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# Tracking the large AWO in the N5 domain, 2025-2023

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At least one large anticyclonic white oval (AWO) is often recorded in the north part of the N5 domain, tracked by JUPOS and imaged close up by JunoCam. Here we assemble the data on this oval since 2015, and show that it is almost certainly a single feature. Like most large AWOs in other domains, it can be tracked back as far as reliable observations allow.

## *Introduction*

A full analysis of the N5 domain up to 2016, from amateur data supplemented by some Hubble maps, was given in [ref.1]. Because spots at such high latitudes often show very large and sudden changes in drift rate, it was never possible to identify features in the N5 domain between apparitions. But since 2016, coverage of this domain has greatly improved, for two reasons:
(1) Amateur imaging has continued to improve, so from 2020 onwards, JUPOS analysis has documented more spots at higher latitudes than ever before (largely done by Gianluigi Adamoli, who has measured features up to very high latitudes). Apparition reports are posted on this web site, as listed below. The last 3 of these reports (2020 onwards) provided the first substantial details about the N5 domain, and they present more about the long-lived N5 AWO and its interactions than is included in this brief bulletin.
(2) JunoCam provides hi-res images and partial maps of the north polar region on almost every orbit, which allow us to identify tracked features clearly and to follow the largest ones through geocentric solar conjunction. (Note, however, that Juno's orbit constrains the imaging so that on many perijoves only about half the N5 domain is imaged.) Maps are presented in our reports on each perijove, posted on this web site. Closeup images of the large AWO from JunoCam have particularly been noted in our reports for PJ20, PJ23, PJ25, PJ41, PJ57, and PJ59, but there may be other good ones.

Here we present the JUPOS chart from 2015 to 2023 from latitudes 60-66ºNg (planetographic) [= 57-63ºNc (planetocentric)], in order to display the largest N5 AWO(s) which are always found in this range, and to exclude other white spots further south in the domain which would confuse the AWO tracks. This range does not extend down to the N5 jet (mean latitude 55.8ºNg [52.2ºNc]), but it includes the N6 jet (mean latitude 63.8ºNg [60.7ºNc]), as the largest N5 AWO is often seen straddling this latitude in JunoCam images; apparently it diverts the jet around it. Small points are JUPOS measurements from amateur images, and may include some cyclonic spots as well as AWOs. Large points (larger for the largest oval) represent AWOs on JunoCam maps.

As shown in our previous reports [ref.1 & the last three apparition reports below], these AWOs usually have a slow (retrograding) speed when at latitudes below 62.2ºNg, but above 62.2ºNg, they accelerate to very fast (prograding) speeds according to the zonal wind profile, up to DL2 = -56 deg/30d (e.g. in 2012 and 2022) as they approach the N6 jet peak. (A few smaller spots have been recorded travelling even faster, up to DL2 = -76.6 deg/30d in 2021, though still not equalling the N6 jet peak speed detected by spacecraft.) The chart confirms that the large AWO alternates irregularly between fast and slow speeds, sometimes switching from one to other very suddenly. Whenever we have analysed the data, the AWO simultaneously changes latitude accordingly. Latitudes measured from JunoCam maps generally agree with the division that we have found.

## *Results*

The main conclusion from this chart is that the largest oval, identified by its well-documented tracks in JUPOS charts and by its size in JunoCam maps [larger symbols on the chart], is likely to be a single

feature throughout. Points on the chart are connected by lines under these assumptions. The only connection with significant doubt seems to be across solar conjunction in 2018-19.

This connection requires the AWO to have drifted faster than DL2 = -61 deg/30d [DL3 = -53 deg/30d] in 2018 Sep-Oct., followed by a rapid reversal in late Oct. to match the JunoCam observation (PJ16, 2018 Oct.29) of a large AWO at low latitude (58ºNc, 61ºNg); this would have been retrograding and thus can be identified with the JUPOS track from 2019 Feb. onwards. This speed is near the upper limit of what has been observed (see above). Alternatively, the PJ16 observation may have been a different large AWO that otherwise escaped detection, and the JUPOS tracks for the large oval in 2018 and 2019 could connect up without difficulty. Unfortunately there were no other JunoCam images of the relevant region over this period.

Tracks of other N5 AWOs, which cannot be distinguished by their size, still cannot be extended so far. In fact, even when tracks appear to be continuous, this can mask sudden unexpected changes, as we found most clearly in 2021 (see the chart, and ref. below). In 2021 we closely followed two moderate-sized AWOs (labelled a and b) and the large one (labelled e) for several months or more, and found several events where the labelled oval suddenly reversed its drift to adopt a track that appeared to be continuous with that of a smaller, short-lived feature. Most strikingly, ovals a and b approached until they were almost in contact and the chart seems to suggest that they passed each other, but in fact they rebounded and exchanged tracks. JunoCam maps during the subsequent solar conjunction provide a likely track for the large AWO (e) and possible re-identifications of a and b, which then may have successively merged into the large AWO (e). The large AWO had been observed to merge (at least partially) with a smaller one in 2017 April (see 2016/17 report, below). But given the sudden changes that can confound tracking, it is not possible to be certain whether AWOs merged unless the event was directly observed, nor to identify other AWOs through solar conjunctions.

## *References to our previous reports*

***Ref.1:*** Rogers J, Adamoli G, Jacquesson M, Vedovato M, & Mettig H-J (2017),
**'Jupiter's high northern latitudes: patterns and dynamics of the N3 to N6 domains.'**
https://britastro.org/node/11328

*Apparition reports covering the N5 domain:*
2016/17 no.9.
2018 no.6 [includes JunoCam maps PJ12-PJ14].
2019 no.9.
**2020 no.9,** "Final numerical report: Northern hemisphere".
**2021/22 no.9,** "N4 to N6 domains" [inc. JunoCam maps PJ33-PJ39].
**2022/23 no.6,** "Final report on the high northern latitudes" [inc. JunoCam maps PJ41-PJ46].

*Also see:*
Rogers J, Adamoli G, Hansen C, Eichstaedt G, Orton G, Momary T, Jacquesson M, Bullen R, & Mettig H-J (2022). **'Jupiter's high-latitude northern domains: Dynamics from Earth-based and JunoCam imaging.'** EPSC Abstracts Vol. 16, EPSC2022-16.