On the mesoscale vortices that induced heavy rainfall events in China

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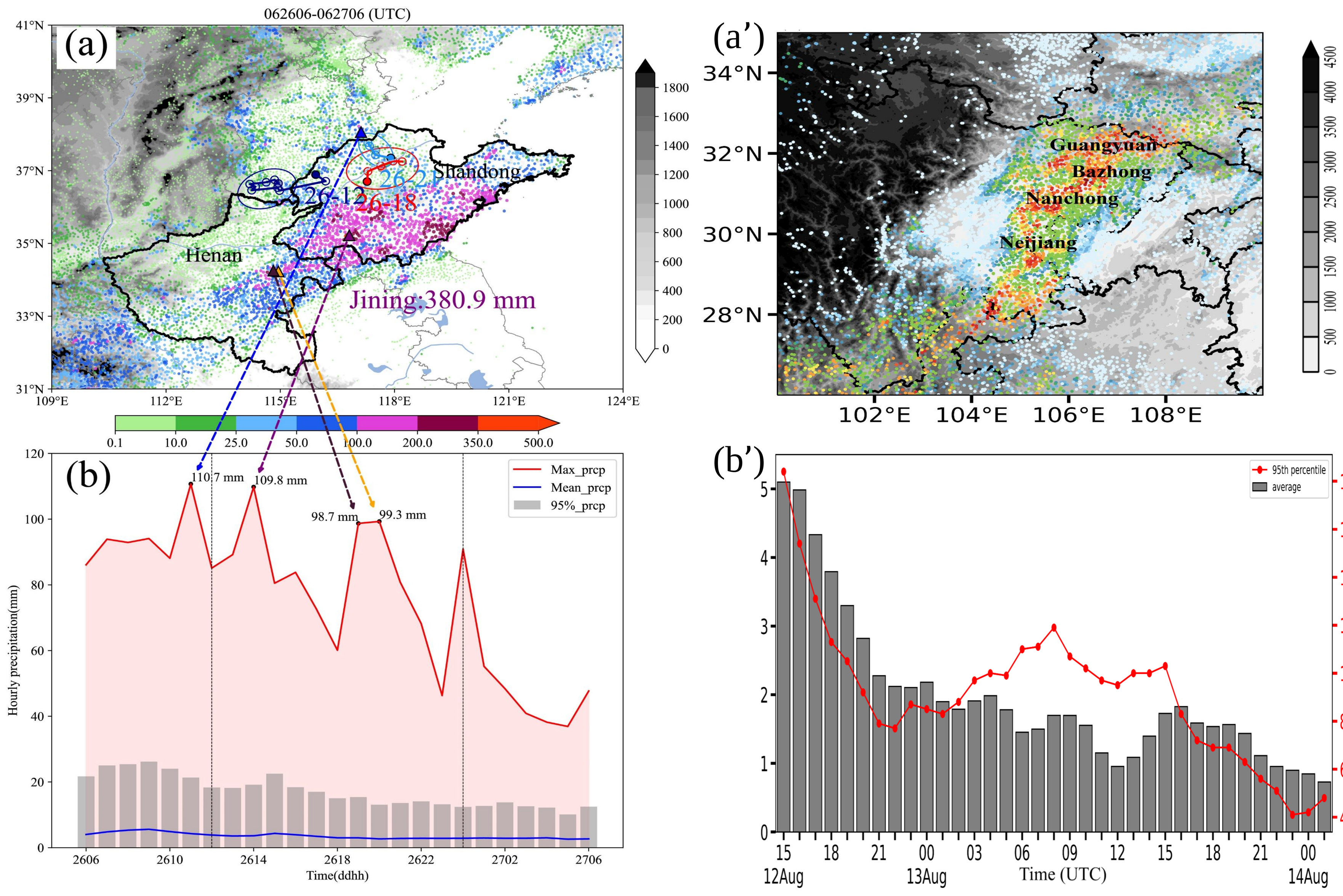
1 Rainfall features with different vortices



Case 1: During 26–27 June 2022, influenced by **three mesoscale vortices**, **Central and East China** (particularly for Henan and Shandong) experienced the first widespread torrential rainfall event of the 2022 flood season (maximum 24-h accumulated precipitation was ~380.9 mm), which resulted in severe social impacts. (Left column)

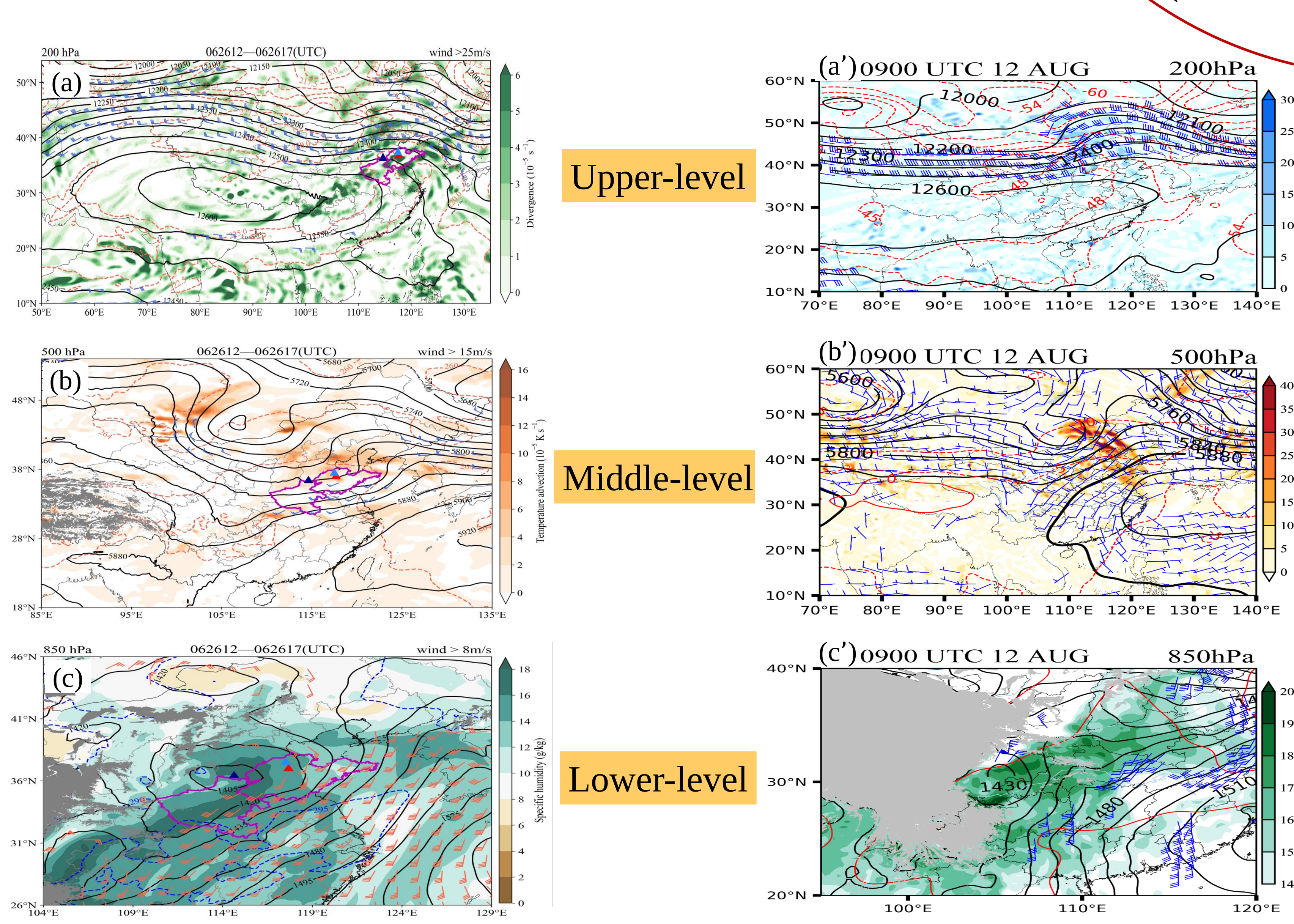
Case 2: During 12–14 August 2020, influenced by **sixteen southwest mesoscale vortices**, the **Sichuan basin** experienced a torrential rainfall event. Maximum accumulated precipitation was ~259.3 mm), which resulted in severe social impacts. (Right column)

2.1 Background environment

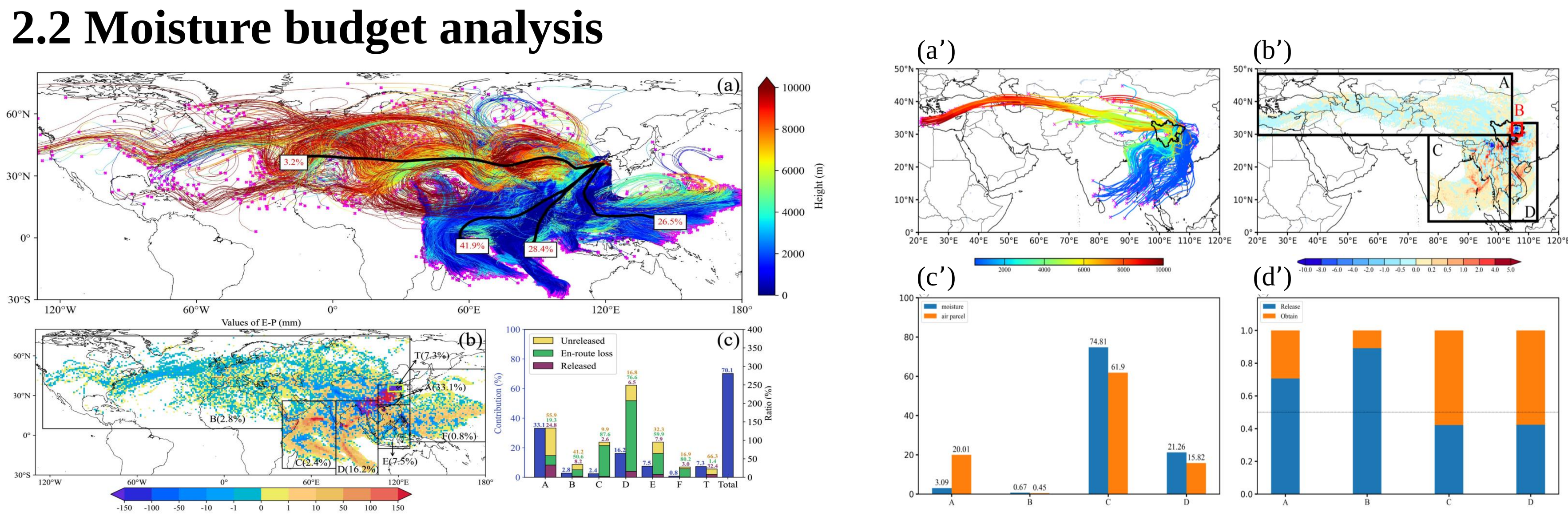
Strong upper-level divergence with South Asian high

Intense middle-level warm advection with trough

Powerful lower-level convergence due to a low-level jet



2.2 Moisture budget analysis



Trajectories for the targeted air particles from 1200 UTC 11 to 0000 UTC 27 June, 2022

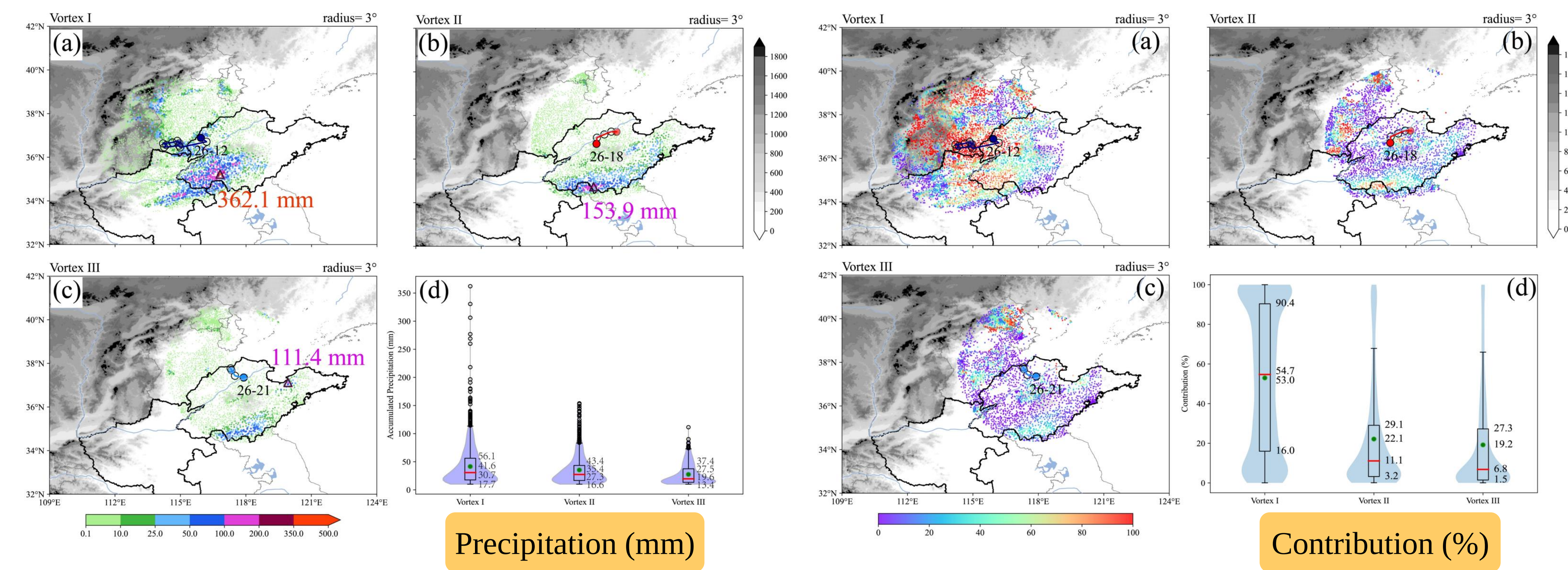
Trajectories for the targeted air particles from 1500 UTC 7 to 0100 UTC 14 August, 2020

Heavy Rainfall Events · Mesoscale Vortices

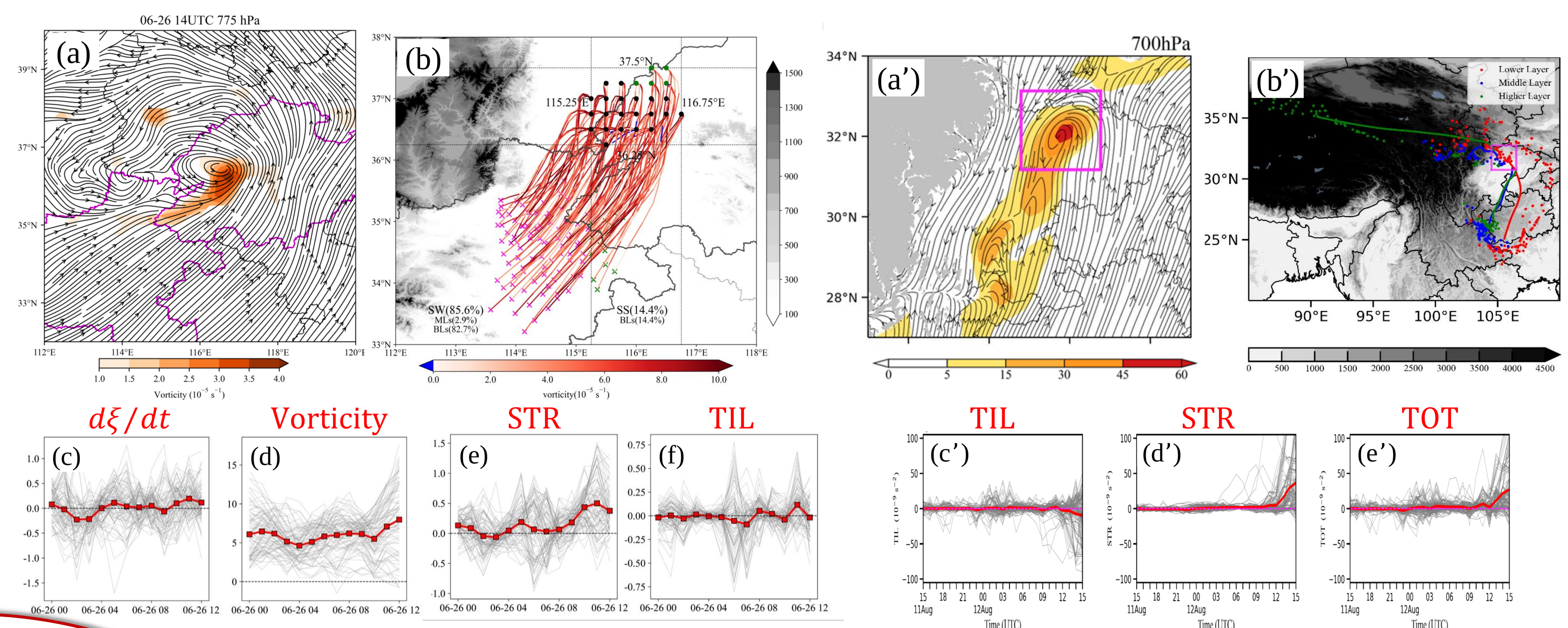
Key Points

- The mesoscale vortices show a high occurrence frequency in China
- Heavy rainfall is largely related to mesoscale vortices, which have different life spans
- There are significant similarities and differences in the factors that governed the formation and evolution of different vortices

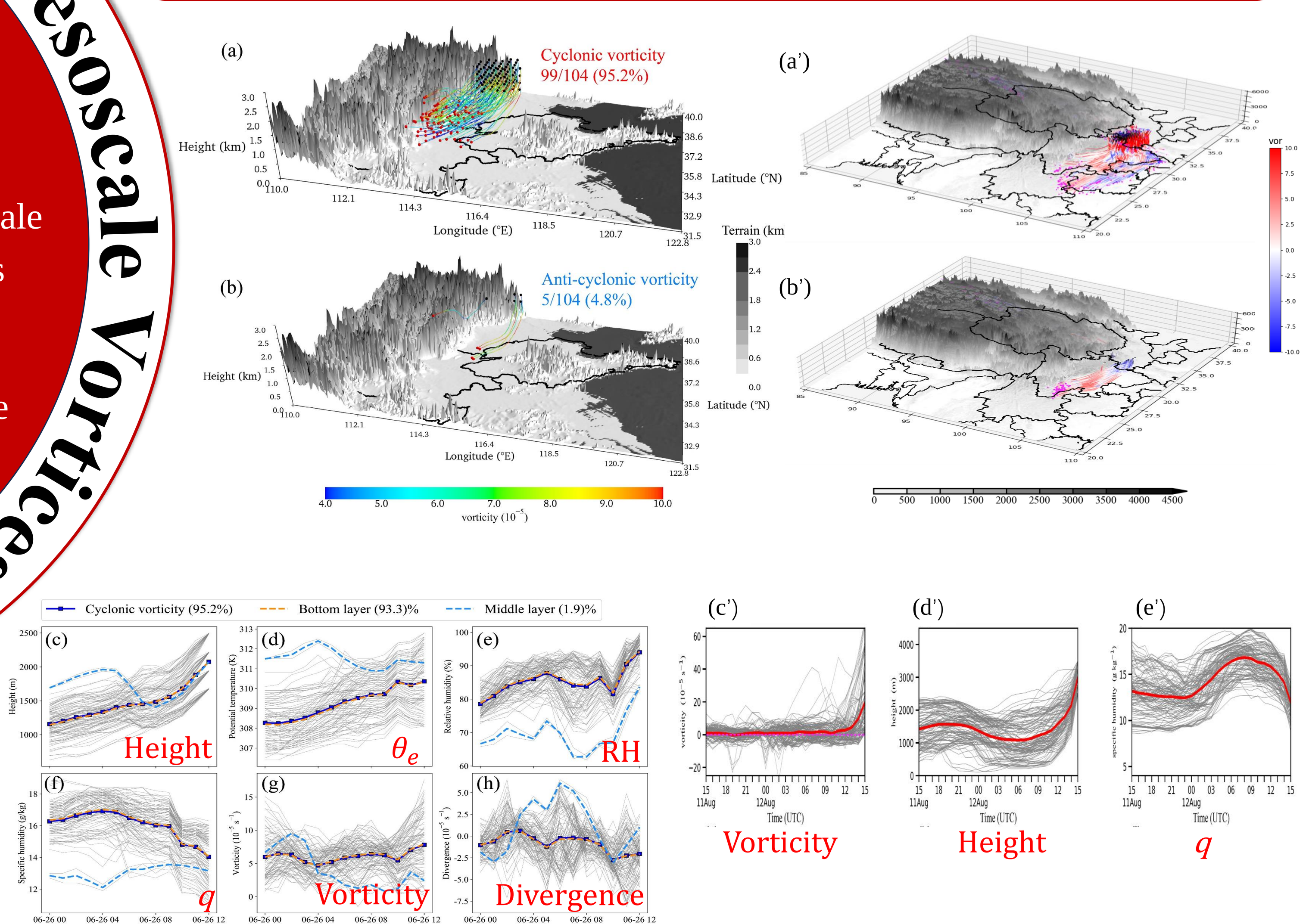
3 Main features of the vortices



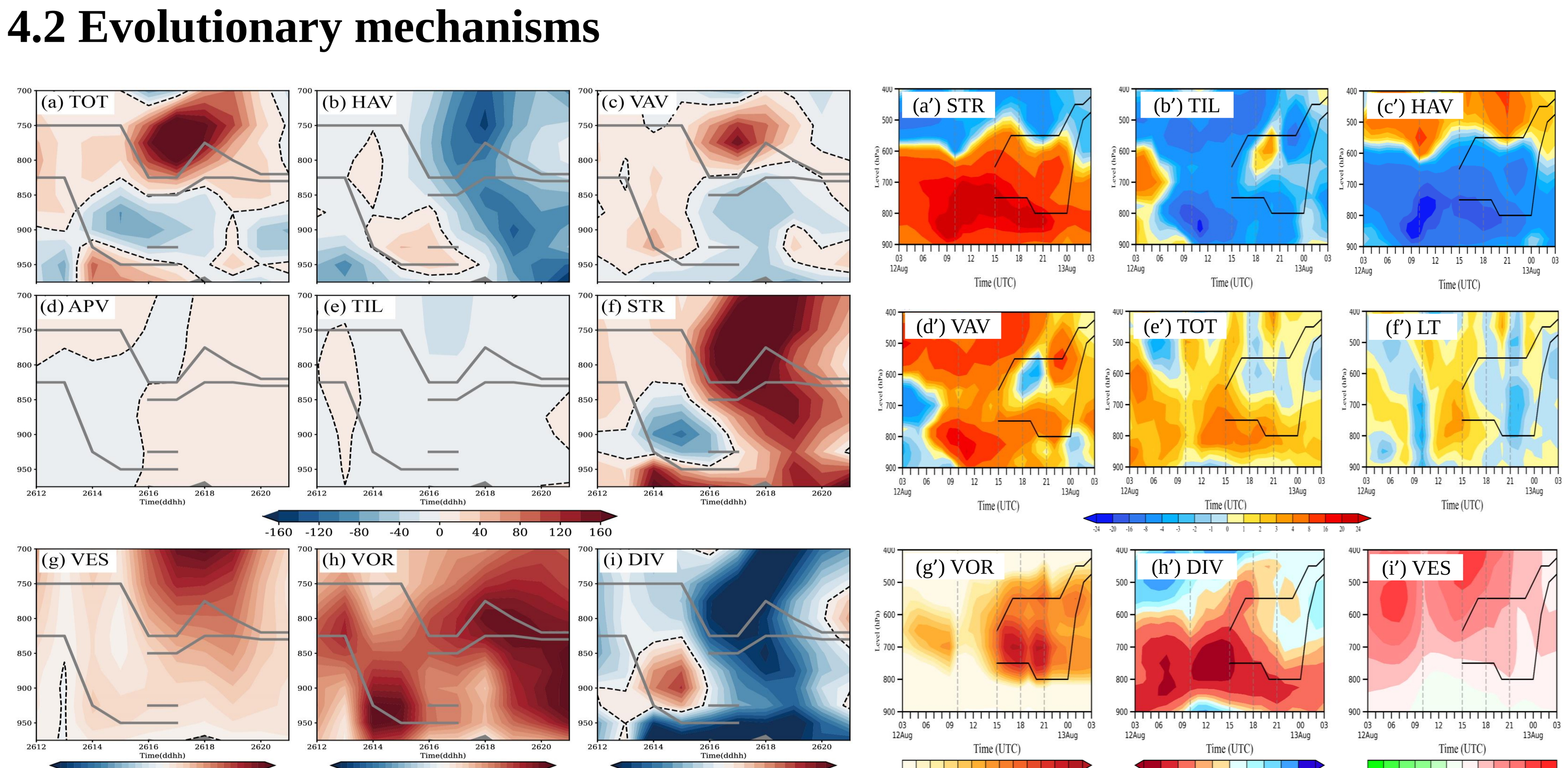
4.1 Formation of the vortex



Backward trajectory analysis is used to show the air particles that played a significant role in the formation of the vortices. These air particles experienced an increase in cyclonic vorticity due to **convergence-related vertical stretching**, leading to the formation of the vortices.



4.2 Evolutionary mechanisms



Throughout its lifespan, **convergence-related vertical stretching** was the most favorable factor for the primary vortex's development, followed by **convection-related vertical transport** of cyclonic vorticity. Horizontal transport had a detrimental effect.

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