

Primary factors of extreme summer conditions in East Asia in 2013

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Surface Temperature Anomalies (Summer 2013)

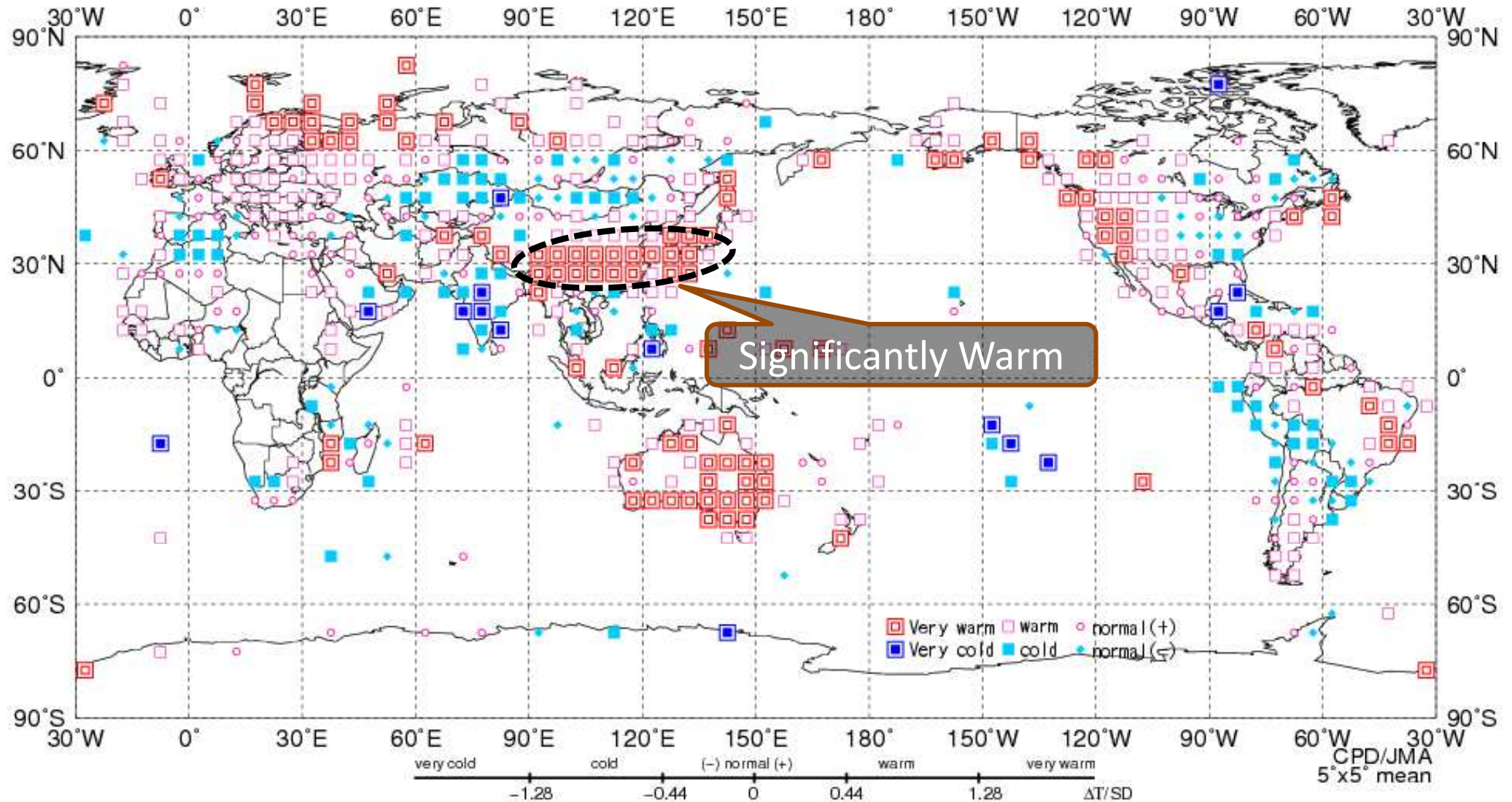


Fig.1 Three-month mean temperature anomalies for summer (JJA) 2013

Categories are defined by the seasonal mean temperature anomaly against the normal divided by its standard deviation and averaged in 5°x5° grid boxes. The thresholds of each category are -1.28, -0.44, 0, +0.44, +1.28.

Precipitation Ratio (Summer 2013)

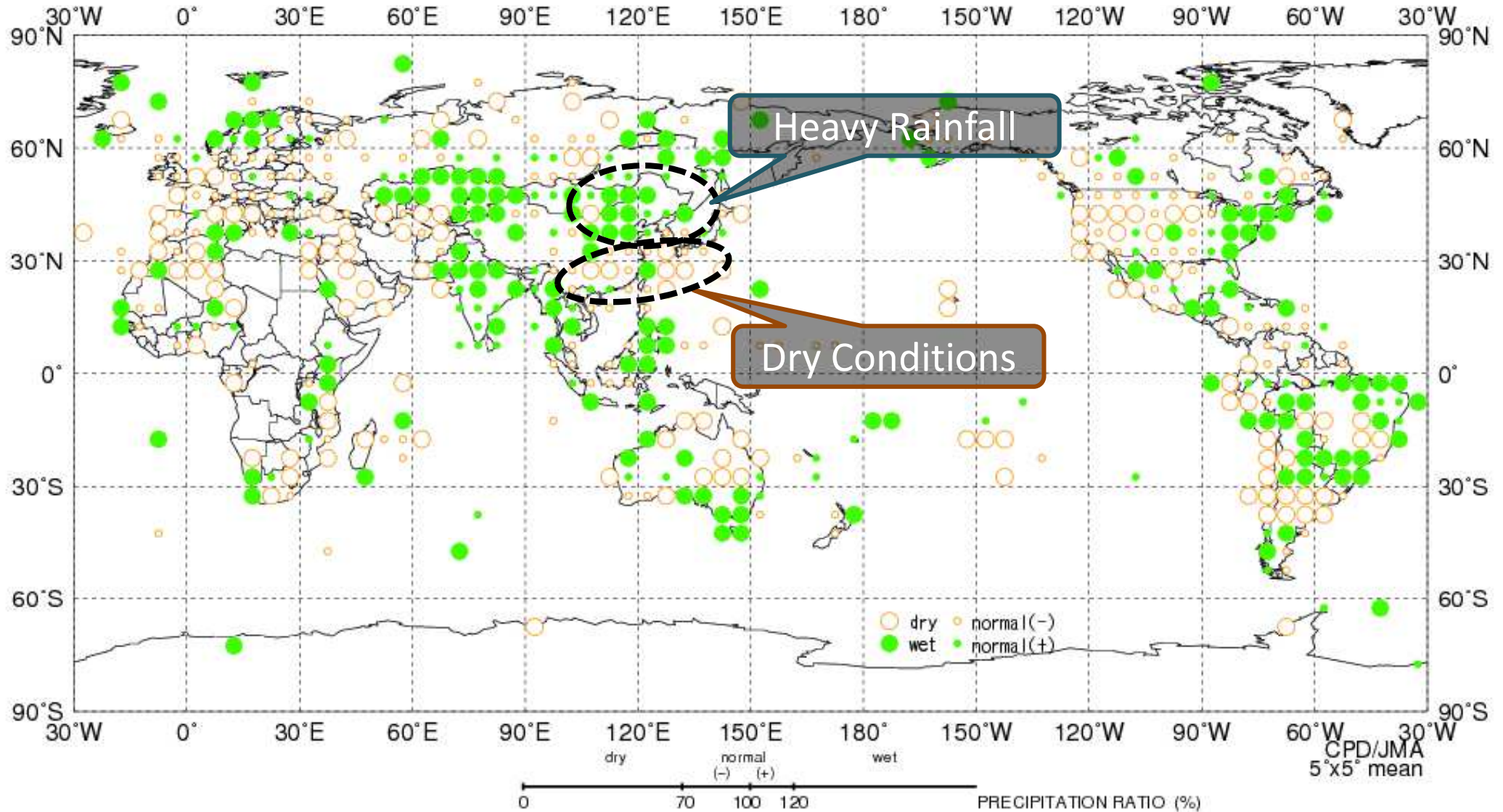


Fig.2 Three-month mean total precipitation amount ratios for summer (JJA) 2013
Categories are defined by the seasonal mean precipitation ratio to the normal averaged in 5°x5° grid boxes. The thresholds of each category are 70%, 100% and 120%.

Characteristic Atmospheric Circulation (July – August 2013)

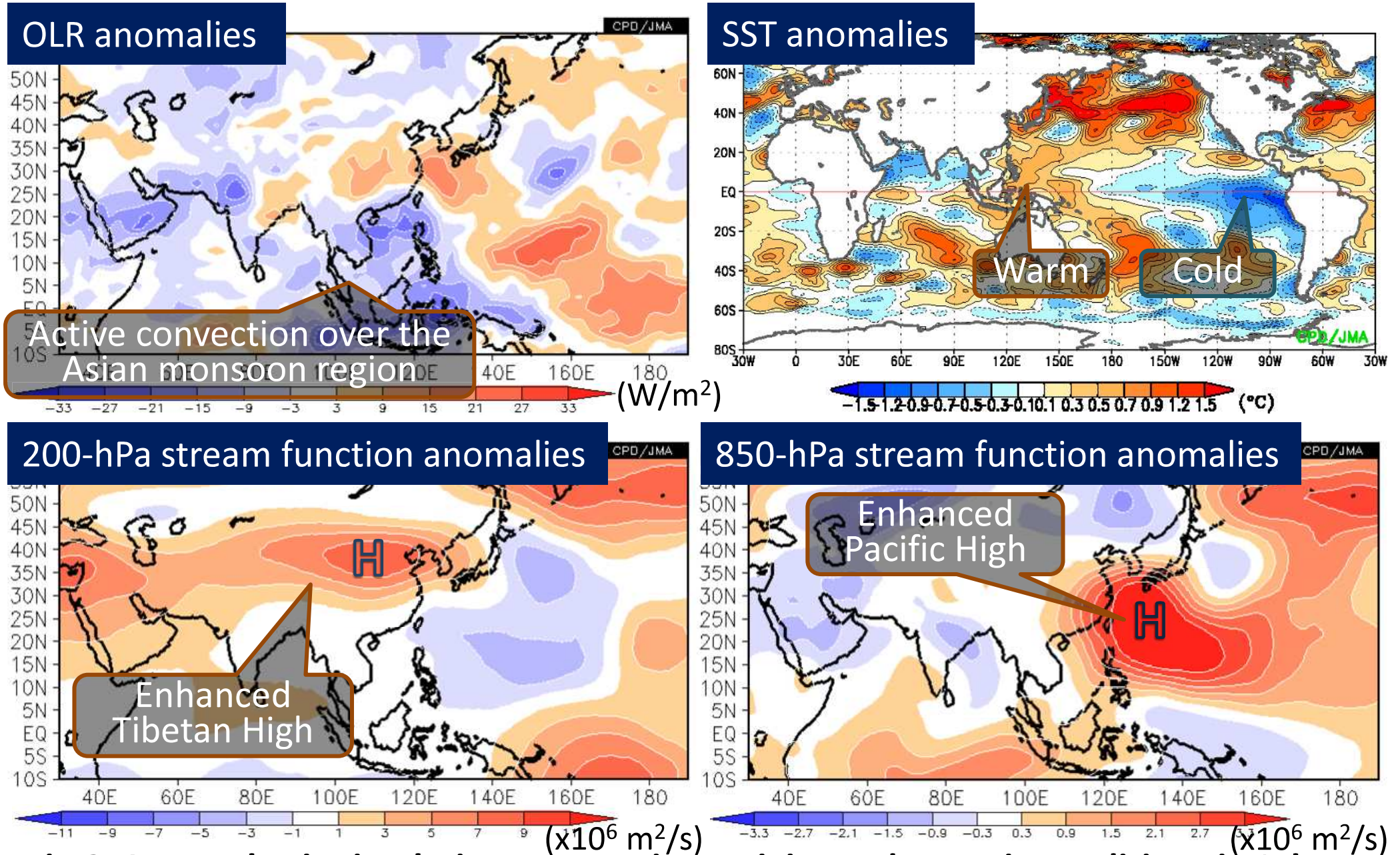


Fig.3 Atmospheric circulation, convective activity and oceanic conditions in July – August 2013

† Data used for this investigation is JRA-55, OLR (provided by NOAA) and COBE-SST.

Enhancement of Pacific High (July – August 2013)

200-hPa velocity potential and divergent wind anomalies

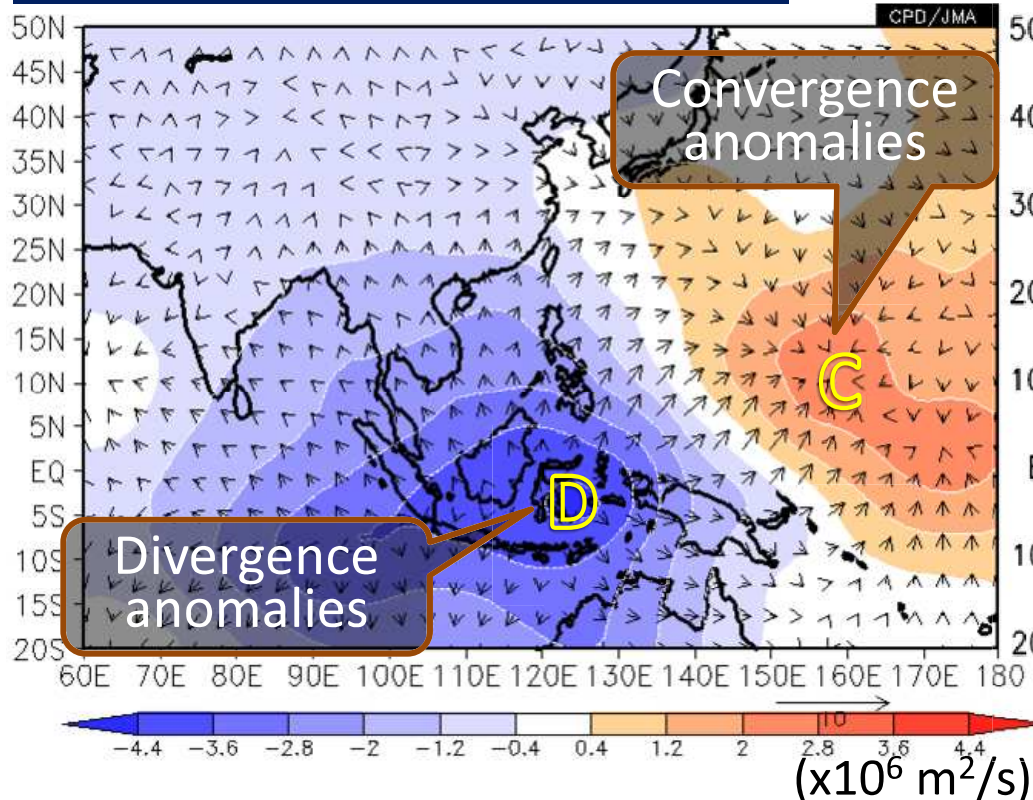


Fig.4 Two-month mean 200-hPa velocity potential and divergent wind anomalies for July – August 2013

850-hPa vorticity tendency anomalies (vortex stretching/squashing effect)

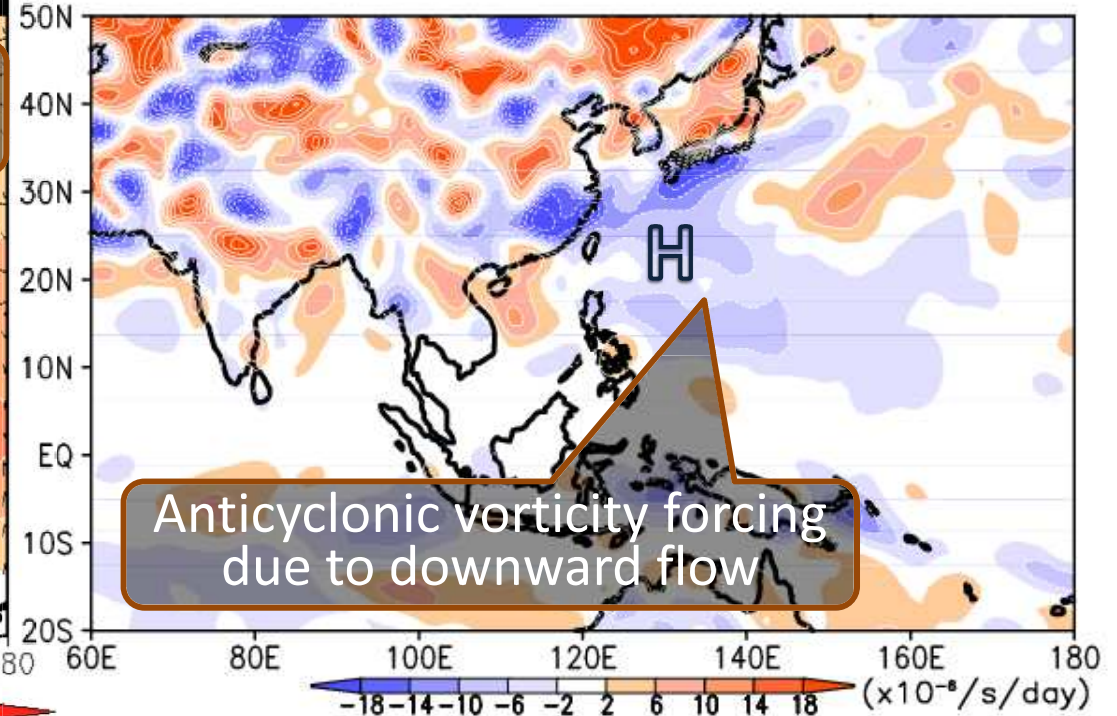


Fig.5 Two-month mean 850-hPa vorticity tendency anomalies from the stretching/squashing effect for July – August 2013

- In the lower troposphere, vortex squashing effect (downward flow) contributed to the negative vorticity anomalies to the south of Japan.
- Downward flow originated from active convection area of the Asian summer monsoon region.

Pacific High and Moist Air Advection (July – August 2013)

925-hPa water vapor flux and SLP

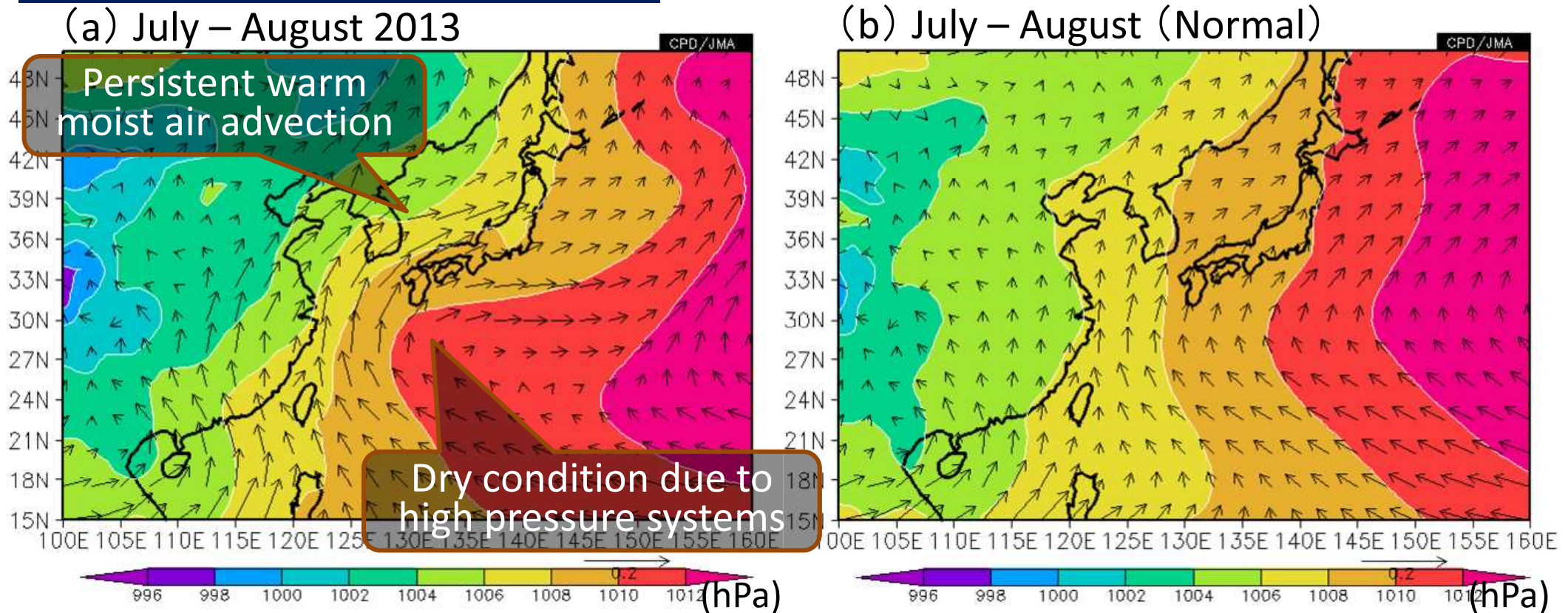


Fig.6 Two-month mean sea level pressure and 925-hPa wave vapor flux for July – August

† Shading: SLP

Vector: 925-hPa water vapor flux

○ The prevailing of high-pressure systems contributed to severe heat dry conditions.

○ Enhanced warm moist air continued to flow over northeastern China and the Sea of Japan side areas of Japan, contributing to heavy rain.

Unstable Atmospheric Conditions

500-hPa height

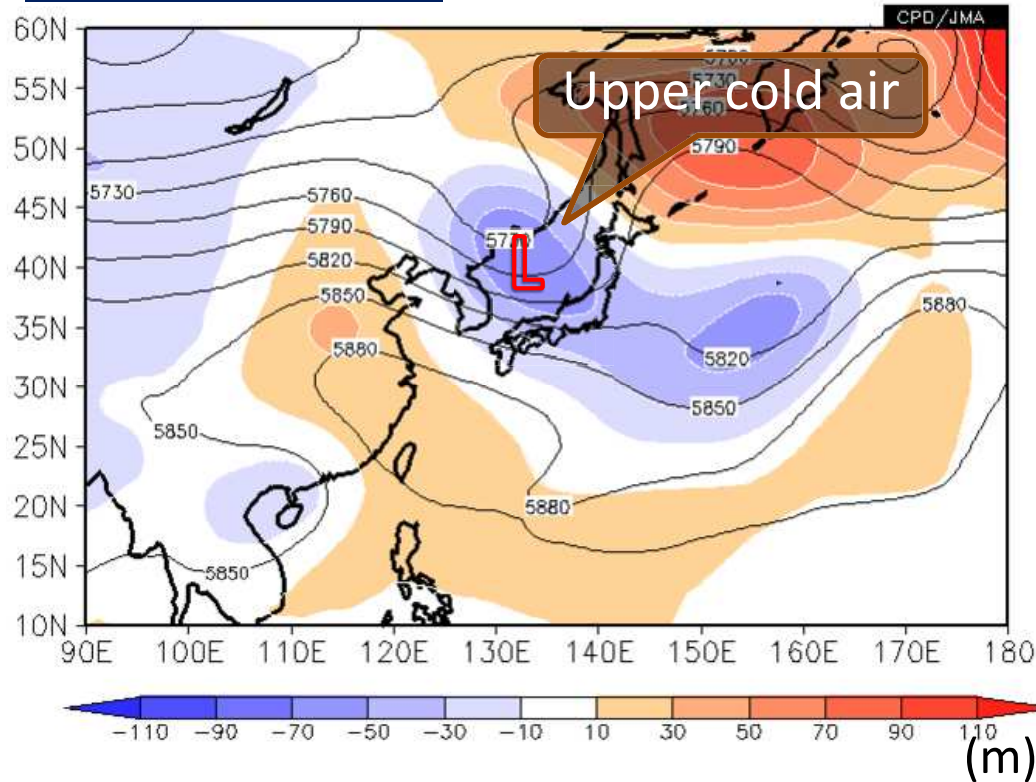


Fig.8 5-day mean 200-hPa zonal wind for 24 – 28 July 2013

† Contour: 24-28 July 2013 average
Shading: anomalies

200-hPa zonal wind

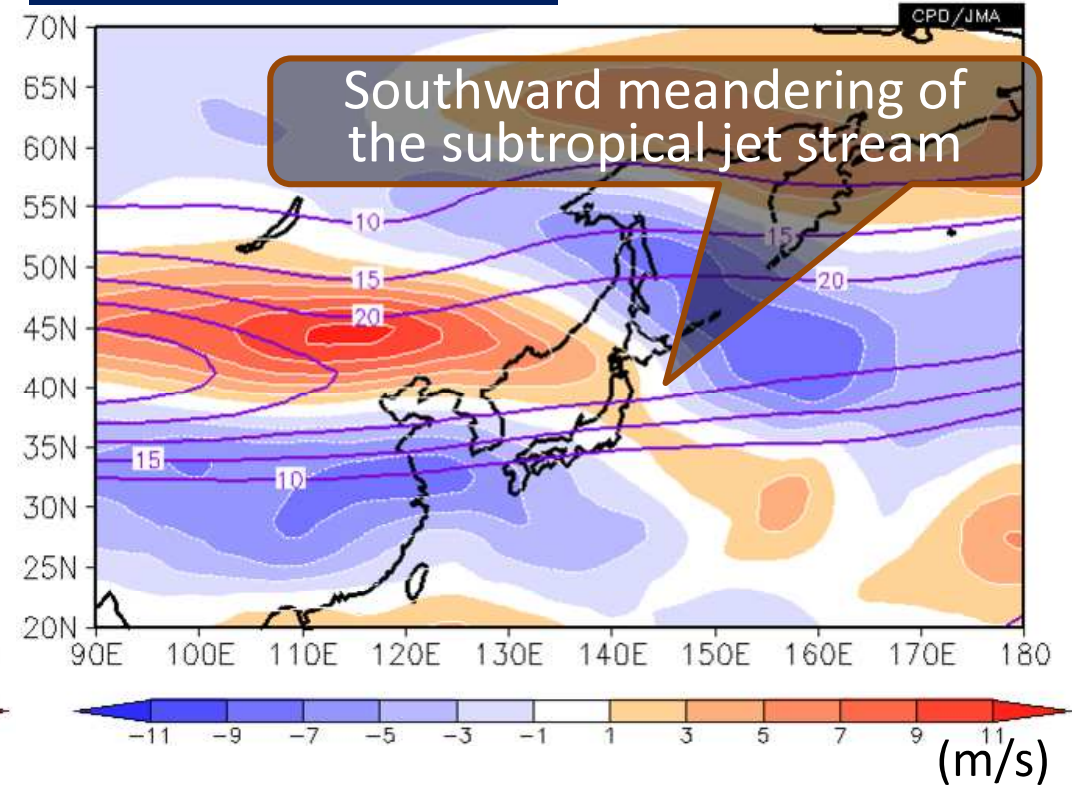


Fig.9 Two-month mean 200-hPa zonal wind for July – August 2013

† Shading: anomalies
Purple line: normal

○ Upper cold air occasionally flowed over northeastern China and Japan in association with the southward meandering of the subtropical jet stream, contributing to heavy rain brought by unstable atmospheric conditions.

Primary Factors of Extreme Boreal Summer Conditions

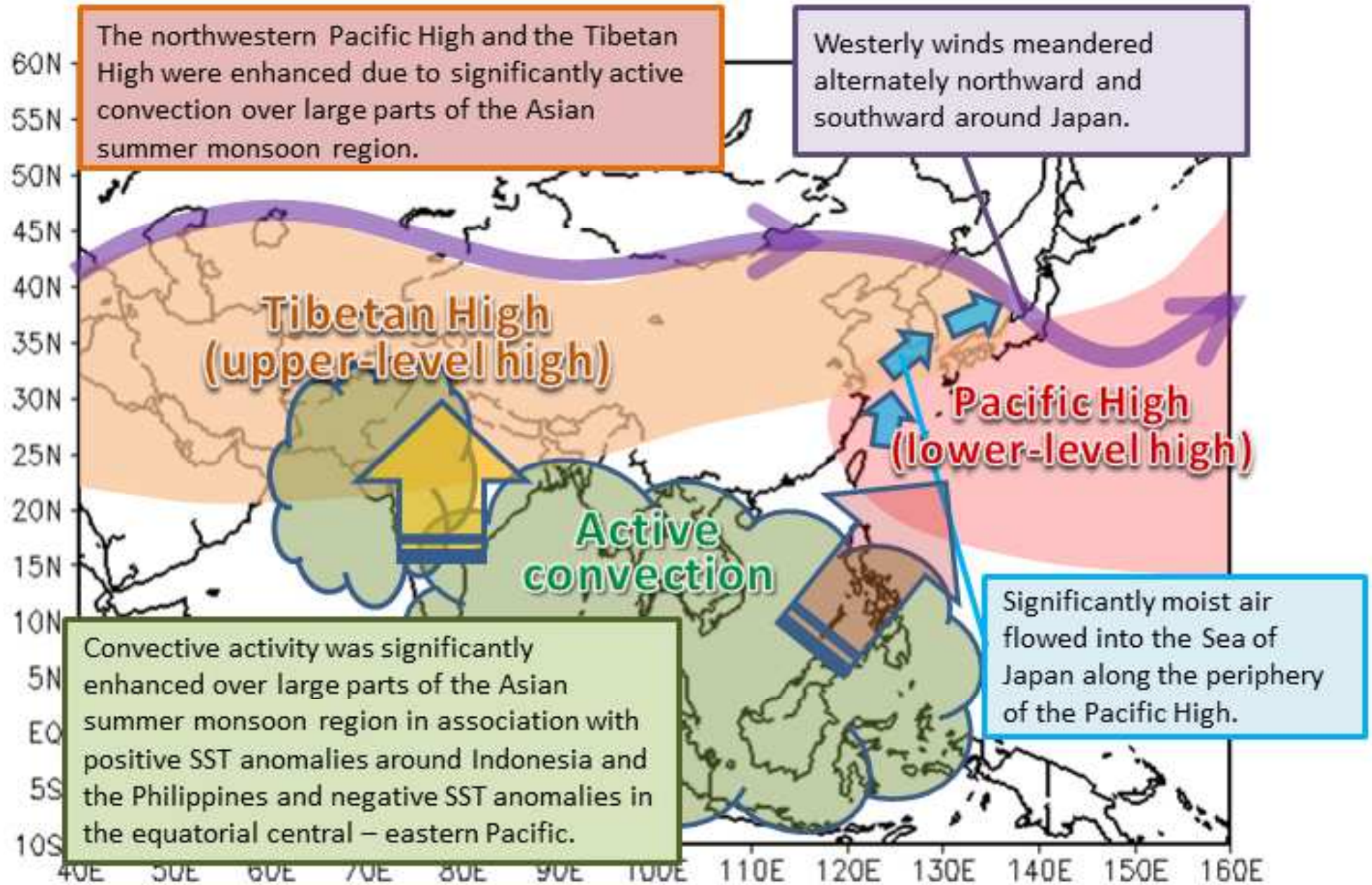


Fig.10 Primary factors contributing to the extreme summer conditions observed in July and August 2013