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20th century trends in Northern Hemisphere extratropical cyclone occurrence

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Extratropical cyclones (ETCs) are major producers of mid and high latitude weather, particularly during the colder times of the year, and are responsible for many types of extreme weather, including intense precipitation, snowstorms, wind storms, hail, and tornadoes. A major uncertainty in climate change is how ETCs have changed both globally and regionally over the past 100+ years. Understanding the character and causes of past changes provides important insights into possible future changes. We will document shifts in the spatial distribution and frequency of ETCs from the late 19thto the early 21st Century in the Northern Hemisphere, based on a new dataset of analyzed atmospheric fields. This effort, the NOAA-CIRES 20th Century Reanalysis, provides state-of-the-art reanalysis data for the period 1871-2008. Mean sea level pressure fields for 56 ensemble members of the 20th Century Reanalysis were analyzed every 6 hours locating all local pressure minima enclosed by an isobar 2 hPa greater than the minima. Each local minimum was then linked from one 6h period to the next to construct storm tracks. Each ETC had to exist for at least 72 hours and travel a minimum of 1000 km, restricting our analysis to longer-lived ETCs. The ETC counts are the average number of tracks across all 56 ensemble members for the months of November through March. Preliminary analysis suggests that the ratio of the number of high latitude to mid latitude ETCs was much higher in the late 19th/early 20th Centuries; on the surface, this implies a shift in the mean track of ETCs to the south during the latter two-thirds of the 20th Century. Indeed, the lowest mid-latitude values occur in the 1910s through 1930s, a signal that is most prominent in the Pacific sector. The mid-latitudes became more active after the 1930s. At the same time, at high latitudes there is a shift with higher activity in the eastern Hemisphere and lesser activity in the western Hemisphere. Over the Pacific Ocean, the late 20th/early 21st Century is characterized by more activity over the central Pacific and less over the eastern and western Pacific, compared to the mid 20th Century.