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The cycles and dynamical properties of convective outbreaks in Jupiter's highest speed jet from a 55-year study

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Jupiter's zonal wind system has its most intense jet centred at latitude 23.5° N where peak velocities reach 140 to 180 ms^{-1}. One of the most spectacular planetary-scale disturbances takes place on it, changing a bright whitish band of clouds into a dark belt, known as the North Temperate Belt (NTB), with the convective outbreaks and their effects in the belt being named the NTB Disturbance (NTBD). The disturbance begins with the rapid eruption of typically 1 to 3 "plumes", bright clouds of convective origin that, after a rapid initial expansion, generate a turbulent wake formed by a turmoil of eddies and filaments that encircles the planet. We have studied the reported cases starting in 1970 and ending with the last two most recent NTBD eruptions in August-September 2020 and January-February 2025. Our analysis shows the existence of a cycle between plume outbreaks with a mean period of 4.64 years (range 3.84 to 4.87 years) for the 10 outbreaks observed between years 1970 and 2025. Interestingly, there was a large period of ~17 years (from the end of 1990 to early 2007) without eruptions (we call the "NTBD desert"). During this period, the NTB was a dark belt, populated with large and long-lived anticyclones. Other key properties of the plumes, such as their zonal velocity, initial meridional migration and zonal acceleration, and their spatial distribution and cadence, are also analyzed using ground-based and Hubble Space Telescope observations.