Northern Hemisphere Flow Regime Transitions, Blocking, and the Onset of Spring in the Central USA

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Abstract: Studies have shown that maxima in the time series of Northern Hemisphere (NH) Integrated Enstrophy (IE) can be associated with large-scale flow regime transitions and often, the onset and decay of blocking events. Studies have also demonstrated that maxima of this quantity can be identified in ensemble model forecasts as much as 10 days in advance. During February and March 2019, strong IE maxima were associated with changes in the NH flow regimes that brought very cold conditions to the central part of the USA. These colder conditions also were associated with very strong Pacific and Atlantic Region blocking events. Using the NCEP re-analyses, three different teleconnection indexes, and surface temperature data from six different cities in the central USA, these IE maxima are identified. The maximum, minimum temperature and precipitation characteristics for these cities during the different large-scale flow regime characteristics are determined. The results will demonstrate that relatively warm conditions persisted through the first part of February before a period of anomalously colder (as much as 20°F below normal) and drier weather, with more snow, persisted into early March. This period was bookended by major changes in the NH IE time series and a strong simultaneous NH blocking episode. Following this period, the temperature regime returned to values that were closer to normal. Finally, these changes were anticipated well by an ensemble model.

Keywords: Blocking; teleconnections; integrated enstrophy; weather forecasting; flow regimes, climatology.

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