



Trends and interdecadal changes of weather predictability during 1950s-1990s

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To study the atmospheric predictability from the view of nonlinear error growth dynamics, a new approach using the nonlinear local Lyapunov exponent (NLLE), is introduced by the authors recently. In this paper, the trends and interdecadal changes of weather predictability limit (WPL) during 1950s-1990s are investigated by employing the NLLE approach. The results show that there exist significant trend changes for WPL over most of the globe. At three different pressure levels in the troposphere (850, 500 and 200 hPa), spatial distribution patterns of linear trend coefficients of WPL are similar. Significant decreasing trends in WPL could be found in the most regions of the northern mid-latitudes and Africa, while significant increasing trends in WPL lie in the most regions of the tropical Pacific and southern mid-high latitudes. In the lower stratosphere (50 hPa), the WPL in the whole tropics all shows significant increasing trends, while it displays significant decreasing trends in the most regions of the Antarctic and northern mid-high latitudes. By examining the temporal variations of WPL in detail, we find that the interdecadal changes of WPL in most regions at different levels mainly happen in the 1970s, which is consistent with the significant climate shift occurring in the late 1970s. Trends and interdecadal changes of WPL are found to be well related to those of atmospheric persistence, which in turn are linked to the changes of atmospheric internal dynamics. Further analysis indicates that the changes of atmospheric static stability due to global warming might be one of main causes responsible for the trends and interdecadal changes of atmospheric persistence and predictability in the southern and northern mid-high latitudes. The increased sea surface temperature (SST) variability exerts a stronger external forcing on the tropical Pacific atmosphere that tends to enhance the persistence of tropical Pacific atmosphere. This process appears to be responsible for the increase of atmospheric predictability and persistence in the tropical Pacific since the late 1970s.