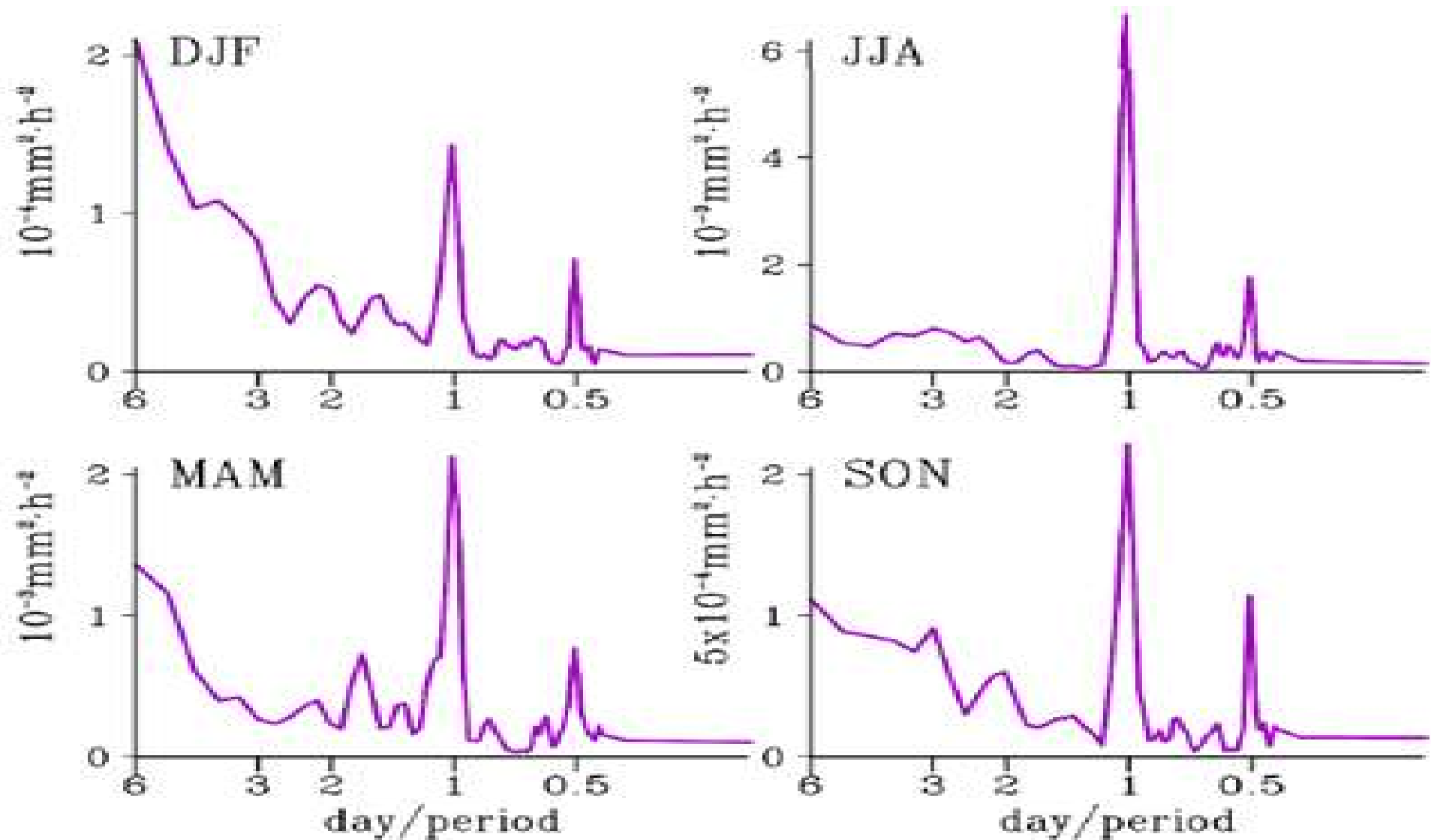
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## Variance of 3-hourly precipitation

(a) Variance of 3hourly P for 1998–2009



# Power Spectrum of 3-hourly precipitation



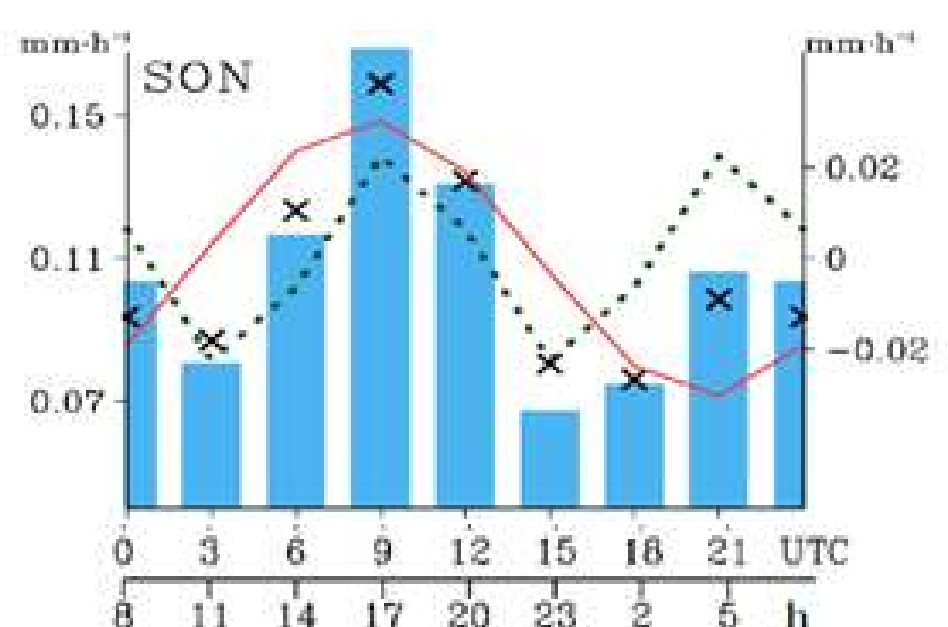
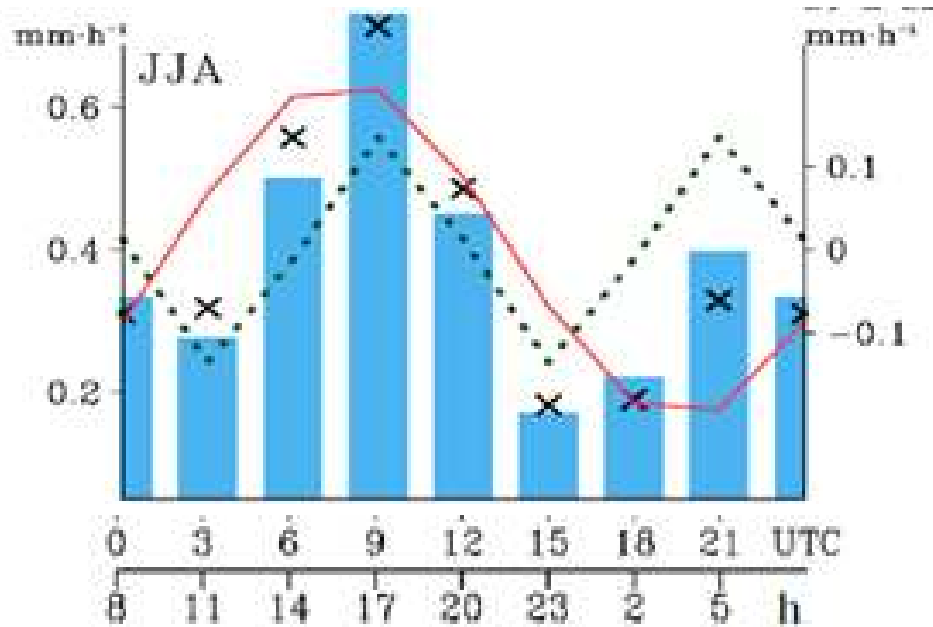
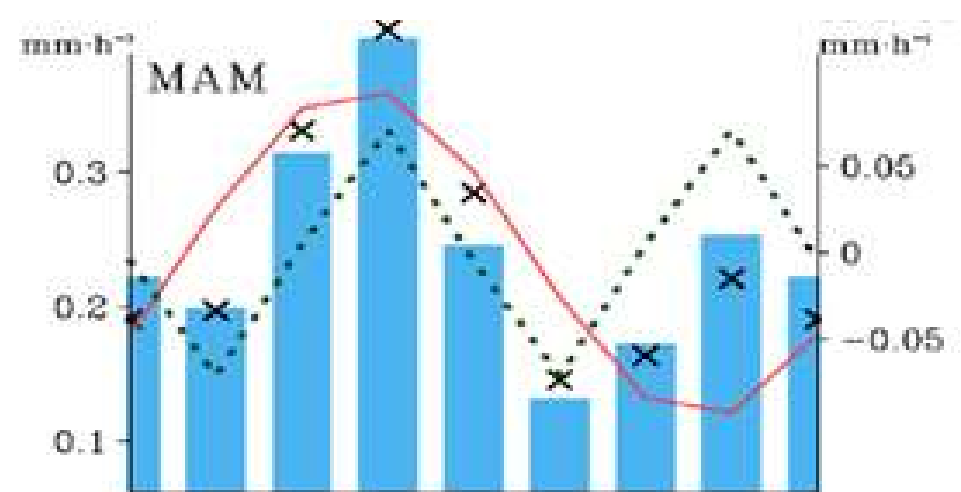
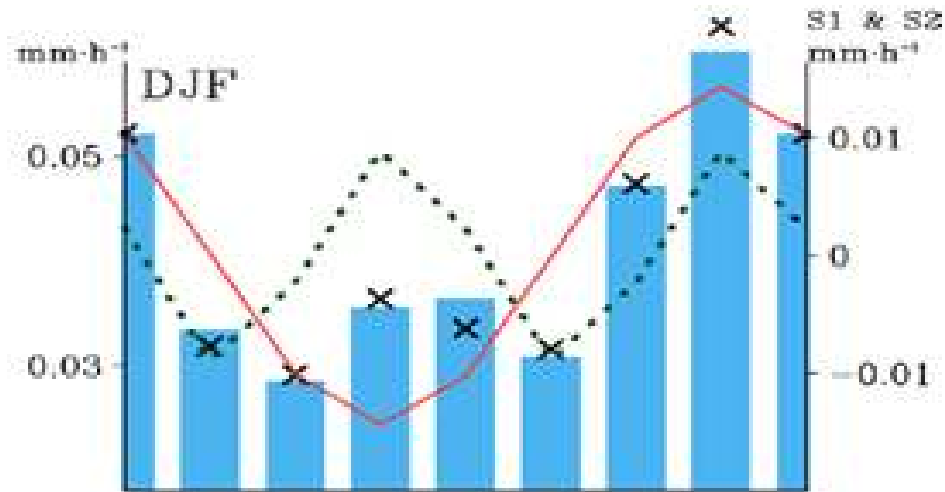
## ■ Data (1998-2009)

- **Rainfall: 3-hourly, 0.25° long x 0.25° lat gridded TRMM 3B42 precipitation dataset**
- **Atmospheric conditions: 3-hourly GEOS5 reanalysis dataset with a spatial resolution of 0.667° long x 0.5° lat, interpolated to a 1° long x 1° lat**
- **Precipitation cloud types: Extended Edited Cloud Reports Archive (EECRA), which provides 3-hourly weather reports from about 15,000 station and ship observations.**

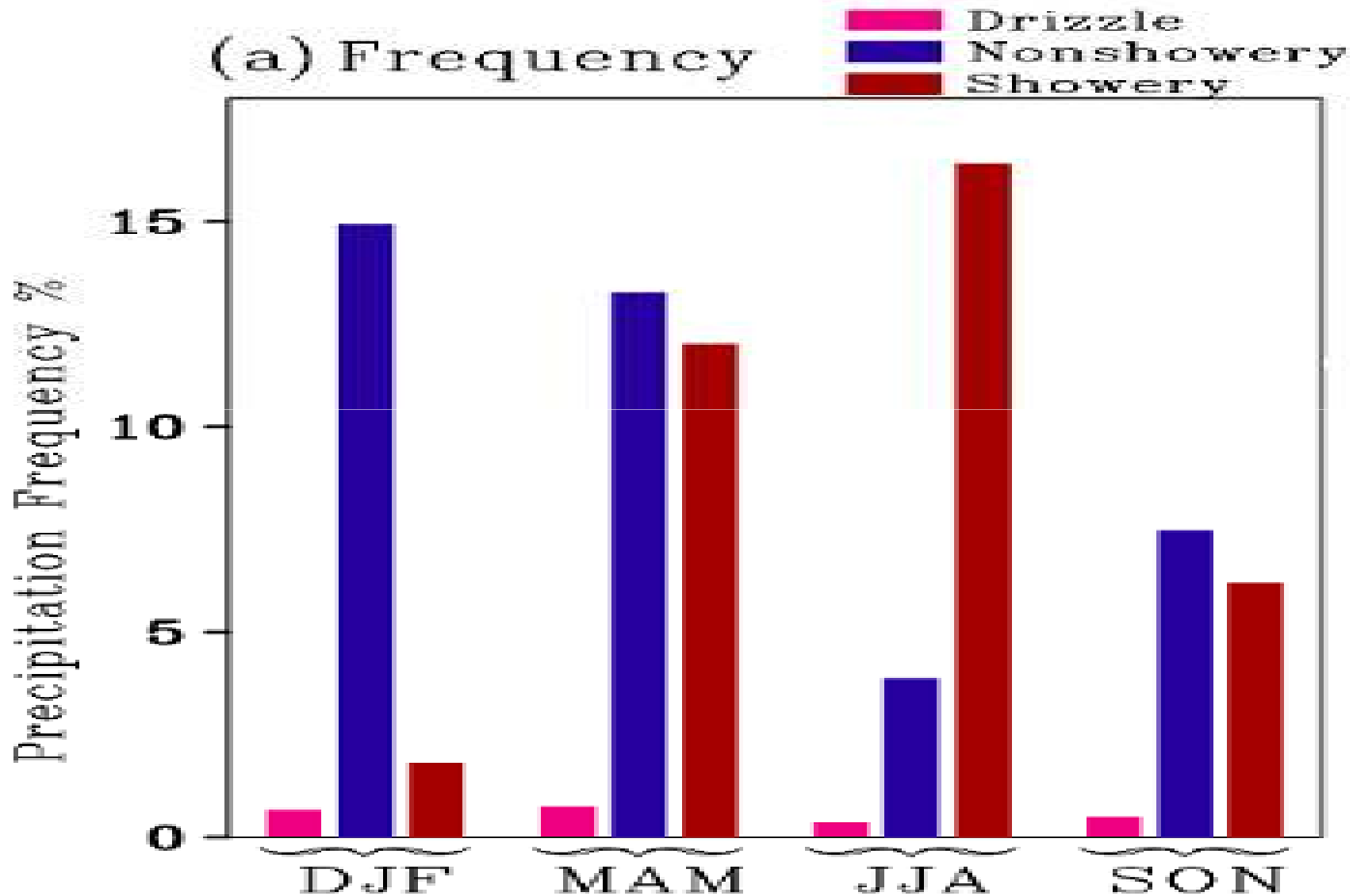
## ■ Data (1998-2009)

- **High-level clouds ( $C_H$ ) form at heights  $> 6$  km**
- **Middle-level clouds ( $C_M$ ): cloud base between 2 and 6 km**
- **Low-level clouds ( $C_L$ ): cloud base up to 2 km**

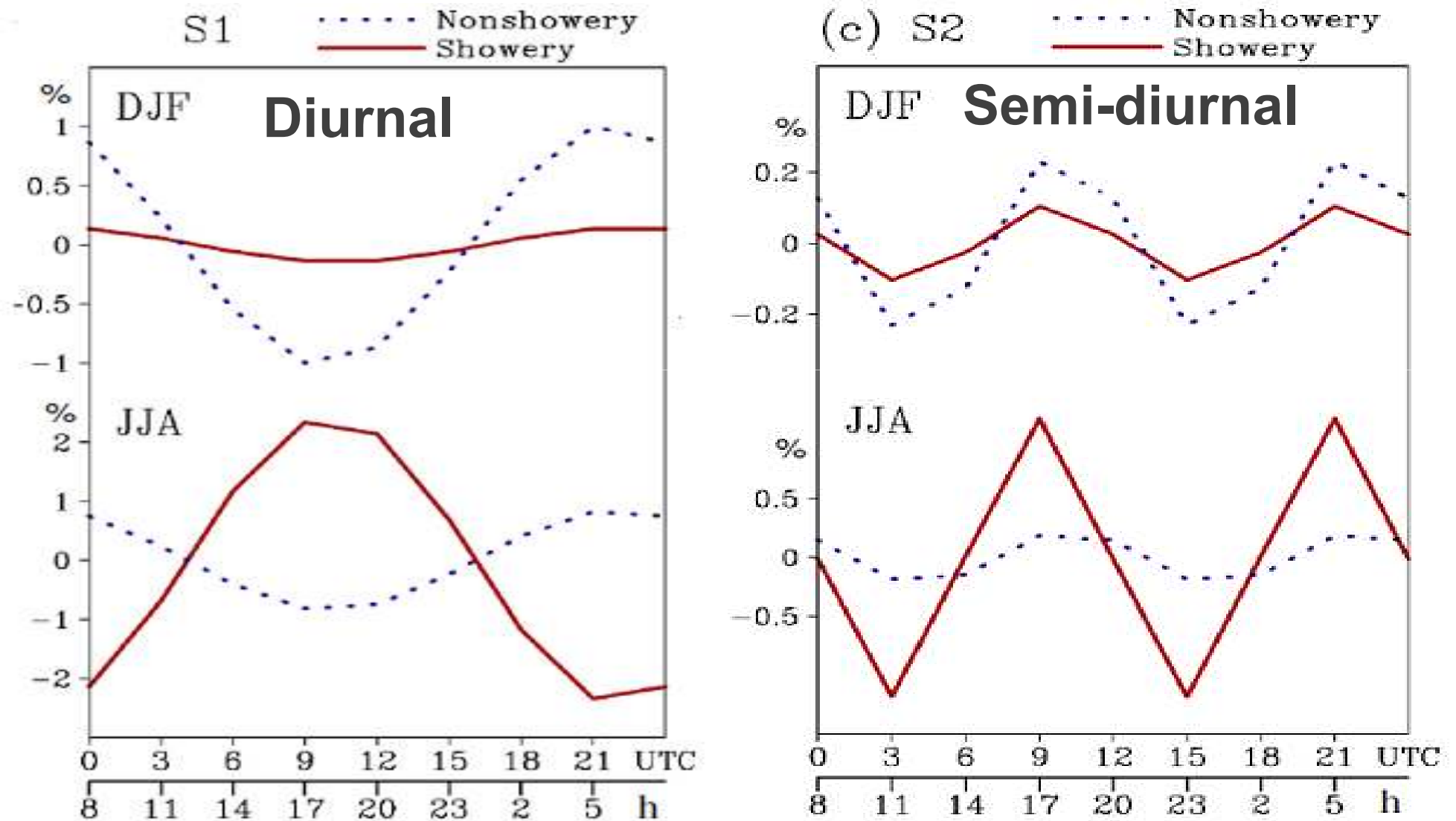
# 3-hourly precipitation in different seasons



# Types of precipitating clouds in different seasons

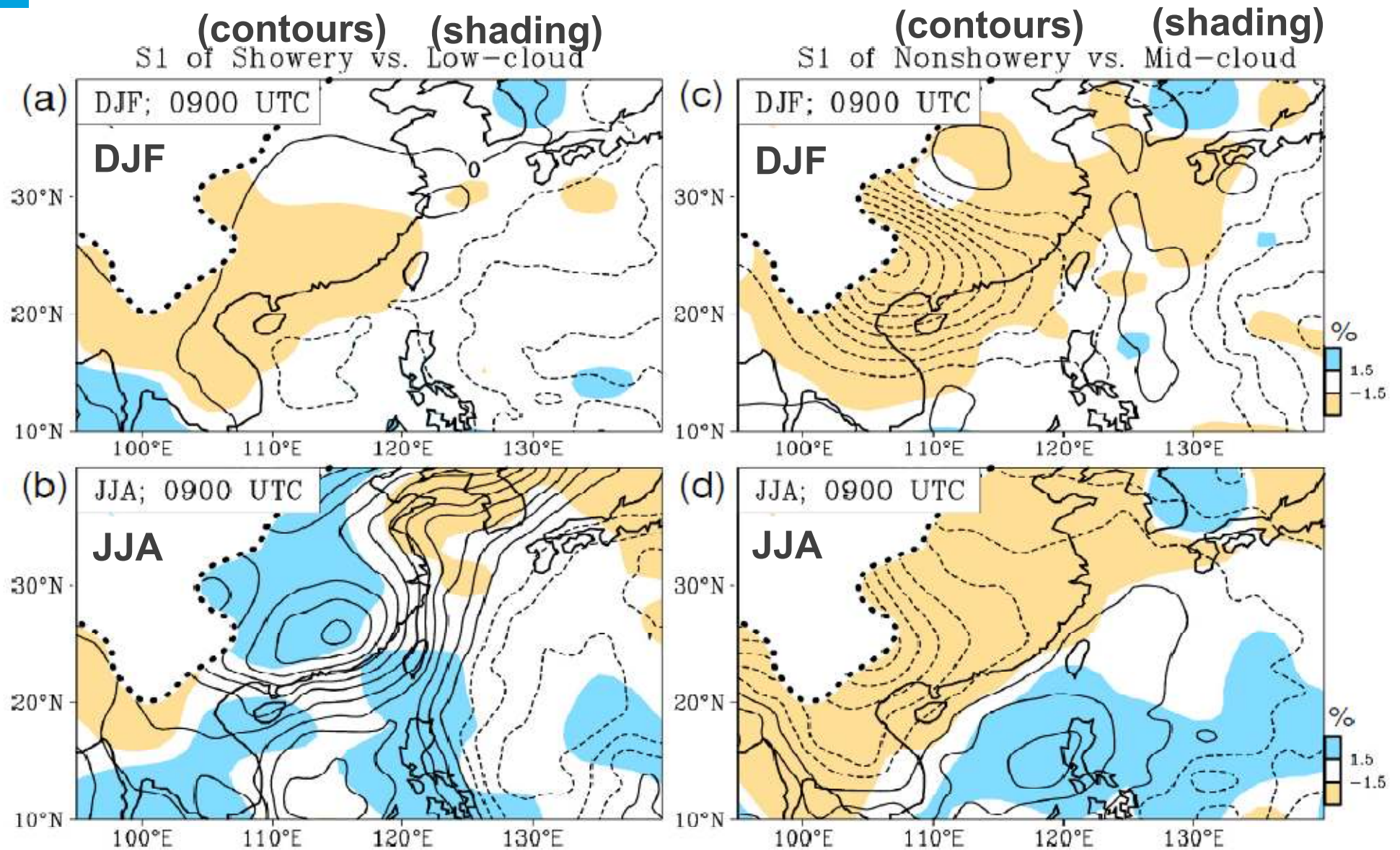


## Temporal variations of precipitating cloud types in different seasons

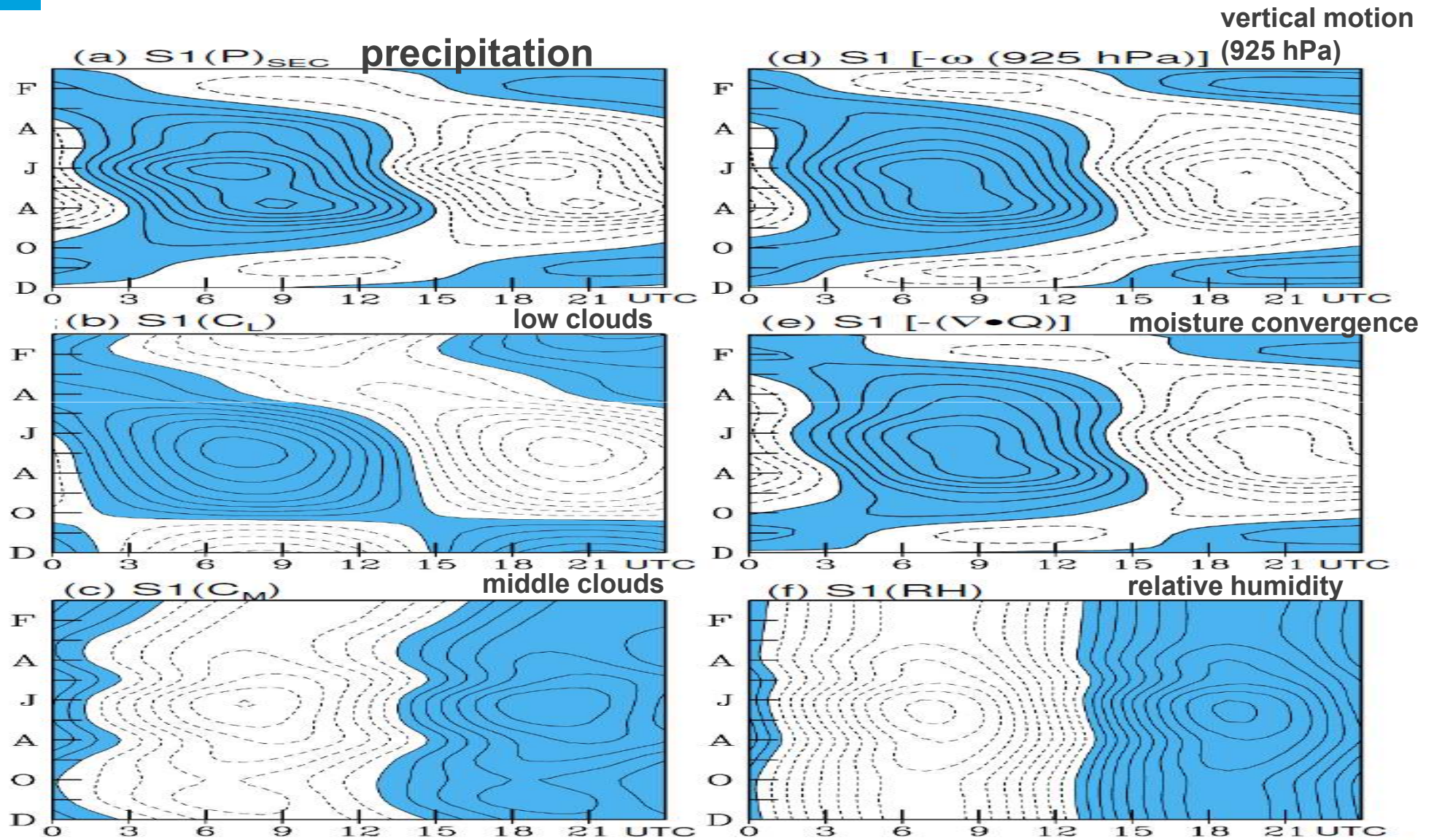




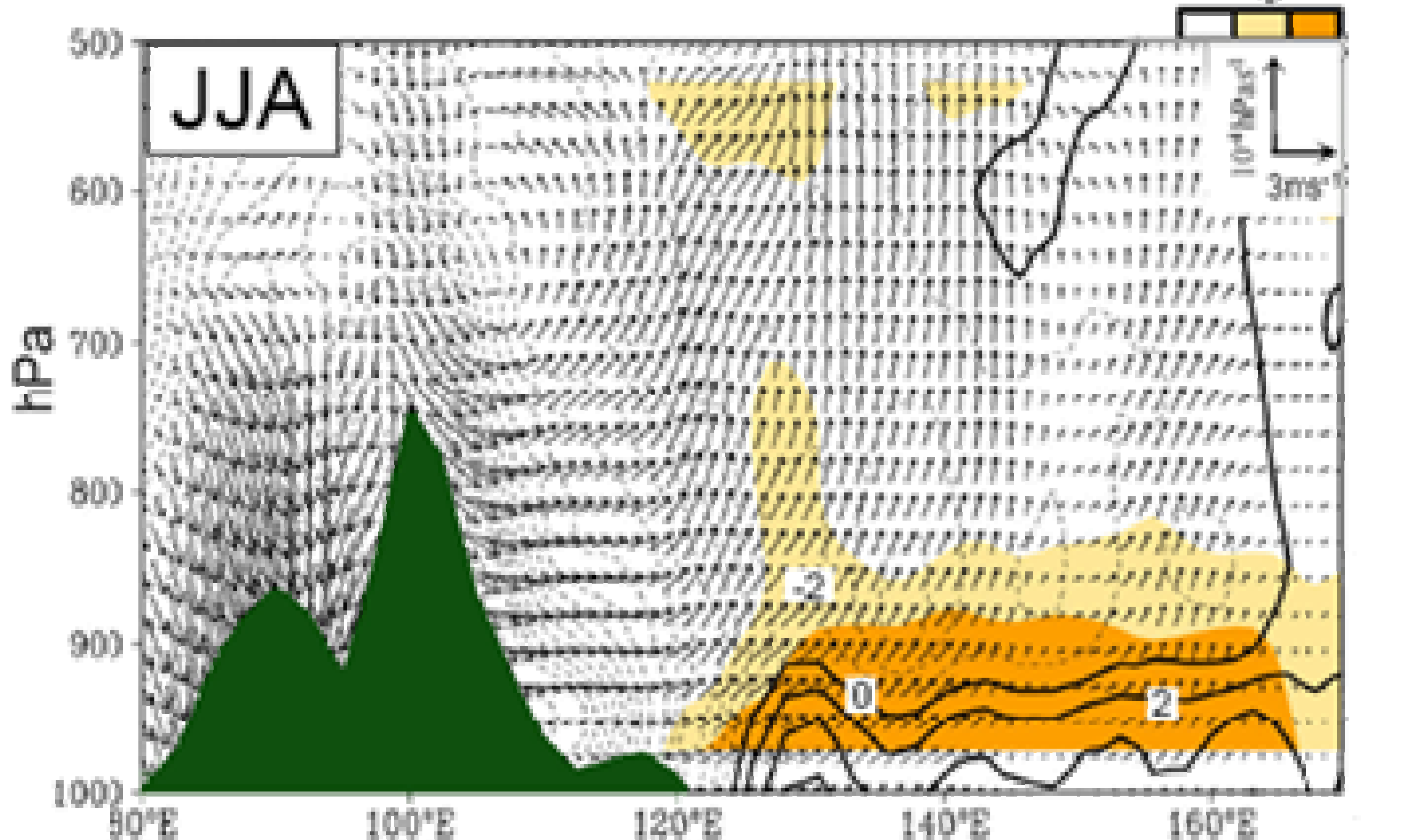
# Diurnal variations of precipitating clouds in different seasons



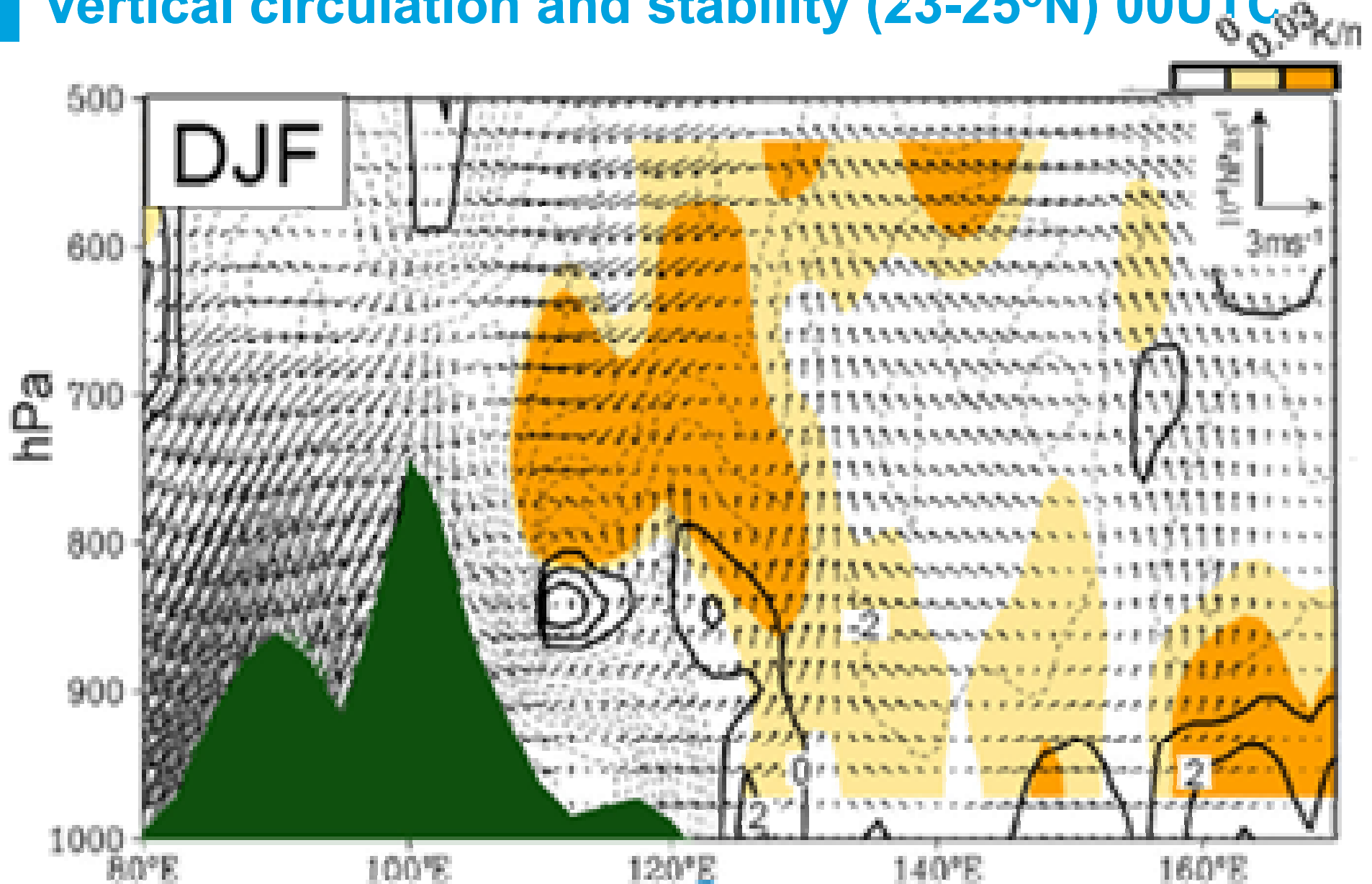
# Diurnal variations



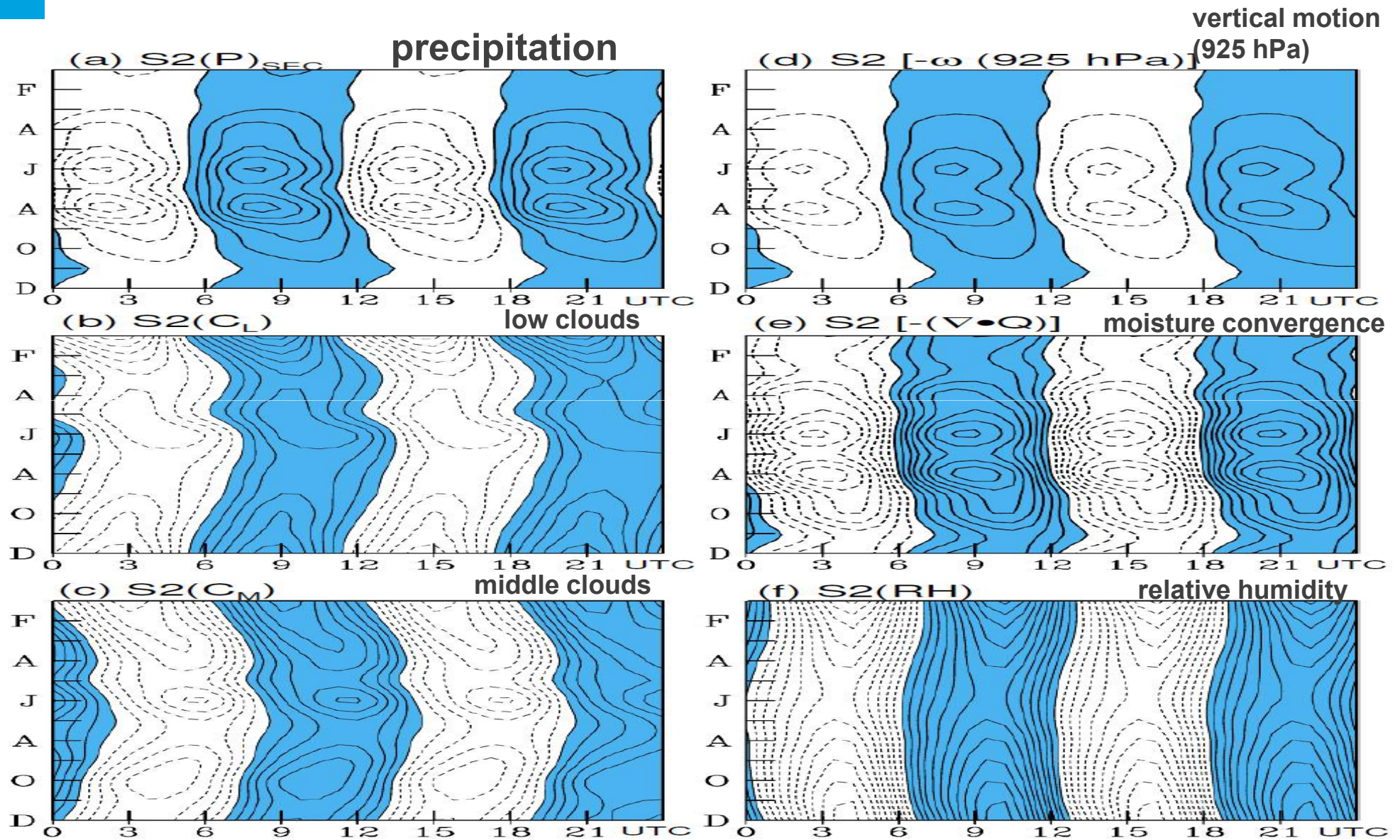
# Vertical circulation and stability (23-25°N) 00UTC



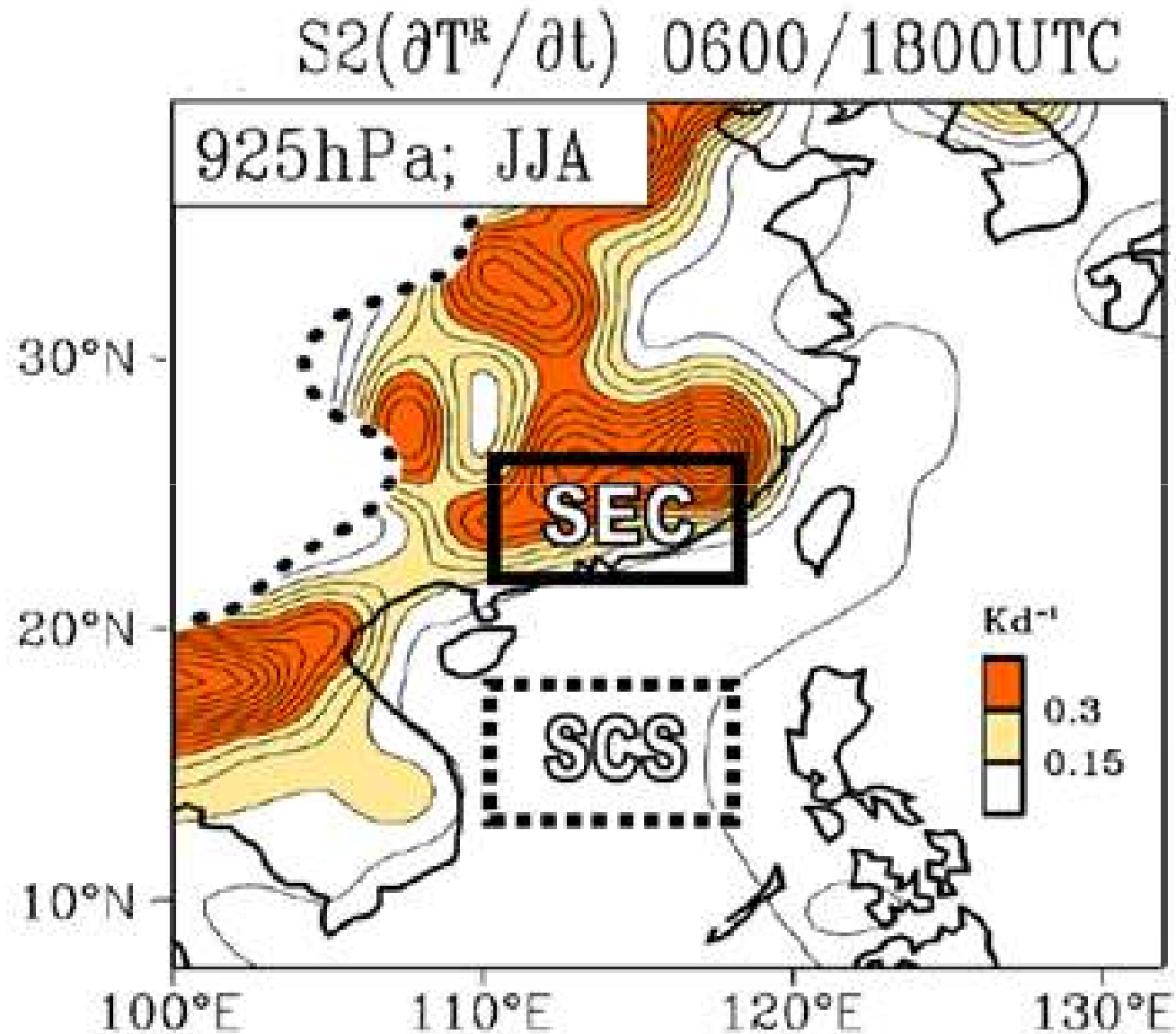
# Vertical circulation and stability (23-25°N) 00UTC



# Semi-diurnal variations

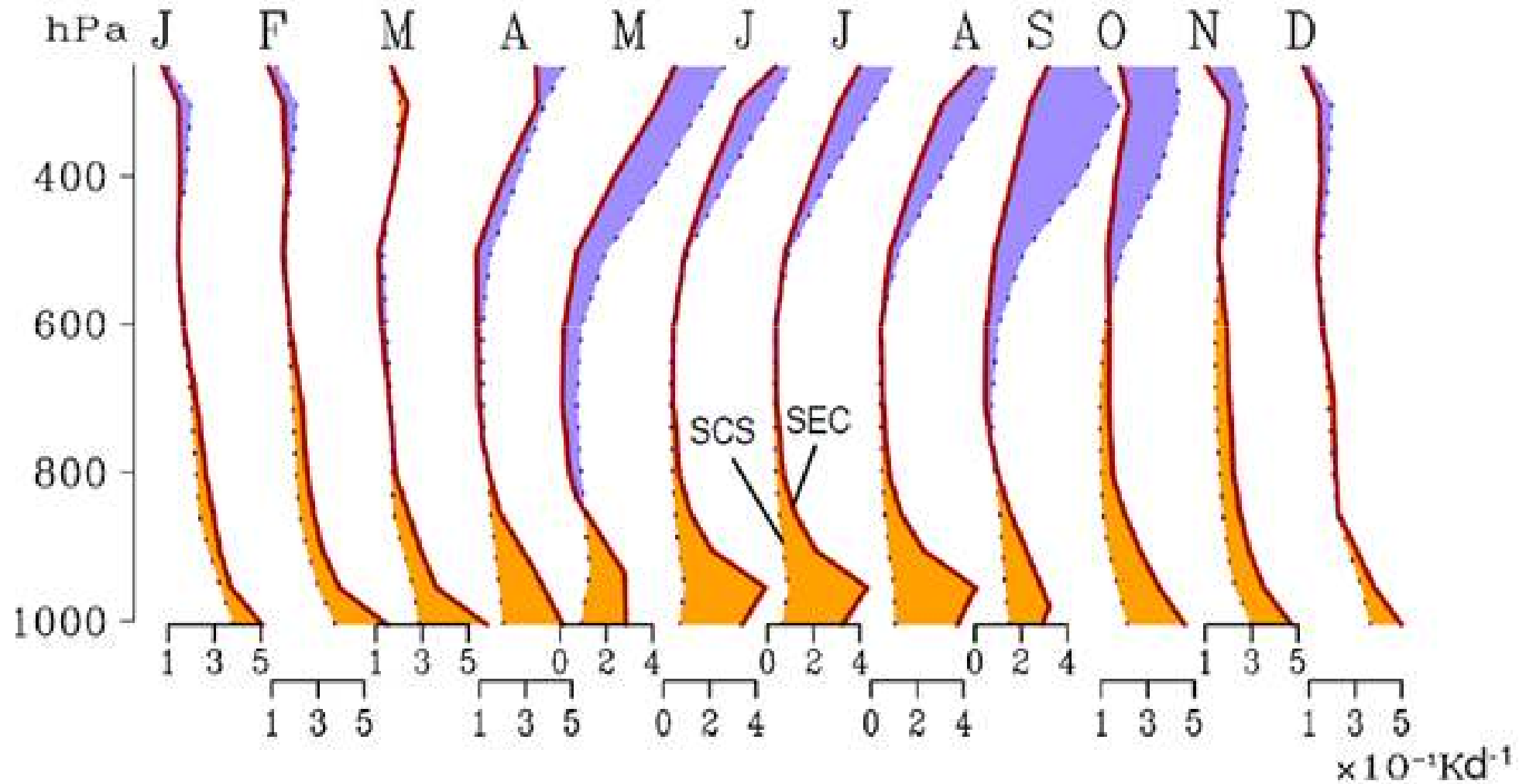


# Semi-diurnal variations of vertical variations of temperature



# Semi-diurnal variations of vertical variations of temperature

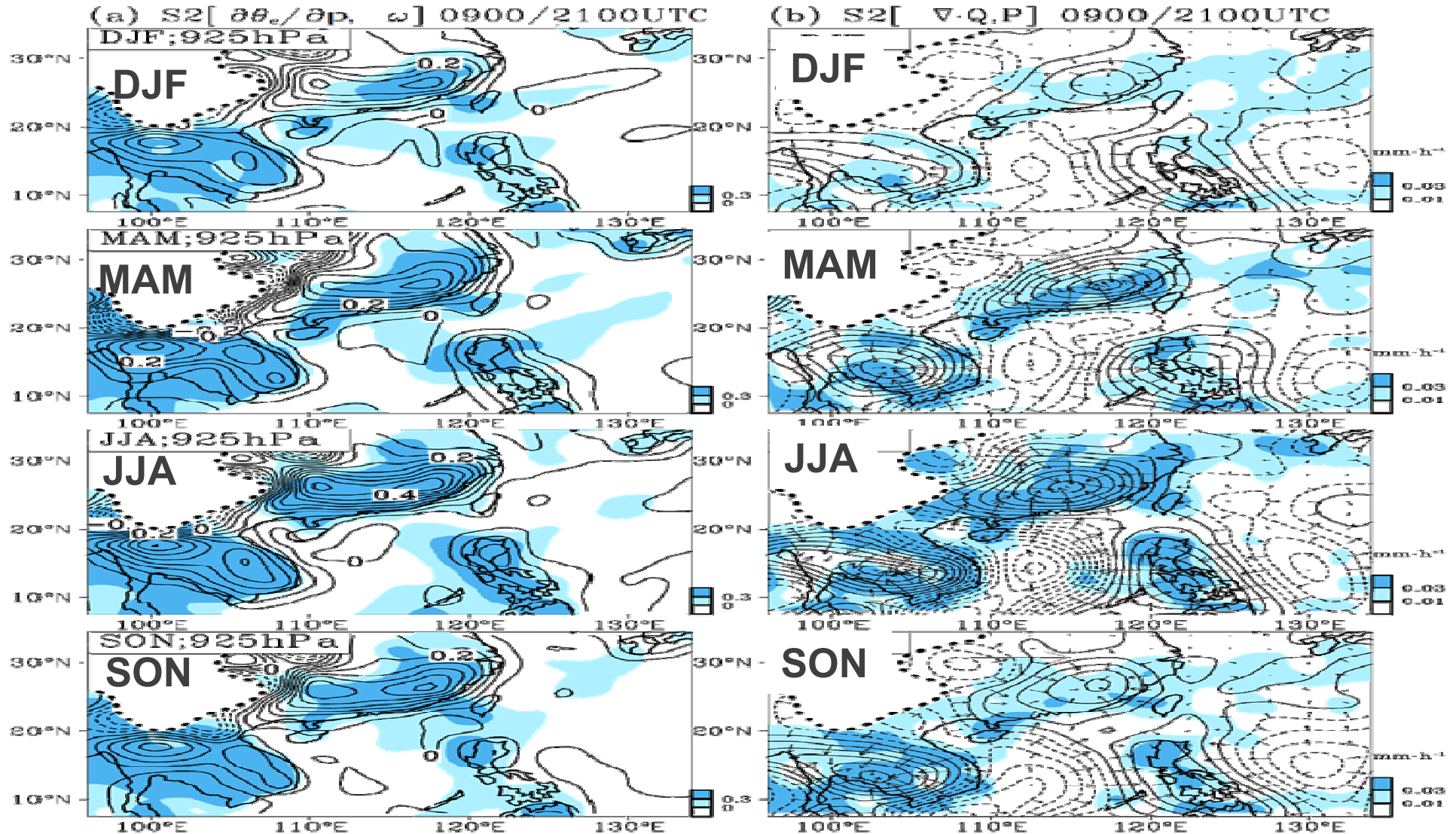
$S2(\partial T^R / \partial t)$  SEC vs. SCS; 0600/1800 UTC



# Semi-diurnal variations

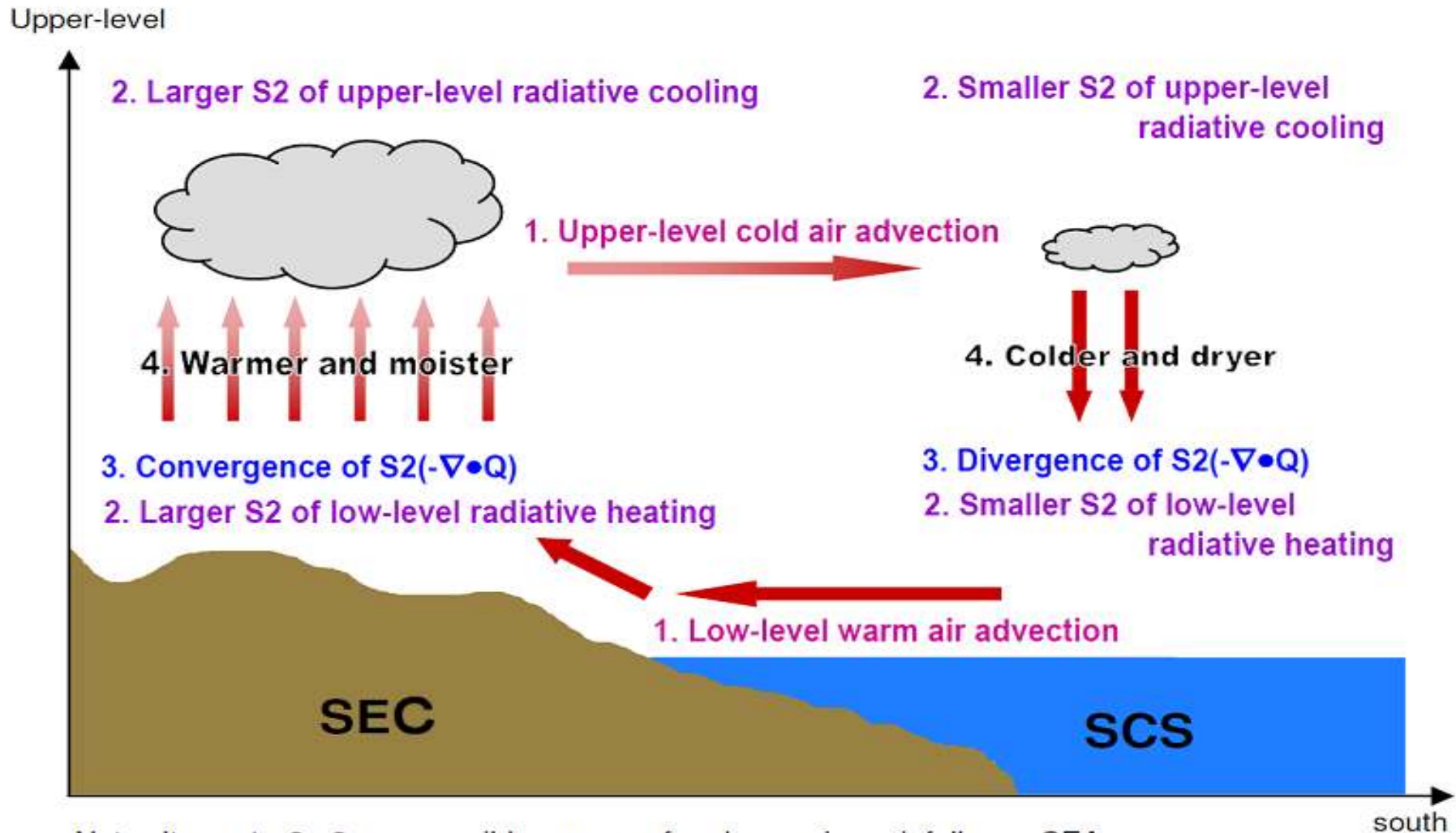
vertical stability (contours), vertical motion (shading)

moisture convergence (contours),  
precipitation (shading)





# Mechanism for early morning maximum in rainfall in SEC



Note: Items 1., 2., 3. are possible causes of early morning rainfall over SEA  
 Item 4. is a feature related to items 1-3

## ■ Summary

- **Showery precipitation is the major contributor to diurnal variation of rainfall in the summer, spring and autumn in SEC.**
- **Non-showery precipitation contributes in the winter.**
- **Formation mechanism: diurnal variation of moist convection process and relative humidity.**

## Summary

- **Semi-diurnal precipitation is approximately in phase for all seasons because both the semi-diurnal moist convection and the relative humidity have similar temporal evolution in all seasons.**
- **Semidiurnal variation of land-sea differential heating between SEC and SCS tends to produce a relative unstable environment in SEC at 0900/2100 UTC, which induces more water vapor flux transporting from SCS into SEC to support the occurrence of semi-diurnal maximum.**