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Title: Improving Understanding and Predictions of Extreme Events:
The Climate-Weather Connection

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Abstract:
Here we identify how phenomena and processes across the temporal spectrum from climate to weather contributed to a specific extreme event, the record warmth occurring over the central and eastern U.S. in March 2012. We also consider the extent to which this event might have been anticipated from prior climate information. Placing the event in a historical context, we find ˜1°C warming in March temperatures over this region since 1901. The long-term warming is an order-of-magnitude smaller than temperature anomalies observed during the event, indicating that most of the extreme warmth must be explained by other factors. Several lines of evidence strongly implicate natural variations as the primary cause for the extreme event. The 2012 temperature anomalies had a close analogue in an exceptionally warm U.S. March occurring over 100 years earlier, providing observational evidence that natural variability alone could have produced an extreme event very similar to March 2012. Coupled model forecasts and AMIP simulations with observed sea surface temperatures (SSTs) show that forcing from anomalous SSTs increased the probability of extreme warm temperatures in March 2012 above that anticipated from the long-term warming trend. A strong Madden-Julian Oscillation further increased the probability for extreme U.S. warmth and provided important additional predictive information on the timing and spatial pattern of temperature anomalies. Our results indicate that several pieces from climate to weather ultimately linked together to produce this extreme event. The probability for exceptional warmth evolved dynamically as different phenomena became predictable across time scales from climate to weather. Increased understanding of the connections between climate and weather will be vital for better anticipating the possibility for extreme events, with more general implications for what information might provided and when it might be provided. The WWRP Subseasonal to Seasonal Prediction Project can provide important contributions toward achieving this goal.
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