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Climatology of the cyclone size characteristics and their changes during the cyclone life cycle

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Climatology of the atmospheric cyclone sizes and their change over the cyclone life cycle is analysed on the basis of tracking of 57 years of NCEP/NCAR reanalysis sea level pressure data over the Northern Hemisphere. In order to quantify the atmospheric cyclone sizes we used the coordinate transform that allows for the co-location of the cyclone center with the virtual pole and for the establishment of the unique coordinate system for the further determination of cyclone geometry. This procedure was incorporated into the numerical cyclone tracking scheme and provided quantitative estimation of cyclone geometry at every stage of the cyclone development. Climatological features of the distribution of the cyclone size characteristics (effective radius, asymmetry) are considered for the cyclones with different central pressure, deepening rate and life time. Using the long-term climatology of cyclone sizes, climate variability of the cyclone size characteristics during the last 5 decades over the Northern Hemisphere mid-latitudes is assessed. Mean effective cyclone radius may experience significant changes, ranging from 300-400 km over the continents to more than 900 km over the oceans. There has been found strong dependence of the cyclone effective radius on the cyclone life time and intensity, implying the largest cyclone sizes for the most intense and long-living transients. Analysis of the cyclone size changes during the cyclone life cycle implies the cyclone radius increase during the cyclone development stage from 50 to 150%. Evolution of the cyclone size during the cyclone life cycle implies a universal dependence of the normalized cyclone effective radius and the normalized cyclone age. The actual maximum cyclone radius can be determined from these two non-dimensional parameters and cyclone central pressure. Further application of the analysis of cyclone size and shape is suggested.