

## Supporting Information for

### **A trans-hemispheric relay of extratropical forcing governs ENSO evolution**

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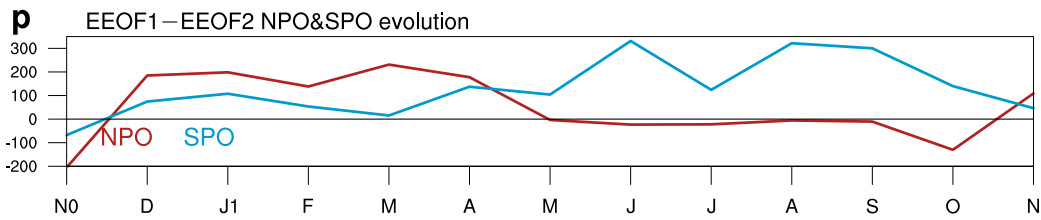
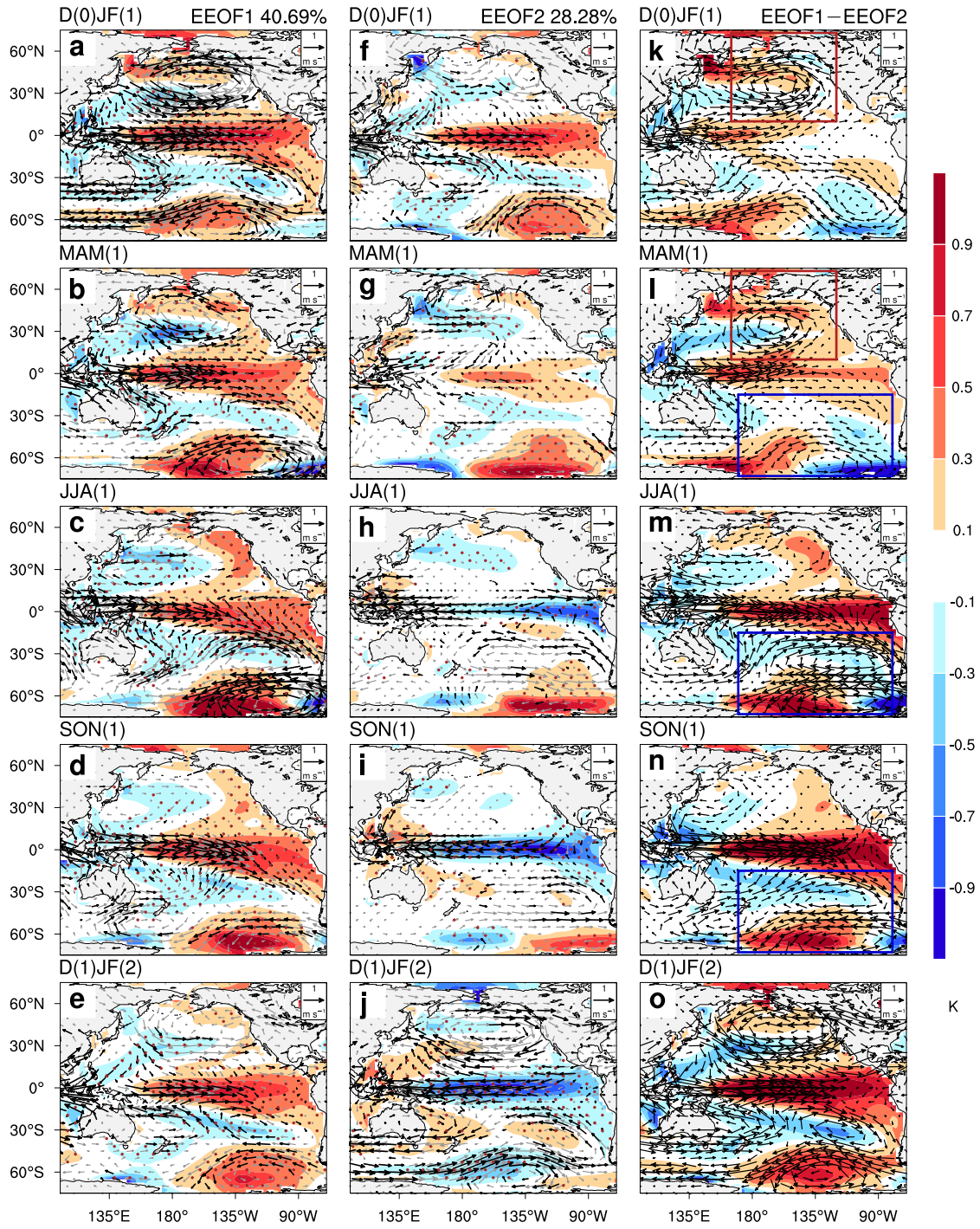
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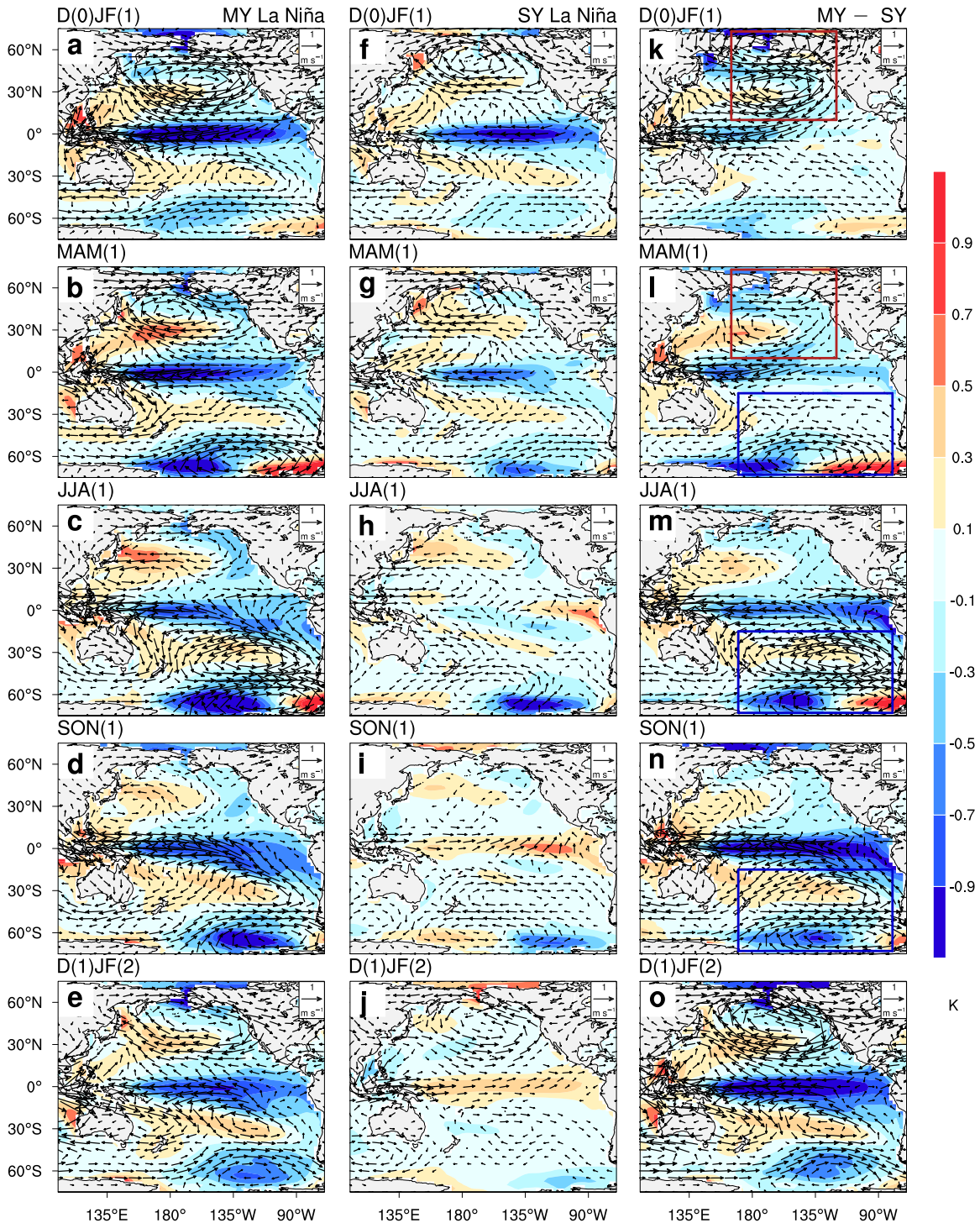
#### **This PDF file includes:**

Extended Data Figures 1 to 5

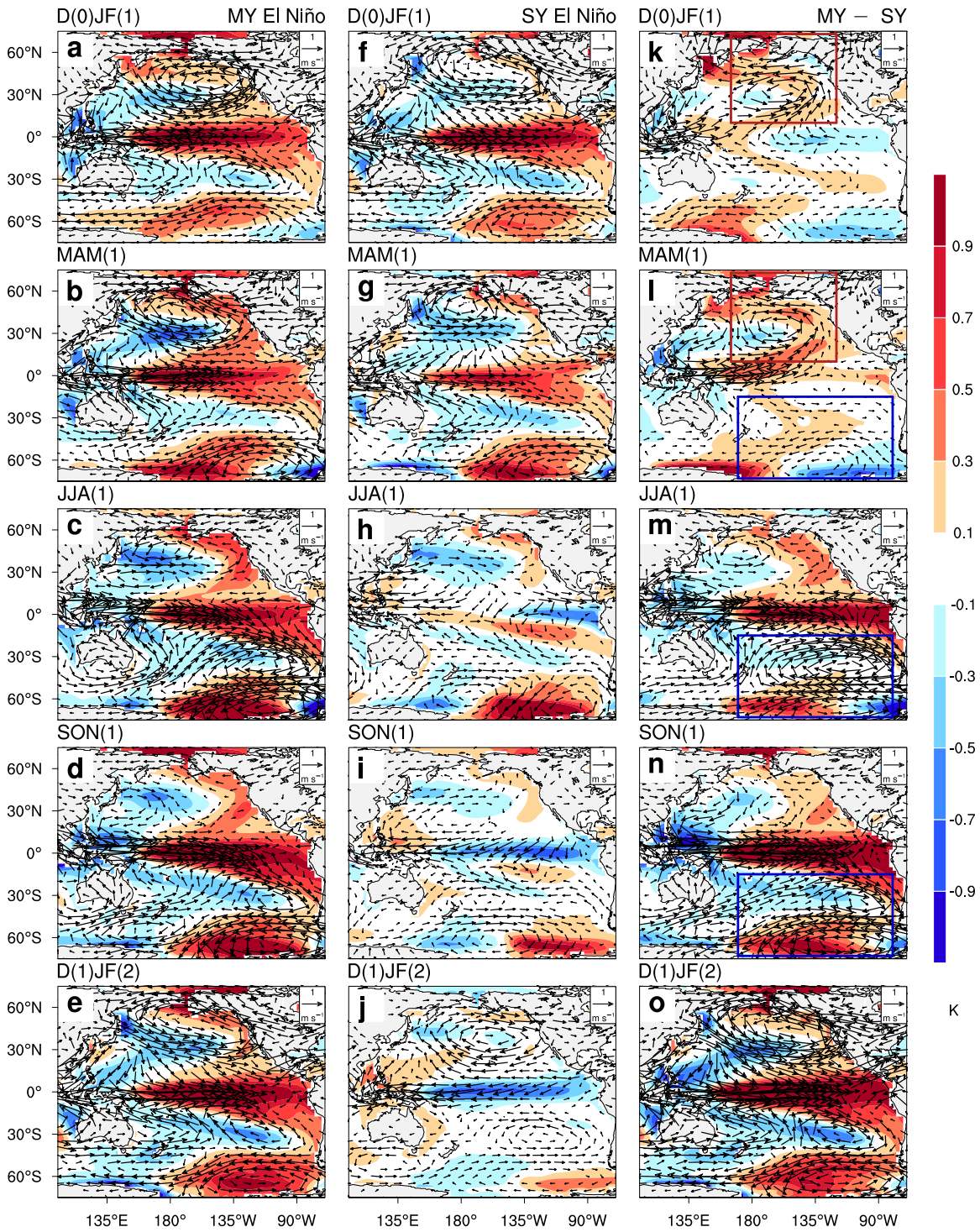
**Figures**



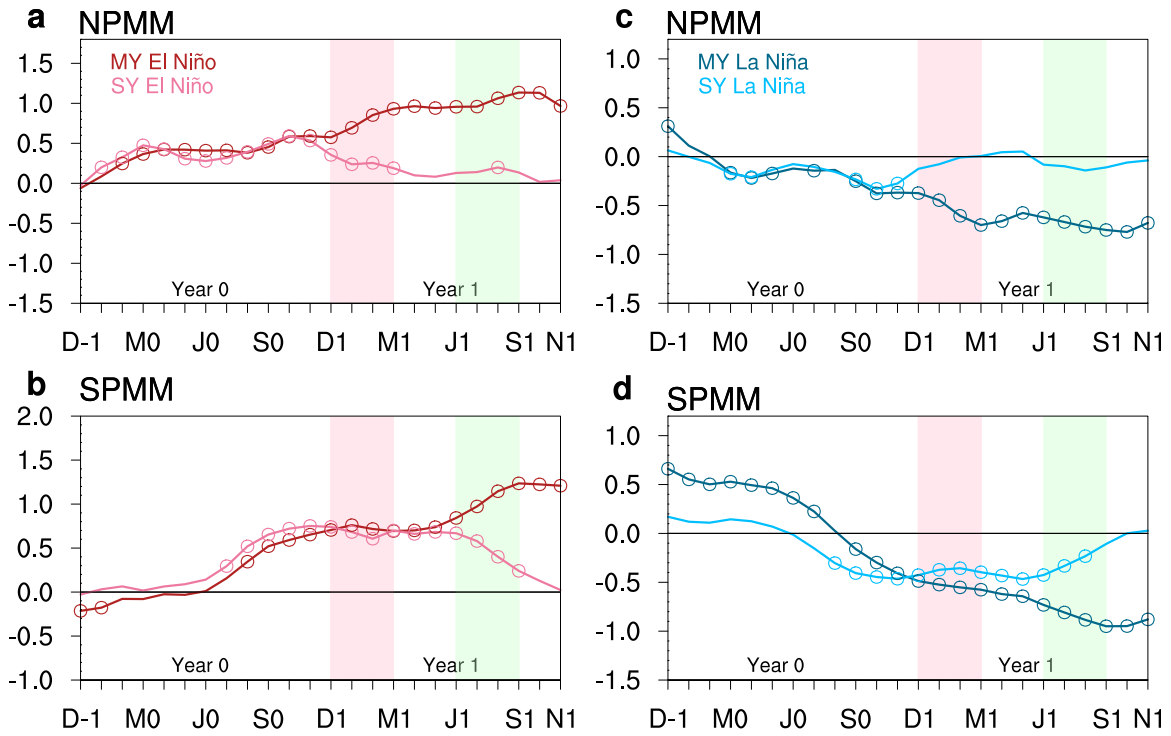
Extended Data Fig. 1. Phase-maintenance and phase-transition ENSO pathways and their associated extratropical circulation patterns in CESM1. Same as Fig. 1, but for CESM1.



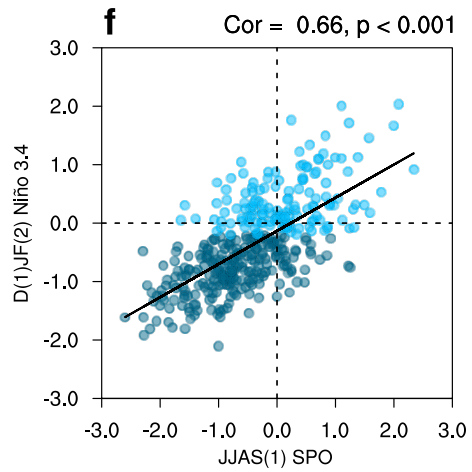
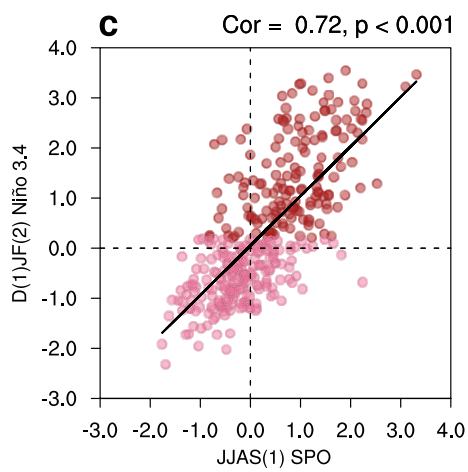
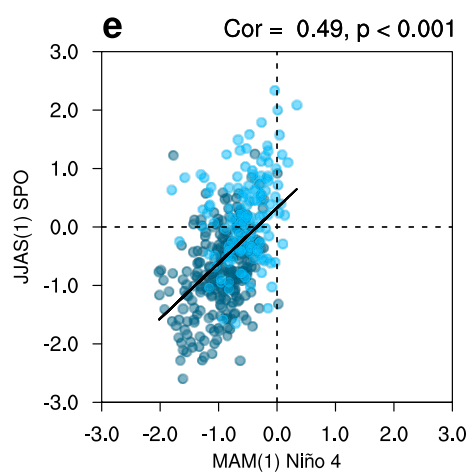
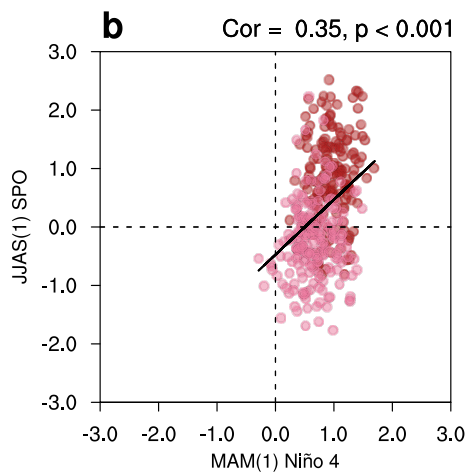
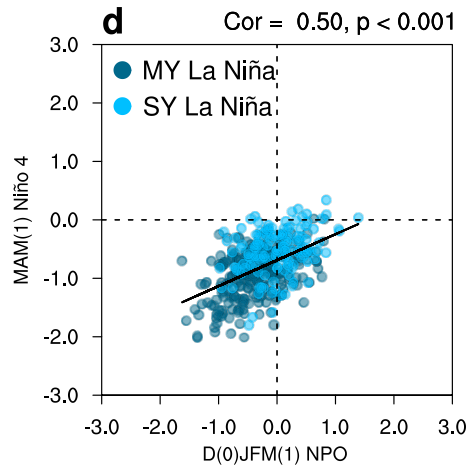
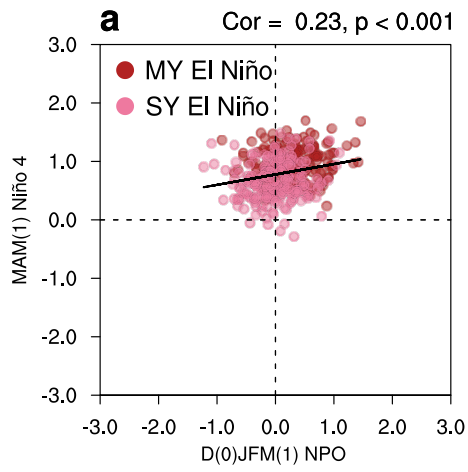
Extended Data Fig. 2. Seasonal evolution of MY and SY El Niño composites and their differences. Composite seasonal SSTAs (shading; K) and 850-hPa wind anomalies (vectors;  $\text{m s}^{-1}$ ) in **a–e** MY El Niño events, **f–j** SY El Niño events and **k–o** their differences from the mature winter of Year 0 [D(0)JF(1)] to the mature winter of Year 1 [D(1)JF(2)]. Stippling denotes SSTAs significant at the 95% confidence level, and black vectors denote wind anomalies significant at the 90% confidence level.



Extended Data Fig. 3. Seasonal evolution of MY and SY La Niña composites and their differences. Same as Extended Data Fig. 2, but for MY and SY La Niña events.



Extended Data Fig. 4. Evolution of NPMM and SPMM indices for MY and SY ENSO events. Same as Fig. 2, but for the NPMM and SPMM indices.



Extended Data Fig. 5. Event-scale linkages along the hemispheric relay pathway for El Niño and La Niña. Scatterplots illustrating the sequential relationships between wintertime NPO variability, springtime central-Pacific SSTAs, summertime South Pacific variability, and the subsequent-year ENSO state. **a–c** El Niño events: relationships between **a** D(0)JFM(1) NPO and MAM(1) Niño 4, **b** MAM(1) Niño 4 and JJAS(1) SPO, and **c** JJAS(1) SPO and D(1)JF(2) Niño 3.4. **d–f** Same as **a–c** but for La Niña events. Colors denote MY and SY events (see legend). Solid lines indicate linear regression fits, and annotated values give correlation coefficients and p values.