The North Pacific as a regulator of summertime climate over Eurasia and North America

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The role of the North Pacific as a regulator of boreal summer climate over Eurasia and North America is investigated based on NCAR/NCEP reanalysis, global precipitation, and a variety of climate data sets. Two summertime interannual climate modes associated with sea surface temperature (SST) variability in the North Pacific are identified. The first mode features an elongated band of warm (cold) SST anomalies in the North Pacific, the second mode exhibits a seesaw of SST variations between the northern and southern North Pacific. Both modes are distinct from El Nino and are linked to coherent SST anomalies over the North Atlantic, suggesting the presence of an "atmospheric bridge" linking the two extratropical oceans.

Using the principal component of the most dominant mode as the North Pacific Index (NPI), composite analyses show that the positive phase of NPI (warm North Pacific) is associated with the formation of contemporaneous low-level anticyclones over the North Pacific and North Atlantics, respectively. The anticyclones are linked by quasi-zonally symmetric circulation anomalies in the middle-to-upper troposphere spanning Eurasia and North America, which are manifested in a poleward shift of the subtropical jet and storm tracks. The reverse is true for the negative NPI phase. Associated with the positive (negative) phase of NPI, are tendencies for hot/dry (cool/wet) summers over Japan, South Korea and the eastern portion of the Yangtze River Valley, which are coupled to hot/dry (cool/wet) summers in the Pacific Northwest, western Canada, US northern Great Plains and the Midwest. Cumulative probability computed from daily temperature and rainfall data show that the odds of occurrence of

extreme events are impacted in a way consistent with the mean climate shift during opposite phases of the NPI. The possible role of air-sea interaction in sustaining the climate modes is discussed.