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A global-scale gridded classification of multivariate surface weather types: the GWTC-2

Cameron Lee
Kent State University

First developed in 2014 for North America, the original gridded weather typing classification (GWTC) scheme represented a new edition of synoptic-scale classifications within the lineage of multivariate surface weather typing classification schemes, and the first high-resolution gridded system of its kind. Similar to the widely used Spatial Synoptic Classification, this mode of synoptic climatology categorizes days at individual points in space according to their meteorological characteristics – especially temperature and humidity. These point-based classifications are then repeated for multiple locations in order to identify synoptic-scale weather situations, akin to air masses. The GWTC-2 utilizes reanalysis and continually updated operational analyses from the Climate Forecast System to expand the original GWTC framework to a global scale. At a 0.5-degree spatial resolution and daily-scale temporal resolution, over 3.8 billion location-days have been classified already, with nearly 8 million more added each month. The GWTC-2 classifies every day at every location into one of 11 spatiotemporally-relative weather types (WTs): nine 'core' WTs representing three categories each of seasonally-relative temperature and humidity, and two transitional WTs identifying traditional cold front and warm front passages. In addition to the global expansion, compared to the original, the GWTC-2 uses a more robust technique for calculating deseasonalized z-scores for WTs at each location, utilizes a simpler process for spatial smoothing, and captures more extreme conditions into its outermost weather types. Currently ongoing applications of the GWTC-2 include an examination of sea-ice melting events in the Arctic, the development of a global extreme weather index based upon areal extent of GWTC-2 weather types, and real-time global forecasts of the GWTC-2 out to 60 days. Furthermore, the GWTC-2 is the first weather-typing classification available over marine environments, opening up a new frontier in applications of synoptic climatology.