

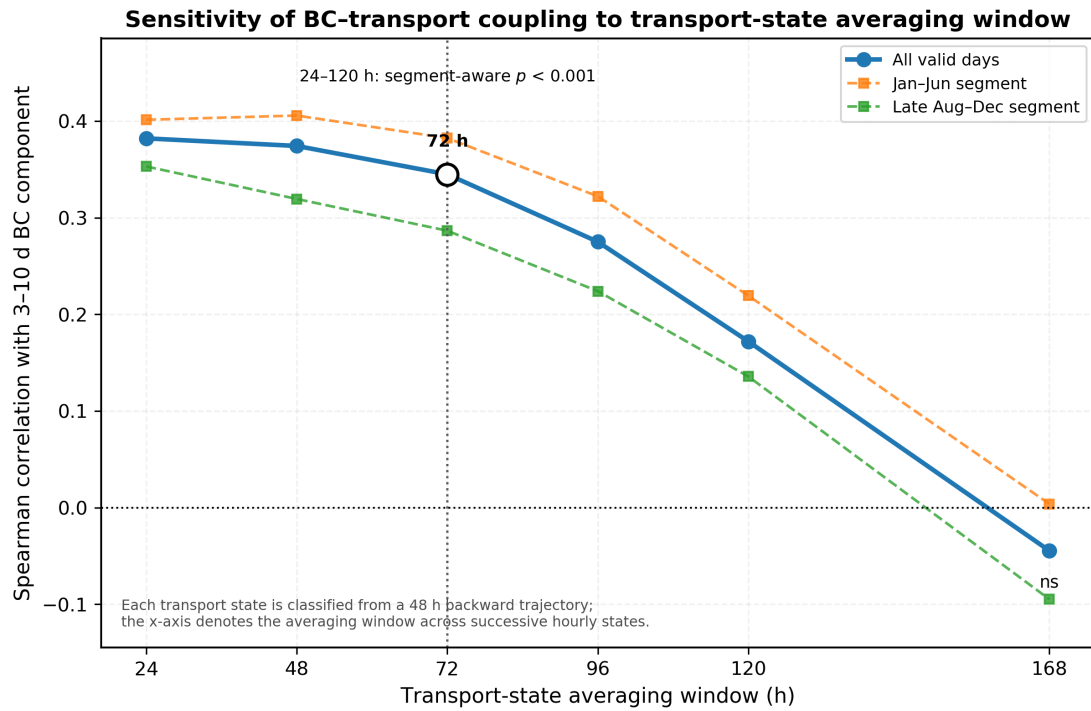


Figure S1. Sensitivity of BC–transport coupling to the transport-state averaging window. Spearman correlations between the independently derived 3–10 d BC component and regional-minus-coastal transport contrast calculated using 24–168 h averaging windows. The thick line represents all valid days, and dashed lines show the two independent continuous BC segments. The 72 h window used in Figure 8 is highlighted. Significance for the combined record was evaluated using the segment-aware circular-shift test. Correlations remained positive and significant from 24 to 120 h and became nonsignificant at 168 h.

To evaluate whether the transport–BC relationship depended on the 72 h averaging window used in the main analysis, the regional-minus-coastal transport contrast was recalculated using windows of 24, 48, 72, 96, 120, and 168 h (Figure S1). The association with the independently derived 3–10 d BC component remained positive and significant for averaging windows from 24 to 120 h, with Spearman ρ decreasing gradually from 0.382 at 24 h to 0.172 at 120 h (segment-aware circular-shift $p < 0.001$ for all windows). The relationship disappeared at 168 h ($\rho = -0.045$, $p > 0.05$). The same progressive weakening was observed independently in both continuous portions of the BC record. These results demonstrate that the transport–BC relationship is not dependent on the specific 72 h window used in Figure 8 and indicate that recent, rather than week-long averaged, transport-state persistence is most strongly associated with multi-day BC variability.

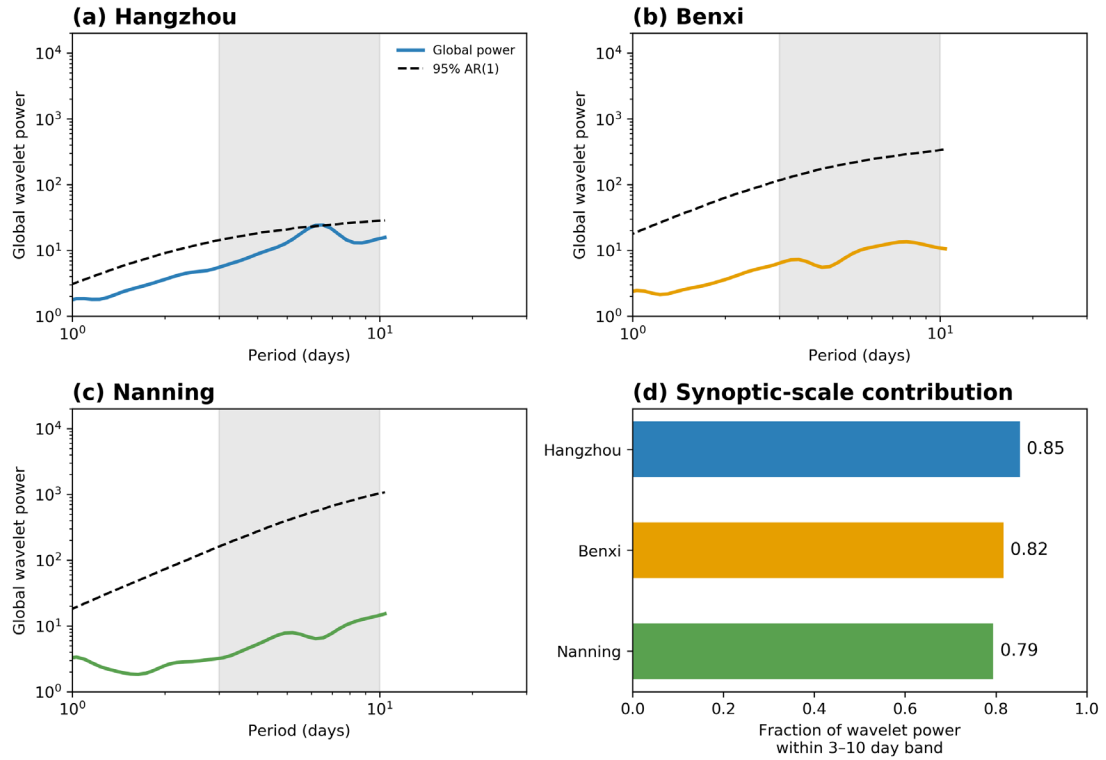


Figure S2. Multi-site comparison of synoptic-scale BC variability. Global wavelet power spectra of BC observations at (a) Hangzhou, (b) Benxi, and (c) Nanning. Solid colored lines represent the global wavelet power spectra, and black dashed lines indicate the corresponding 95% confidence levels estimated from AR(1) Monte Carlo simulations. The shaded regions denote the 3–10 day synoptic timescale band. (d) Relative contribution of the 3–10 day band to sub-10-day wavelet power at the three sites.