The opposition of Mars, 2007: Part II

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A report of the Mars Section. Director: R J. McKim

In Part II we discuss seasonal activity of the white crystal clouds and the polar regions. The Equatorial Cloud Band (ECB) was found to be complete in N. mid-spring from Ls= 43° (2008 Mar 10) onwards. Orographic clouds were well seen. White cloud activity was interrupted by the planetwide dust storm. The apparition was exceptionally favourable for watching the transition from N. polar hood to ground cap. The temporary thinning of the N. polar hood (due to atmospheric warming by the planetwide storm) allowed the new carbon dioxide seasonal cap to be seen from a very early date, from Ls= 312° (2007 Sep 12). The dark dune field which borders the summer cap remnant was well seen at the boundary between permanent and seasonal caps. A partial recession curve for the cap was obtained which differed little from the average result of A. Dollfus. Precise measurements of the S. polar cap's diameter during 2007 were not possible, but the seasonal separation of *Novus Mons* was typical.

White clouds and blue-violet light phenomena

In Part I (published in the August *Journal*[43]) we discussed the global dust storm and the dark markings. [Numbering of figures, references and tables runs on consecutively from Part I.]

During the period of atmospheric warming by the storm, white clouds were absent. From 2007 Oct there was increasing morning and evening cloud. As in 2005 we describe only selected white cloud phenomena, looking more for deviations from well established seasonal trends.

Equatorial Cloud Band (ECB)

This low-latitude cloud belt was detected over the usual seasonal period from the *Mars Odyssey* THEMIS data:[22] these show ECB existed (at least in part) from Ls≈ 0–140°, reaching maximum optical depth about Ls= 60°. Parker (Figure 9) achieved particular success in imaging the ECB with the Astrodon 480nm blue filter, but it was also well seen visually.

As early as 2008 Jan 5 (Ls= 13°; Part I, Figure 2G) and Feb 8 (Ls= 29°) the Director noticed diurnal cloud over *Chryse–Xanthe* extending in a tail along the equator on the a.m. and p.m. sides, respectively: a sign of ECB, as yet still incomplete, developing. Graham on Feb 16 (CML= 57°) found patchy equatorial cloud across the disk, and ECB must have been at least partly present to account for the *Syrtis* Blue Cloud from Mar 2 (see below).

The complete ECB was first caught on 2008 Mar 10 (Ls= 43°) by Kowollik; this is the season at which it typically becomes noticeable telescopically. It remained patchy at some longitudes (*e.g.*, Parker, Mar 29 and Peach, Mar 19 (CM= 077–081°)). McKim and Macsymowicz saw it visually complete on Mar 21–22 (CML= 49–80°). Minami found the morning *Syrtis Major* was faded by the ECB on Apr 30, *etc*. Parker last imaged it prominently on May 8 (continuous through *Chryse–Xanthe–Tharsis*), McKim considered that it faded *Syrtis Major* near the CM on May 12 (Ls= 71°), and Macsymowicz recorded it on May 19 and 20, but upon a tiny disk (D= 5").

For 1995–2008, the extreme range for *complete* ECB was Ls= 43–145°:

Opposition	*Complete ECB range (Ls, °)*
1995[44]	†62 onward
1997[45]	51–141
1999[46]	50–145
2001[37]	up to 145
2003[38]	†85–132
2005[25]	†at 118 in 2004; from 45 onward in 2006
2007 (this paper)	43 onward

†disk too small to obtain earlier or later data

Orographic clouds

Here we report on specific white clouds forming in the afternoon over *Alba Patera*, *Olympus Mons* (aka *Nix Olympica*), the *Tharsis*

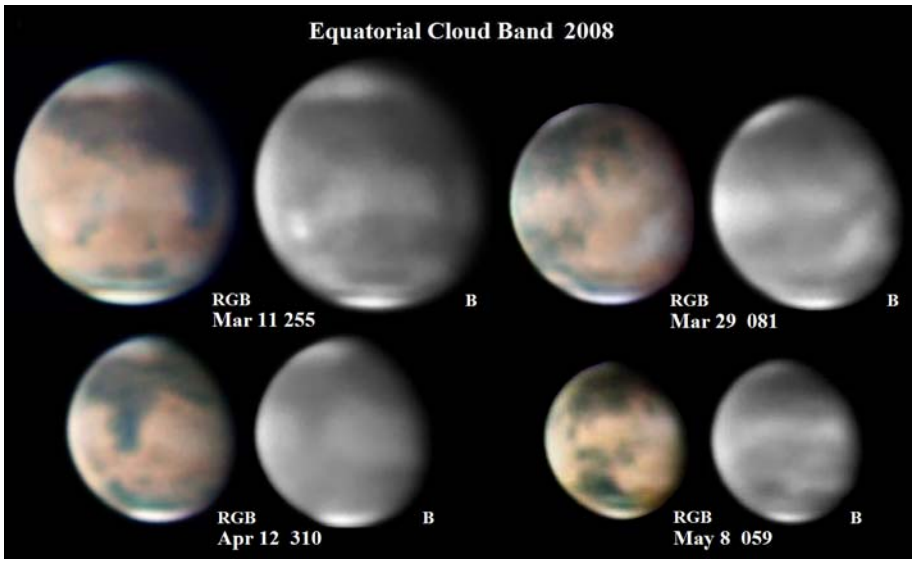


Figure 9. The Equatorial Cloud Band in 2008 in RGB composite and blue image pairs by Parker with Skynyx 2-0M (jointly with Walker on Mar 11) and *Astrodon* λ= 480nm blue filter (E series; bandwidth 135nm). CML is indicated in this and in other figures. (For instrumental data refer to Part I, Table 1; Parker used the same blue filter for all his 2007–'08 images.)

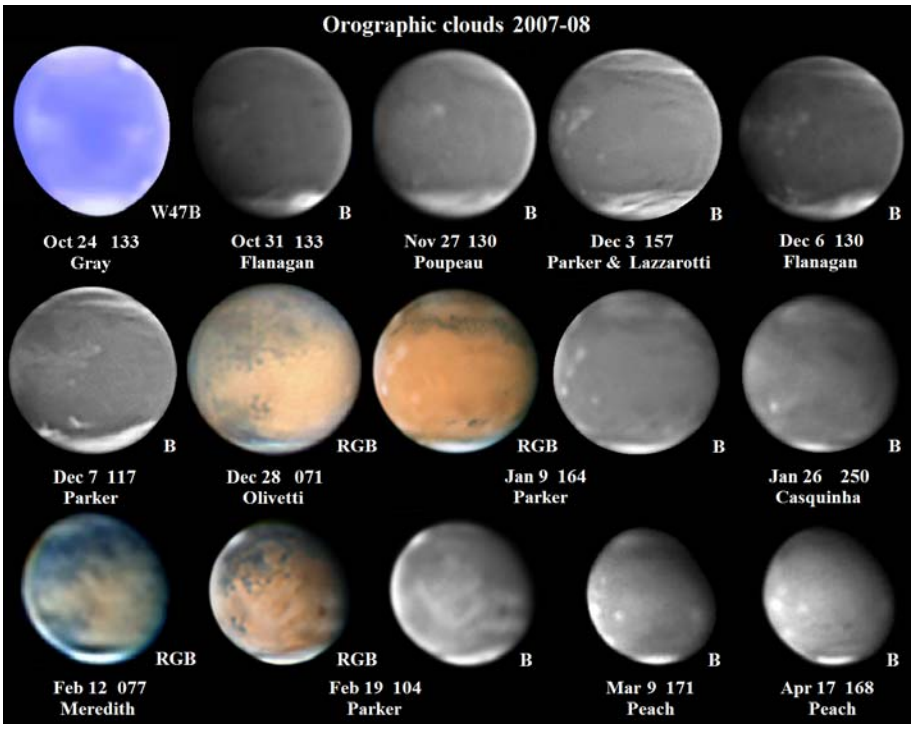


Figure 10. Orographic clouds in 2007–'08: *Tharsis* Montes, *Olympus Mons* and *Elysium Mons*. Drawing by Gray (×365, W47B blue-violet filter), and images (RGB and/or B) by others.

Montes (*Ascraeus Mons*, *Pavonis Mons* and *Arsia Mons*) and *Elysium Mons*. (It is essential to be able to see the evening terminator, or close to it, hence observations before opposition are better able to monitor these clouds.) When joined by small white clouds over *Candor*, W. of *Noctis Lacus* or *Syria Planum* (aka *Nox Lux*), and over *Arsia Mons* in the south and *Lunae Lacus* and *Ascraeus Mons* in the north, the martian 'W' cloud is formed. Refer to Figure 10.

Dust interrupted the seasonal cycles in a different way at each recent opposition.

The Tharsis Montes

Orographic cloud was expected prior to the start of the global storm on 2007 Jun 23. On Apr 6 (Ls= 214°) Valimberti showed general *Tharsis* afternoon cloud that must have included *Arsia Mons*; however, specific cloud at *Arsia Mons* was no longer present upon Peach's Jun 1–6 images (Ls= 249–252°). The July images – taken during the global dust storm – show the *Tharsis* Montes only as dusky spots (with no associated white clouds), especially towards the evening terminator. This aspect persisted throughout the event.

In late Oct, after the storm, the *Tharsis* Montes still appeared as dark spots. Then their evening orographics resumed: lying partly over the volcanoes' W. flanks, the 'dark spot' aspect was gradually displaced. Peach's Oct 18 (Ls= 333°) blue image showed faint evening cloud W. of *Arsia Mons*, which had become brighter next day. Gray (Figure 10) saw it visually on Oct 24. The cloud remained visible in 2007 Dec, forming each day around local noon. On Dec 1 the *Arsia Mons* evening cloud was joined by the other *Tharsis* Montes clouds at *Ascraeus* and *Pavonis Mons*, and *Syria Planum*. In late Dec the evening cloud over *Arsia Mons* was still the brightest: together with *Nix Olympica* (see below), all the components of the 'W' cloud were present. The orographics were still conspicuous upon the evening limb to Peach on Feb 8, but on Feb 15 Parker found the *Arsia Mons* cloud less bright. Peach's image of Mar 9 (Ls= 42°, Figure 10) also shows the latter cloud less conspicuous than the *Ascraeus Mons* orographic. On Mar 20 Parker found evening cloud remaining at *Ascraeus* and *Pavonis*, but none at all at *Arsia*, an observation repeated on Apr 17 by Peach (see also Figure 10).

On 2008 Feb 9 McKim found *Ascraeus Mons* dark at the CM. From Feb 12 to Foulkes (Part I, Figure 4), Kidd (illustrated elsewhere[4]) and Meredith (this paper, Figure 10) it was evident that the dark summits of all the *Tharsis* Montes (as well as *Olympus Mons*: see below) were poking through a sea of low white cloud near the morning terminator: see also Parker's Feb 19 image in Figure 10. The effect was conspicuously visible to many observers for some months until at least Jun 4 (Peach).

Olympus Mons

Our pre-storm images are mostly of inadequate resolution to check for orographic cloud here, but Salway on May 11 (Ls= 236°) caught the *Olympus Mons* evening cloud. At the start of the global dust storm, the caldera of this volcano soon appeared as an obvious dusky patch (see Part I). In late Oct, with contrasts still slighty muted, *Olympus Mons* continued to appear as a dusky reddish patch, darkening towards the evening.

Olympus Mons still appeared as a dusky patch to the Director on Nov 23. But steadily brighter evening cloud there was first distinctly shown by Poupeau on Nov 27 (Ls= 354°), Peach on Dec 2, Parker on Dec 3 and Flanagan on Dec 6 (Figure 10). The HST[21] on 2007 Dec 7 provided confirmation. The caldera was brightened by the opposition effect *ca*. Dec 16–31, so that it appeared bright even on the morning side (for example in Olivetti's Dec 28 image (Figure 10)). The effect was visible from IR to violet, being most apparent at long wavelengths. The caldera was clearly still affected by evening cloud then, for such cloud was certainly in place immediately following the opposition effect (*e.g.*, Casquinha, Dec 30 (Part I, Figure 5)).

In 2008 the evening cloud gradually gained in conspicuousness but it was never possible to see it at its best, the evening terminator being lost to view after opposition. But afternoon cloud was still present here until at least May 23 (Ls= 76°, Peach).

As with the *Tharsis* Montes, *Olympus Mons* appeared as a dark spot amidst white morning cloud, from Feb 4 (McKim) onwards; Parker's image of Feb 19 (Figure 10) shows *Olympus Mons* very obviously reddish.

Alba Patera

At high resolution, the general whiteness often seen in *Alba* is seen to be more compact, and associated with the low volcano *Alba Patera*. Casquinha first caught the small white orographic cloud E. of *Alba Patera* on Nov 29 (Ls= 355°), which was confirmed on Dec 2 in images by Peach, Sharp and Tyler. It is illustrated in Parker's image of Dec 7 in Figure 10. This tiny cloud was followed from local noon onwards and was visible until at least Dec 11. Then Flanagan recorded it again on Jan 8 and 12 near local noon, and weakly just before noon on Jan 14. The 2008 Jan observations show that the orographic cloud lay at the S. edge of the belt of white cloud (mentioned in Part I and discussed later) near lat. +50°. It remained visible later, though no longer so compact, and Peach recorded it as late as Apr 17.

Minami noted that 2007 Dec images showed another small cloud near +48°, 075° in *Mareotis Fossae*, over complex local terrain.

Elysium Mons

Together with nearby *Hecates Tholus*, this tiny feature was significantly brightened, *circa* 2007 Dec 18–31, by the 'opposition effect'. But from 2008 Jan it was brightened instead by the onset of specific orographic cloud: see Casquinha's Jan 26 image in Figure 10. The orographic cloud was clearly detected visually by McKim on Jan 25 and in numerous images during Jan 26–Feb 27. Peach's fine images of Apr 7 also show it weakly: the final sighting in 2008.

The Syrtis Blue Cloud and the Isidis Regio/Libya diurnal cloud

Evening cloud that extended over the *Syrtis* was first imaged on 2007 Dec 8 (Warell), and McKim saw the same brilliant evening cloud over *Isidis Regio–Libya*. Morning cloud there was also recorded from Dec 1. The *Syrtis* Blue Cloud phenomenon is apparent once the ECB (see above) has developed, and this time it was first reported on the evening side on 2008 Mar 2–4 (Parker) and Mar 15 (Minami), with Walker recording it last on May 14 (illustrated elsewhere[4]). Parker on March 11 first observed its appearance in the morning, and it continued to be detected there till at least Apr 30 (Akutsu). See Figure 11.

'Violet holes'

This phenomenon was discussed in the previous two BAA apparition reports. Pellier called attention to two dark patches imaged in violet light above *Mare Chronium* and E. *Mare Cimmerium* (then on the afternoon side), 2007 Dec 22–23. In white light they showed a chocolate tint. On 2008 Feb 22 Parker drew attention to a similar, dark reddish patch located at +40°, 118° near *Phlegethon*, just off the a.m. terminator (CML= 77°): a northern hemisphere analogue? The redness of *Olympus Mons* in a similar situation and time was remarked upon above. We give these examples rather than a rigorous list.

Martian 'flares'

D_e and D_s coincided on 2007 Dec 20 (+2.2°). US observers would have been well placed to observe any 'flash' or 'flare' from the longitude of *Edom*.[37] *Edom* is light upon Melka's Dec 19 red image (CML= 340°), but not especially so. We pick out sharp images on Dec 19 (CML= 328°) and 20 (CML= 318°) by Maxson, on Dec 21 (CML= 345–350°) by Flanagan, and visual series by Albert on Dec 18 (CML= 339–350°) and 22 (CML= 316–334°); all negative. There is no evidence of any *Edom* flare in 2007.

Polar regions

North polar region

Activity in the NPH and the NPH/NPC transition

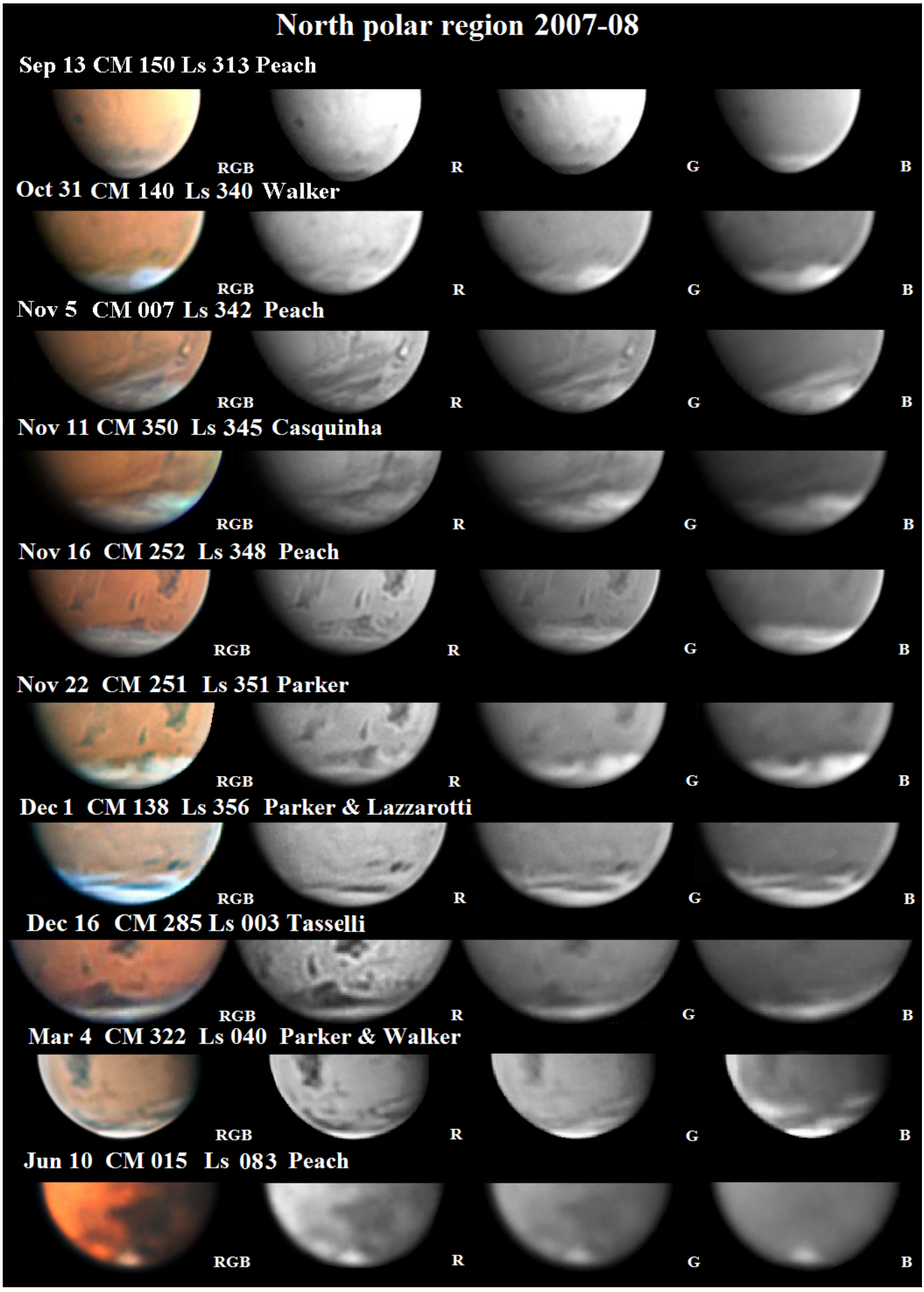
This season when opposition coincided with the dispersal of the polar hood was last favourably observed in 1992–'93, when amateur CCD work was in its infancy and resolution much lower than today. The 2007–'08 images revealed greater detail in the hood and its surroundings compared with 1990s and '80s data.[44–49] Aspects of the NPR are shown in Figure 12 (and also Figures 9–11). The N. pole was visible from 2007 Sep 13–Dec 30; D_e was negative between 2008 Jan 1 and Feb 29, then positive again from Mar 1 till the end of the apparition.

Figure 11. The *Syrtis* Blue Cloud in 2008 upon RGB images by Akutsu (DMK 21AF04.AS), Parker (Skynyx 2-0M) and Peach (355mm SCT, Lumenera LU-075M).

The NPH was already weakly visible prior to the global dust storm in 2007 late June. Faint and dusty after the first week of July, it was again clearly evident from about Aug 1. From the last week of August it became conspicuously light.

A dark area at the N. limb is evident in many red images from about Aug 25 onwards, as D_e became steadily less negative. The region was conspicuously dark in Peach's images of Sep 13 (Figure 12), and by now had separated from the limb. Measures of latitude prove it to be the annular rift which was recorded throughout the 1990s aphelic oppositions. It surrounds the permanent summer ice cap. The Sep 13 images even show a southward protrusion towards $\lambda \approx 160–180°$, as shown on the US Geological Survey *Viking* maps of the polar areas. On Sep 11–13 it is evident from Peach's RGB image that the cap was quite dark from the annular rift down to the pole, even though this area must have contained the summer water ice cap remnant. Studies by Bass *et al.*[50] based upon *Mariner 9* and *Viking* data demonstrate that the albedo of the freshly deposited seasonal cap increases with time: the CO_2 frost (which overlies the entire polar region) is initially dull, and apparently that is what we see here at Ls= 312°, well before spring equinox. 1990s filter work by the Section at this season did not resolve such fine detail: nor was the value of D_e often so favourable. Flanagan, Lawrence, Parker and Tyler also captured the ground cap in September.

The images of Sep 12 and13 were the first to reveal a near-circular seasonal carbon dioxide cap with a definite if faint edge near latitude +50°, remaining near this latitude into October. The S. part of the cap, more affected by the lighter hood, remained brighter than the N. In blue light an overlying hood hid all these features and went down to lower latitude: see Figure 12. The annular rift seemed to decline in thickness and darkness with time, presumably being overlaid somewhat by solid CO_2. Still brighter patches began to appear in the hood, Parker (Sep 27) and McKim (Oct 29; Part I, Figure 2) both observing them particularly on the morning side. The N. part of the cap was uniformly dark in red light until late Oct. After that, this region frequently became lighter in parts in red light, the appearance varying with time and CML, showing a transition to its normal, bright appearance during December.


North polar region 2007-08
Sep 13 CM 150 Ls 313 Peach
RGB
R
G
B
Oct 31 CM 140 Ls 340 Walker
RGB
R
G
B
Nov 5 CM 007 Ls 342 Peach
RGB
R
G
B
Nov 11 CM 350 Ls 345 Casquinha
RGB
R
G
B
Nov 16 CM 252 Ls 348 Peach
RGB
R
G
B
Nov 22 CM 251 Ls 351 Parker
RGB
R
G
B
Dec 1 CM 138 Ls 356 Parker & Lazzarotti
RGB
R
G
B
Dec 16 CM 285 Ls 003 Tasselli
RGB
R
G
B
Mar 4 CM 322 Ls 040 Parker & Walker
RGB
R
G
B
Jun 10 CM 015 Ls 083 Peach
RGB
R
G
B

Throughout October there were better views of the S. edge of the ground cap, and further measures could be made of its latitude. Peach during Oct 7–31 obtained several red images showing the ground cap with tiny albedo markings at its edge. Thus on Oct 18 and 19 he recorded a small dark spot at the cap edge in red light, although an overlying hood hid it in blue. The Oct 31 (Ls= 340°) images by Grafton, Flanagan (Part I, Figure 7) and Walker (Figure 12) showed a large patch of hood restricted to the morning limb, the ground cap being clearly seen across the CM. On the same date but at different CML, McKim and Peach (Figure 12) saw only the hood. But next day the hood returned to hide the cap for Grafton *et al.*, also.

As we saw in Part I, a southward surge of the NPH in late Oct/early Nov led to some N. hemisphere local dust activity, a correlation also noticed in 2005–'06.[25] In Figure 12, Peach's Oct 31 image shows this surge, which continued at that longitude for several days.

Amidst a complex polar region which had probably also been invaded by dust from a storm then crossing *Mare Acidalium*, Peach appears to have imaged the frosted crater *Lomonosov* (+65°, 008°) on Nov 5 (Figure 12). It was shown upon several images, especially in green light. It was located against a dull part of the polar hood/cap, perhaps amidst low albedo frost? This was the first time such a phenomenon has been caught by ground-based imaging, although the feature's crateriform nature was, of course, not evident. A few others just recorded this feature at the absolute limits of their instruments: Pellier on Nov 1, Casquinha on Nov 4 and Grafton on Nov 14.

From Figure 12 we can compare the same CML on Nov 16 and Nov 22: the hood has become more active on the latter date. A common phenomenon of this period is the visibility of "Dawes' slit" where part of the dark N. *Mare Acidalium* shows through the hood (late Sep–Nov). There were many other rifts in the hood, and occasions where the cap was clearly seen at some longitudes but obscured by hood at others. For instance, see Parker's Nov 22 image in Figure 12.

The edge of *Vastitas Borealis* marking the sharp outer limit of the NPC was very clearly caught in the November images. Peach's images reveal the annular rift, but the darker N. part of the cap was less dark now, and at some CML of similar albedo to the S. part in red light. In the latter part of November the stable ground cap was still occasionally displaced by the NPH. The annular rift was visible in many Nov–Dec images, and Peach still showed it on Dec 1 (Figure 12), but it was now getting close to the N. limb. The lightening of the extreme N. part of the cap continued. The rift was recorded for certain by Flanagan and Peach on Dec 21 (Part I, Figure 3) and by Casquinha, Dec 23–29. The optimum season for viewing it had arrived,[44,45] but the negative value of D_e soon hid it from view. By 2008 Mar 1, D_e was back to zero, and the season was not too late (Ls= 39°), but the rift could no longer be resolved.

The NPH was still evident at times in December. McKim saw it on Dec 3, appearing larger in blue light. On Dec 8 he noted that the hood was only present on the morning side, over N. *Mare Acidalium*. The hood often veered to lower latitude at the morning or evening side: further examples can be seen in Figure 12 on Nov 11 and 22, and (weakly) Dec 16, in Figure 10. From around Nov 28 (Pellier) onwards, the remaining hood more often appeared as long E–W strips detached from the south edge of the ground cap, and sometimes as a continuous cloud belt near latitude +50°; at other times there existed multiple strips (Figures 10, 12). Some locations were more favoured: *Mare Acidalium–Tempe–Arcadia* was frequently affected, also E. and W. of *Utopia*.

After 2007 mid-Dec the hood became much less active. Flanagan and Parker could still image the cloud belt on 2008 Jan 13–14. Parker noticed some a.m. hood over *Mare Acidalium*, Jan 19–25, and McKim found evidence of it on Jan 16 and 24.

Further sightings of morning cloud at *Acidalium* were made, but they represent local clouds not associated with any polar hood. On Feb 15–19 Peach and on Mar 1 and 2 Parker saw small bright clouds in variable positions over *Baltia* at the S. border of the cap. These would have been precursors for the cyclonic clouds observed there during northern summer during the 1990s aphelic apparitions.[45,46]

Compare Ls data for cap and hood for 1992–'93,[47] 2005–'06[25] and 2007–'08:

	Terrestrial date	*Ls (°)*
Cap first seen: **	1992 Nov 25	001
	2005 Jan 4	351
	2007 Sep 22	312
Cap only from:	1992 Dec 11	009
	2006 Feb 22	016
	2008 Jan 25	022

** hood only before then

The value of D_e made it difficult to catch the early NPC in 2005, but nevertheless 2005 did not differ much from 1992. What is remarkable is the very early appearance of the ground cap in 2007. Given that all diurnal white cloud activity was interrupted by the dust storm and did not recommence till 2007 Oct (Oct 5 for *Hellas* evening cloud, Oct 18 for the *Arsia Mons* orographic, *etc.*), it is likely that the NPH was also affected to some extent (thinned or obliterated), allowing a clear view of the ground cap. Like the diurnal clouds further south, the hood eventually returned, dispersing at a more typical seasonal date. Thus the NPH brightened in late 2007 as it returned to its seasonally expected form.

A complete search of HST and spacecraft images for the earliest seasonal record of the NPC has not been attempted, but Pellier noted that the cap edge was well visible on *MGS* 2002 Jan images[51] from as soon as Ls= 309° onwards, coincidentally a few months following the 2001 global dust storm. This is in perfect accord with the 2007 result.

NPC recession

It was possible to measure the decay of the NPC upon images from 2007 Sep 12 onwards, and to follow it until about 2008 Aug 1 (Ls= 107°, D= 4"; Yunoki). The temporary return of the polar hood hindered the Oct–Nov measurements but there were still enough sightings of the ground cap for the statistics. Measurements of the latitude of the NPC S. edge at the CM were made in the usual way:[8] Table 3 and Figure 13 represent 561 measurements (mostly red images) by 32 observers. No good latitude measures were possible after 2008 late April (D< 6"), so only part of the recession could be followed and we defer comparison with the 1990s[6, 44–47] and 1980s[48,49] until the next (2009–'10) opposition report. Figure 13

Figure 12 *(left).* The N. polar region in 2007–'08. Sequences showing RGB composite and individual R, G and B images. Note the formation of the cap, the slow dispersal of the hood and the partial cloud belt remaining near lat. +50°, and later the recession of the cap. Data from Casquinha (Skynyx 2-0M), Parker *et al.*, (410mm refl., Skynyx 2-0M), Peach (355mm SCT, Lumenera LU-075M), Tasselli (DMK 21AF04.AS) and Walker (320mm refl., DMK 21AF04.AS). Blue filters: *Astronomik* Type 2 (Casquinha, Peach), *Astrodon* λ= 480nm blue filter, E series; bandwidth 135nm (Parker), *Trutek* (Tasselli) and Custom Scientific (Walker).

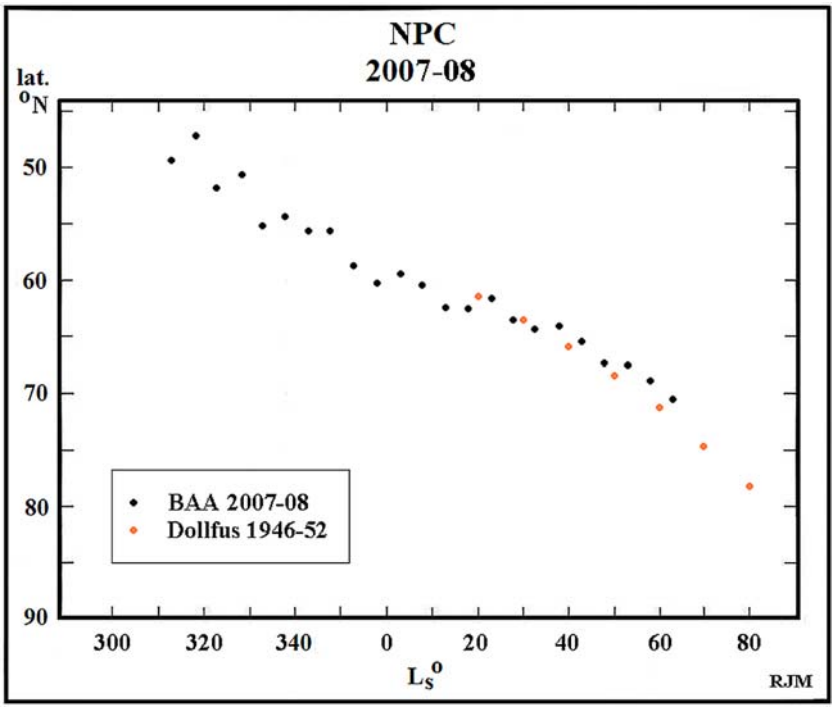


Figure 13. Recession curve for the N. polar cap, 2007–'08, latitudes being 5° means in Ls. The average recession curve of A. Dollfus[52] has been added.

includes the mean recession curve of A. Dollfus:[52] accord is very good; the current recession was either identical to the mean or marginally slower.

Seasonal separation of *Olympia* occurred months after opposition. On Apr 17 Peach (Figure 10) showed the NPC indented in the middle and the region of *Olympia* extended to the S*f*. but not detached. Near-separation is suggested by Morita and Yunoki on May 6–11. Kidd's images of May 14 (Ls= 72°) were the first to strongly suggest detachment: it was also caught during June. In 1995[44] *Olympia* had completely detached at Ls= 70°: good accord for difficult observations.

Table 3. NPC latitude measurements, 2007–'08

Mean L_S (°)	*Latitude (°) of S. edge of cap on images*	*No. of measures*
313 (*e.g.*, 311–315°)	49.4	15
318	47.2	7
323	51.8	8
328	50.6	10
333	55.2	23
338	54.4	25
343	55.6	24
348	55.6	40
353	58.5	19
358	60.3	54
003	59.4	65
008	60.4	48
013	62.4	15
018	62.6	28
023	61.8	31
028	63.5	42
033	64.4	51
038	64.1	15
043	65.5	8
048	67.3	3
053	67.5	12
058	68.9	14
063	70.5	4
	Total	561

Iaxartes (*Chasma Boreale*) cut into the late spring cap: on Apr 22 there was a slight indentation in the NPC S. edge (Peach), which by May 21 (Yunoki) and Jun 4 (Peach) was faintly seen (D= 5") to be cutting into the cap. *Hyperboreus Lacus* began to separate from the retreating cap in 2007 May, and was clearly seen by Peach on May 1 and Jun 10 (Figure 12) and the Director on Jun 9.

As noted in Part I, *Phoenix*[23] landed safely on 2008 May 25 in the N. polar region.

South polar region

SPH to SPC transition

Minami saw a light polar region on 2007 Jan 20 (Ls= 170°, D= 4".1). The ground cap was probably first recorded upon Heffner's tiny but useful image on Feb 2 (Ls= 177°). By Feb 19 (Ls= 186°) Minami could also see the SPC visually, and *Rosetta* confirmed it on Feb 24. Olivetti on Mar 31 imaged the cap clearly together with a dark band to the north: see Figure 14.

SPC fragmentation

Despite the tiny disk it was possible to make measurements of the cap upon the best images from Mar 31 onwards, but too few for publishable averages. The recession, insofar as our data suggest, was normal.

Buda's images of Apr 19–23 show *Argenteus Mons* bright within the cap, the SPC becoming asymmetric by Apr 30. Salway showed *Argenteus Mons* protruding at the cap edge on May 26. Peach's fine Barbados series from 2007 May–Jun strongly suggest the separation of *Novus Mons* at the *f*. limb, May 28 to 31. Salway on Jun 2 (CML= 308–320°) agreed: 'The SPC looks to be breaking up a bit?' Heffner's image for May 30 and Buda's for Jun 2 also suggest *Novus Mons* at the cap edge, the period being within bounds and consistent with 2003 and 2005.

Peach's images of May 31–Jun 4 portray dust activity east of where *Thyle Mons* had recently decayed (Part I, Figure 6). The later global storm (and unfavourable D_e) interfered with the visibility of the cap's summer remnant, as already described in Part I.

The cap was very hard to see between late June and mid-July, being veiled by dust. By August the tiny remnant was close to the S. limb. Biver followed it visually until Aug 26 (Ls= 302°), as did Peach's images. D_e became positive on Sep 13, so that the SPC could not be followed later, nor its transition to SPH timed.

S. polar region

A feature of the apparition was the presence of long thin stretches of white crystal cloud, around latitudes –45 to –50°, and most noticeable in 2007 Dec, some months after the decline of the global storm. Adachi and Minami drew attention to its singularity, as it does not seem to have been previously noted telescopically. Figure 14 features this cloud belt as well as the usual S. polar hood; Figures 10 and 1 (Part I) also show it.

The thin cloud belt was first recorded faintly on the a.m. side only in Casquinha's blue image of Nov 23, CML= 237°. Then it was seen to more completely cross the disk on 2007 Nov 27 (over S. *Electris–Eridania–Ausonia*) by Flanagan, on Nov 29 (CML= 120°) by Casquinha, on Dec 1 (CML= 138–150°) by Parker, on Dec 2 (CML= 120–172°) by Peach, *etc*., nearly two months after the cool-

ing atmosphere had permitted the formation of diurnal water-ice clouds closer to the equator. It therefore seems unrelated to the storm: given that it was best seen with a deep blue filter, and was only apparent on the very best images, lack of earlier records could be due to inadequate resolution.

The cloud belt was separated from the thin, foreshortened S. polar hood that was starting to fringe the S. limb at about the same time. From the start, the belt was reinforced where it coincided with morning cloud filling *Hellas*. As *Hellas* moved to the evening side, the stream of water vapour faded somewhat as it trailed away westward, but remained more or less continuous across *Noachis*. From January it also interacted with the bright cloud in *Argyre*, thickening when the latter appeared on the morning limb. From Jan 9 through late Feb the *Argyre* cloud (see also Part I, Figure 4; Feb 9 drawing by Hancock) rotated with the planet (being diurnal only, faint, or absent before that). By 2008 early Jan the thin cloud belt had become absorbed into the widening and developing polar hood. *Argyre* was still light, but less so, and thenceforth only on the a.m. or p.m. side, from early Mar at least until late Apr, and its apparent size shrank as D_e became more positive.

The usual S. polar hood had appeared in 2007 early Dec. It had become continuous from 2008 late Jan onwards, and it followed the usual pattern of development. It occupied S. *Hellas* and *Ausonia* (Part I, Figure 2F) from December, and *Argyre* from Janu-

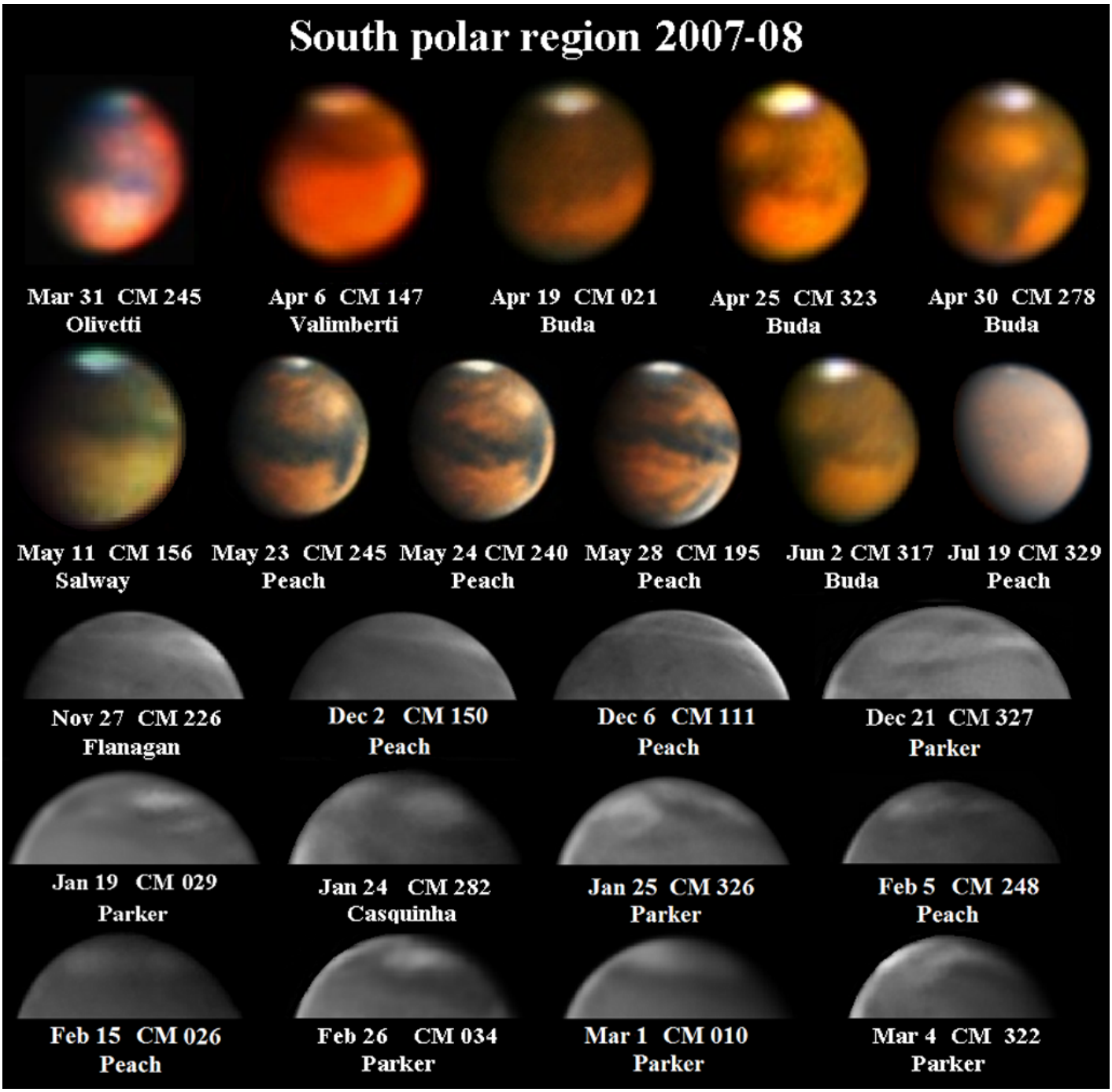
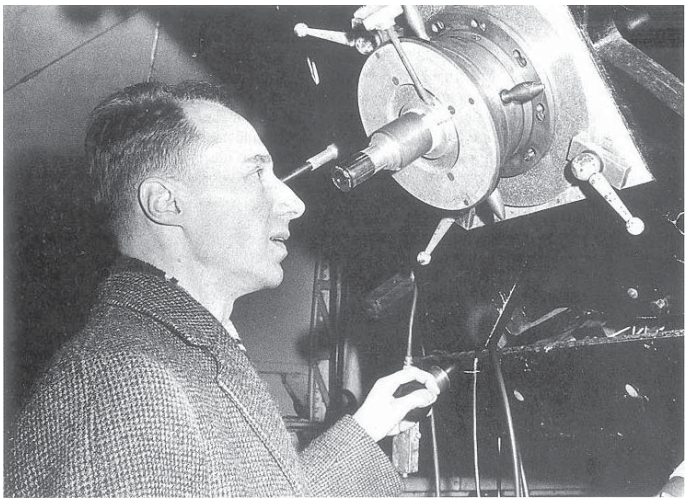


Figure 14. The S. polar region in 2007–'08. *First and second rows*: Aspects of the S. polar cap in 2007 pre-opposition RGB images. *Third, fourth and fifth rows*: Near and post-opposition images to show the S. polar cloud band observed near lat. –50°, and the formation of the S. polar hood according to blue light images by Casquinha (Skynyx 2-0M), Flanagan (Lumenera LU-075M), Parker (Skynyx 2-0M) and Peach (Lumenera LU-075M). Blue filters: *Astronomik* Type 2 (Casquinha, Flanagan, Peach), *Astrodon* λ= 480nm blue filter, E series; bandwidth 135nm (Parker).



Audouin Dollfus (1924–2010) at the eyepiece in the 1960s.

ary (see above). See also Figure 14. *Hellas* became very bright as the hood developed. By late Feb the SPH was quite large (Figure 14). Its bluish tint was evident by 2008 February (particularly so to Hancock, Feb 6, under CML= 148°). The SPH was still visible in May, as high resolution work was ending.

Lunar occultation

Mars was occulted by the Moon on 2008 May 10. Observing with a 102mm OG on a hot day under a clear blue sky with the Sun near the zenith, Niechoy (during the German planetary observers' weekend meeting at Violau, Bavaria) sketched the planet and the lunar limb immediately up until the occultation (12:14 UT) and then just afterwards (13:10 UT).[53]

Dedication

In 2010 October planetary science suffered an enormous loss by the death of Prof Audouin Dollfus of Meudon Observatory,[54] a great friend of the BAA Mars Section and its members over many years. The writer respectfully dedicates this report to his memory.

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