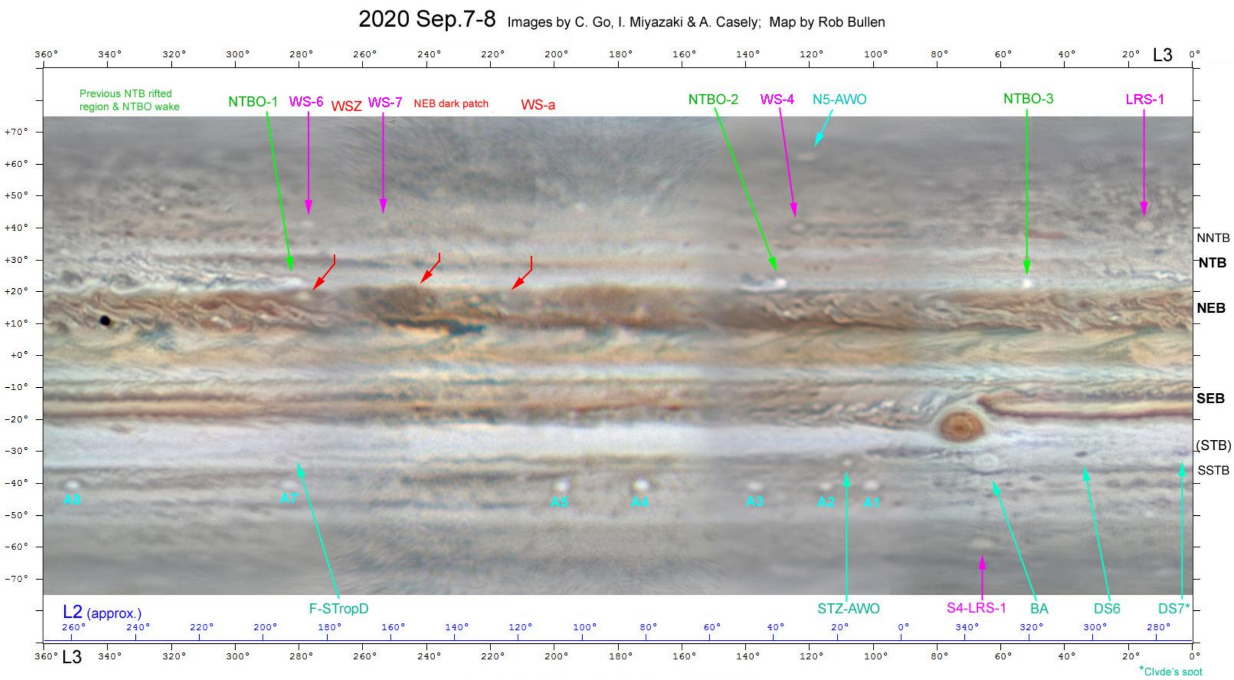
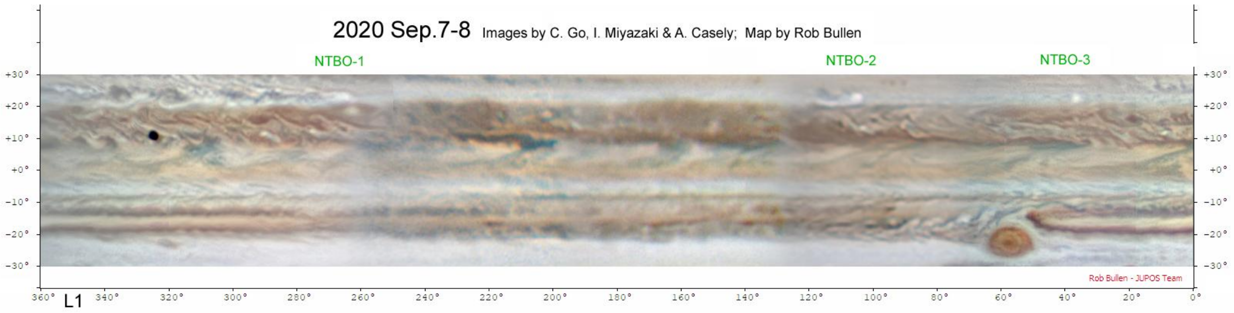
Jupiter in 2020, Report no.7: NTBs outbreak update & a global map

--John Rogers (2020 Sep. 12).   https://britastro.org/node/24202

(1) Global map on Sep.7-8. Figure 1 is a map of the whole planet, prepared by Rob Bullen, in System III, showing the present state of the planet a week before Juno's perijove-29. Figure 2 is a map of the low latitudes in System I, more accurately showing the EZ (which still has strong ochre colour) and the NTB (see below).

Figures 1 & 2:





(2) The NTBs jetstream outbreak.

This outbreak is increasingly spectacular. There are now three brilliant super-fast plumes, each one developing a turbulent wake which disrupts the entire width of the NTropZ and NTB(S). The detailed appearance of the large dark bluish patches in the wake of plume 1 strongly suggests that they are indeed anticyclonic vortices, as Agustin Sanchez-Lavega proposed.

A complete set of maps and a drift chart are regularly updated by Shinji Mizumoto on the ALPO-Japan web site (http://alpo-j.sakura.ne.jp/Latest/j_Cylindrical_Maps/j_Cylindrical_Maps.htm). His latest chart is attached as Figure 3.

Detailed notes on some aspects of the outbreak:

Figure 4 is a collection of images of the outbreak from August 26-31, in RGB & IR & CH4* wherever possible. Just one or two of the best images on each rotation are shown; only one rotation was not covered.
*[RGB: Visible colour. IR: Near-infrared I-band continuum. CH4: 889 nm methane band.]

Plume 1, which appeared on Aug.18, now has a sustained speed of DL1 = -4.9 deg/day. (All speeds herein are from Mizumoto's chart.)

Plume 2: This was discovered by Eric Sussenbach (Curaçao) on Sep.2 at 02h UT, when it was a very bright compact spot in RGB & IR & CH4, and it was also captured by several other observers in the Caribbean and USA about the same time: E. Morales Rivera (at 01:02 UT), F. Rodriguez, R. Rueck, Jim Phillips, Brian Combs. But it had been first captured by Anthony Wesley (Australia) on Sep.1 at 07:39 UT as a tiny bright spot in IR, also just detectable in CH4.
Its speed now is -4.8 deg/day.

Plume 3: This was first spotted by Andy Casely (Australia) on Sep.7 at 08:37 UT, when it was only visible as a tiny faint spot in CH4; A. Wesley (Australia) confirmed it at the same time and detected a very faint 'pinprick' in IR. Ten hours later, Cory Schmitz (S.Africa) detected it as a brighter spot in CH4 also just visible in IR; then on Sep.8 at 03h UT, David Hamilton (Puerto Rico) and Paul Maxson (Arizona) recorded it in RGB & CH4. Ten hours later again, it was very bright in all wavebands.
This must be the earliest stage yet detected in the emergence of any NTBs outbreak plume, with the possible exception of Hubble's images on 2007 March 25 which fortuitously captured the start of that outbreak 2 days before it was recorded from Earth.
Initially its speed was close to System 1 but it has accelerated to DL1 ~ -3.5 deg/day; it may accelerate further, as Plume 1 did.

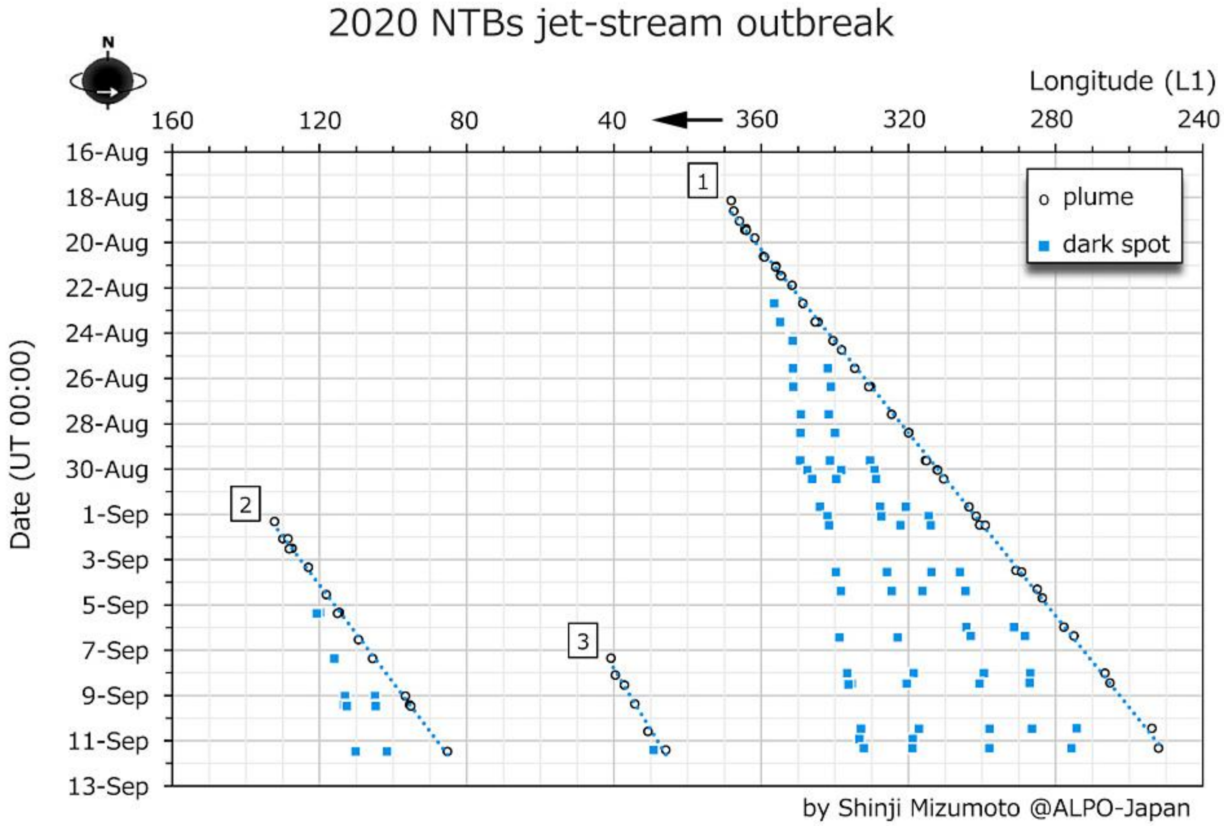
There is also another methane-bright spot that appeared at the f. end of the tail f. plume 1 (Figure 5). It is not as bright as the plumes, but is conspicuous when near the limb, as discovered by Chris Go on Sep.6. In colour and IR images, it coincides with a very dark ring with a small white core, at the f. end of the wake of plume 1. Its shape, and a bright streak f. it, indicate that it is an anticyclonic vortex, so the methane-bright spot may be a very-high-altitude cloud cap rather than a plume. Most likely, it is a remnant of the formerly extensive methane-bright tail of plume 1, trapped in this vortex. It is enhanced near the limb because it is not much affected by limb darkening.

On Sep.8, plume 1 passed White Spot Z in the NEBn, and Casely has produced an animation covering four rotations on Sep.10-11 which shows dramatic interactions involving WSZ and the wake of the NTBs outbreak, including evidence for anticyclonic motions. This animation also confirms that there is a wave pattern along the visible NEBn, although measurements of Mizumoto's maps over a longer time-span will be needed to determine its phase velocity.

Over the whole time-span of the outbreak, there seems to be interference between this wave pattern on the NEBn (perhaps moving close to System 3?) and the wave-like chain of dark patches in the NTropZ (moving close to System 1), both being continually induced by the super-fast plume. Every 4-5 days, they come into phase as a new dark patch is produced: Aug.25 (n=2), Aug.30 (n=3), Sep.3 (n=4), Sep.8 (n=5). On intervening dates, it all becomes much more chaotic. For now, this is a model interpretation which further study may confirm or refute.

How long will the plumes last? In previous outbreaks, a plume typically persisted until it caught up with the turbulent wake of the next plume, then it collapsed and disappeared within ~2 days (or in one case, turned into a slower-moving bright spot instead). The dark spots at the f. ends of such wakes typically drift with DL1 = -0.8 to -1.2 deg/day; the figure f. plume 1 at present is -0.9 deg/day.
From present speeds, and a range of assumptions about future speeds, I estimate encounters as follows:
Plume 3 (approaching wake of plume 1), Sep.25 to Oct.1;
Plume 2 (approaching wake of plume 3), similar dates;
Plume 1 (approaching wake of plume 2), Oct.15-19.
So each plume is likely to disappear within a few days of these dates – unless yet another plume appears to complicate matters.

Figure 3:



Figures 4 & 5 (large sets of images) are posted as individual files.