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Linked extreme weather events during winter 2009-2010 and 2010-2011 in the context of Northern Hemisphere circulation anomalies

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The Northern Hemisphere (NH) planetary-scale circulation during winter 2009-2010 was characterized by an unusual combination of persistent high-latitude blocking and southward-displaced storm tracks, manifest by a strongly negative Arctic Oscillation (AO), in conjunction with a moderate El Niño event. The high-latitude blocking activity and southward-displaced storm tracks supported episodic cold-air outbreaks and enhanced storminess over parts of midlatitude eastern Asia, eastern North America, and western Europe as well as anomalous warmth over northeastern Canada and Greenland that delayed sea ice formation and ice thickening in these areas during winter 2009-2010. Although somewhat less extreme than winter 2009-2010, winter 2010-2011 (through January 2011) was also characterized by high-latitude blocking and southward-displaced storm tracks (manifest by negative values of the AO) during a moderate La Niña event in contrast to the moderate El Niño event that prevailed during winter 2009-2010. Despite the reversal of the ENSO phase from winter 2009-2010 to winter 2010-2011, high-latitude blocking activity and the associated southward-displaced storm tracks again allowed for episodic cold-air outbreaks and enhanced storminess over parts of midlatitude eastern Asia, eastern North America, and western Europe with delayed sea ice formation and thickening over the Davis Strait and adjacent regions. The purpose of this presentation will be to present an overview of the structure and evolution of the large-scale NH circulation anomalies during the 2009-2010 and 2010-2011 winters. The contribution of intraseasonal variability of the large-scale circulation to these anomalies will be emphasized. Emphasis will also be placed on showing how individual synoptic-scale weather events (e.g., recurving and transitioning western Pacific tropical cyclones, diabatically driven upper-level outflow from organized deep convection associated with the Madden-Julian Oscillation, and western North Atlantic storminess) contributed to the formation of significant and persistent large-scale circulation anomalies and how these large-scale circulation anomalies in turn impacted the storm tracks and regional temperature and precipitation anomalies (e.g., intense cyclones over the western U.S., persistent cold and freezes in Florida, and frequent snowstorms in parts of the Middle Atlantic States and the Northeast).