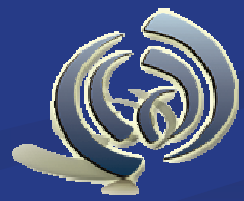
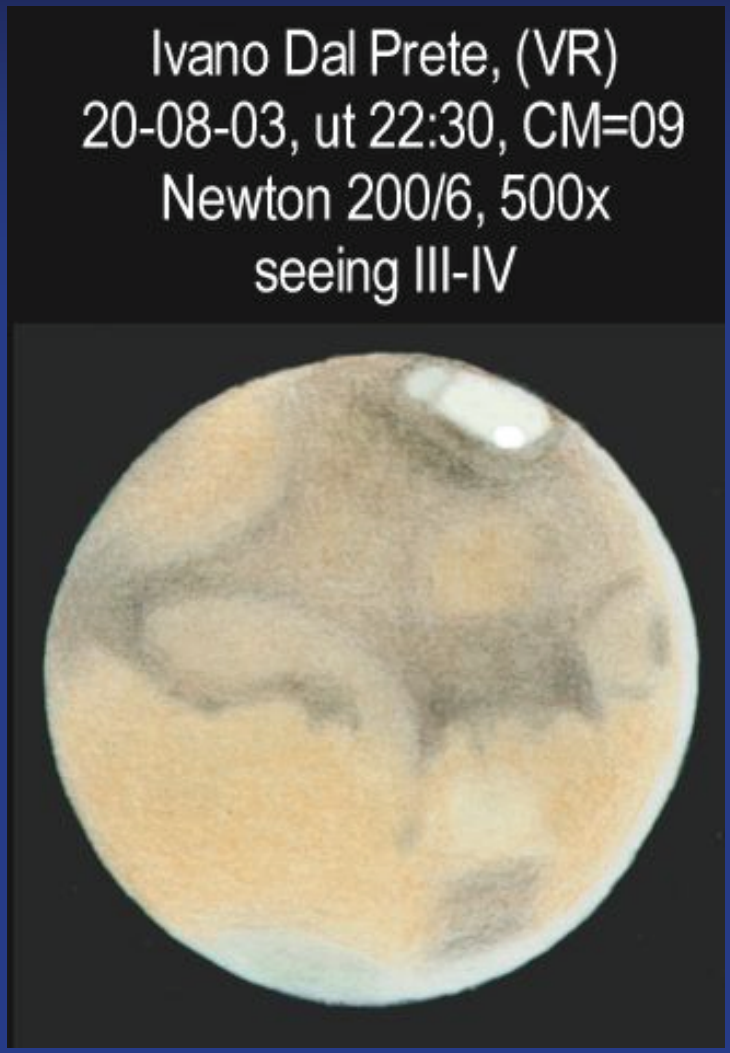
Measuring the SPC regression in 2003-2005

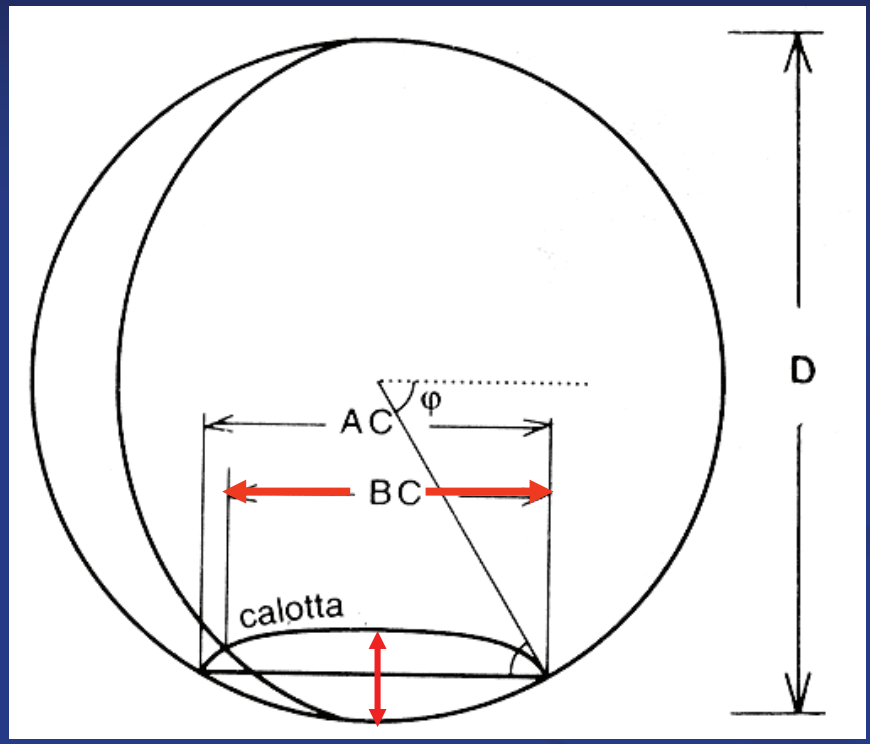
Paolo Tanga

Observatoire de la Côte d'Azur

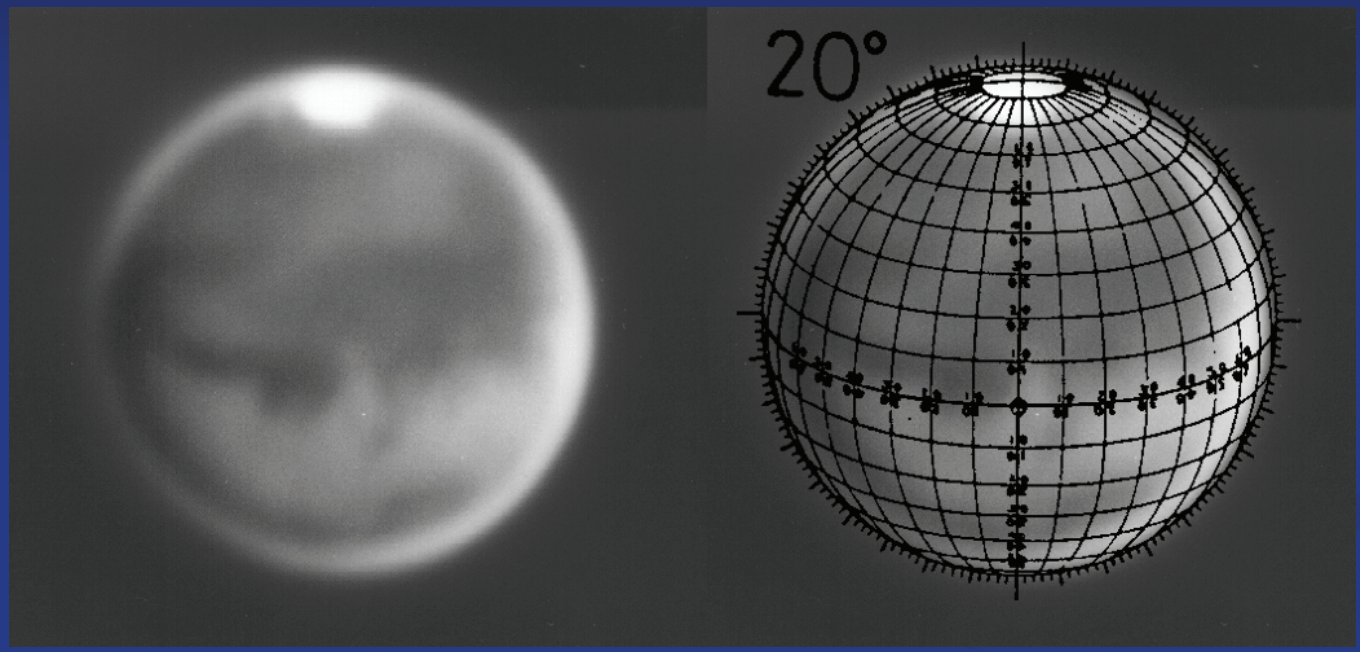


Classical measurement methods - 1





Classical measurement methods - 2

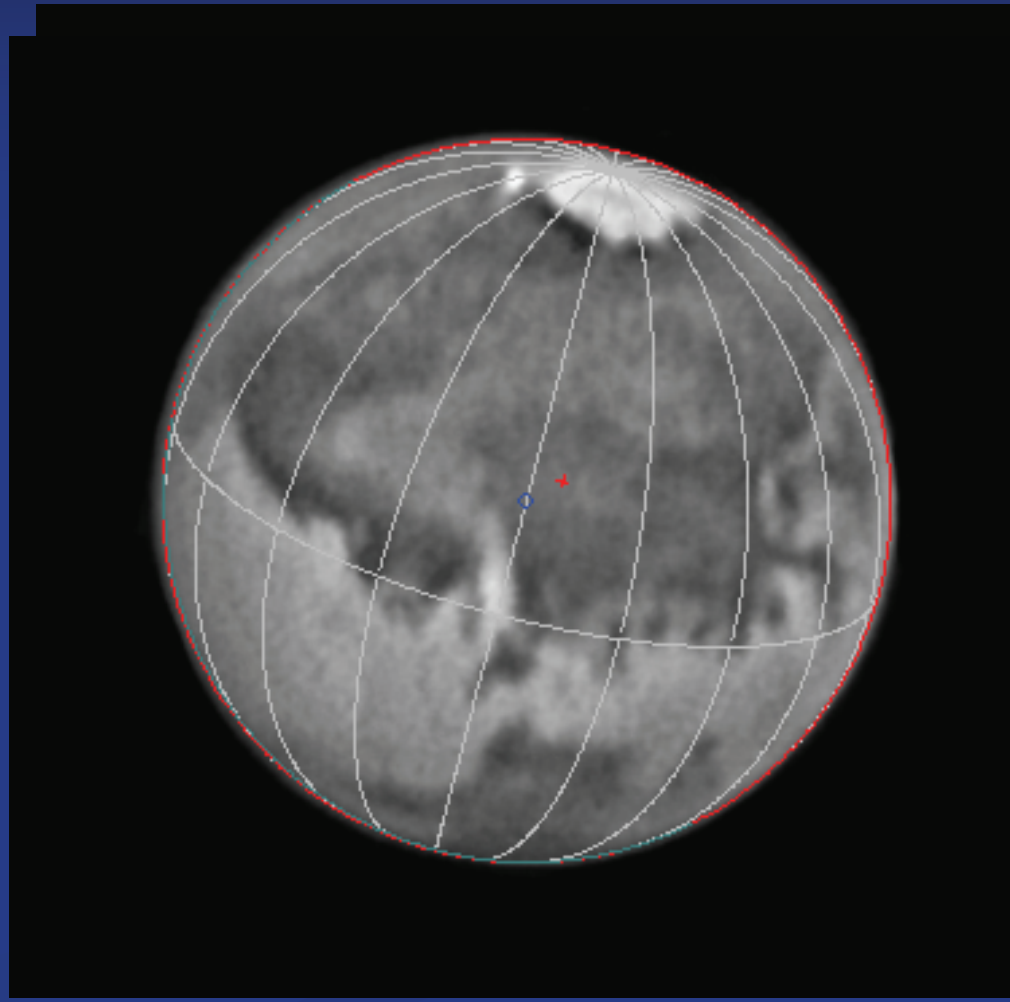


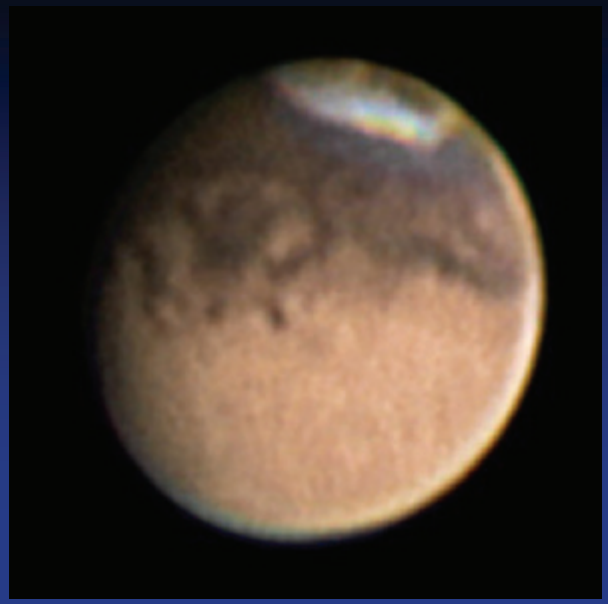
I. Miyazaki, Japan

How to measure complex cap shapes?

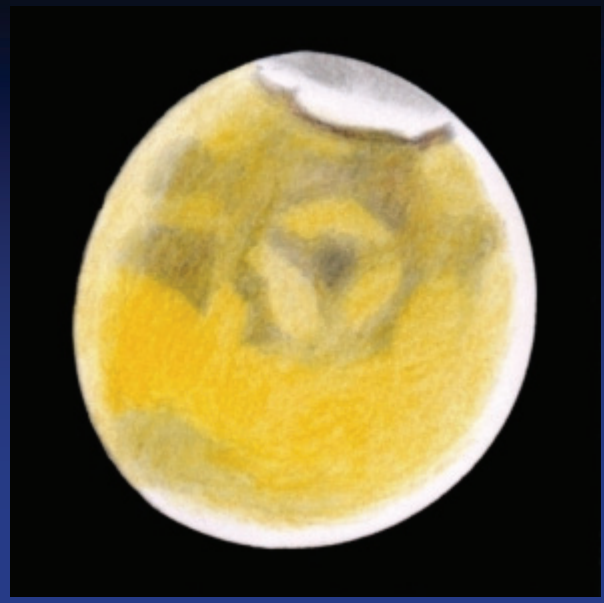
Problems:

- Irregularity of the contour
- Contour definition (sharpness, fragments…)
- De-centering of the cap relatively to rotational pole
- Enhancement applied on images
- ….

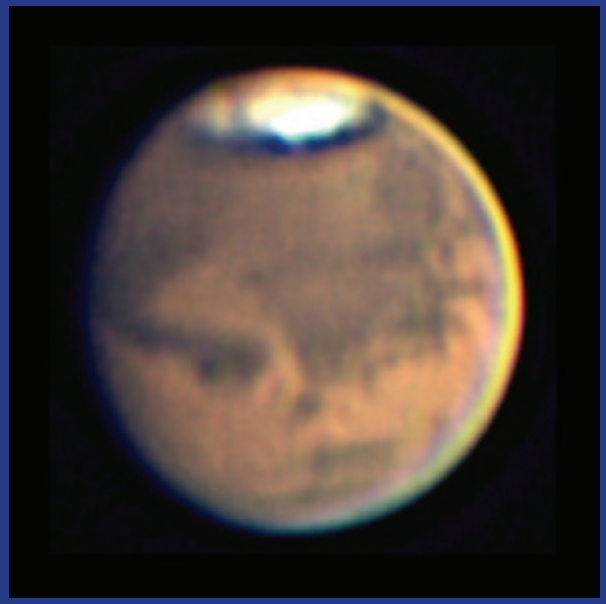




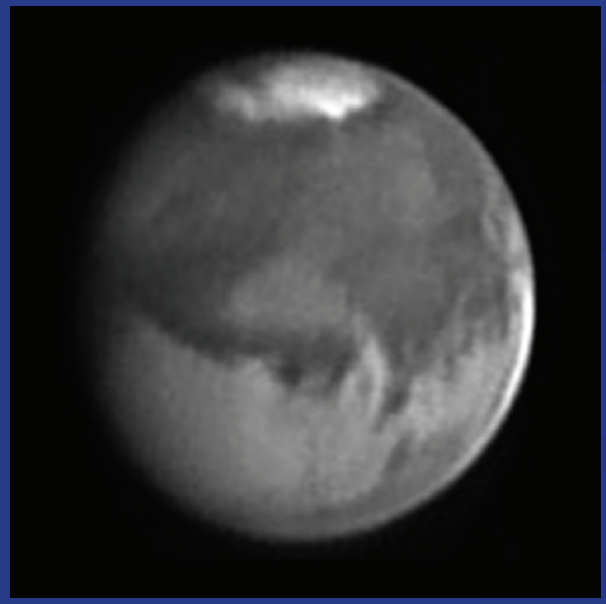
C. Fattinannzi, July 8, 2003



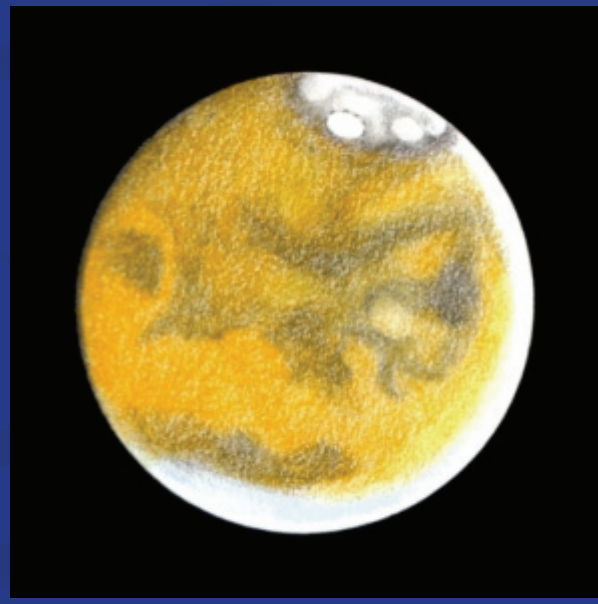
M. Frassati, July 13, 2003



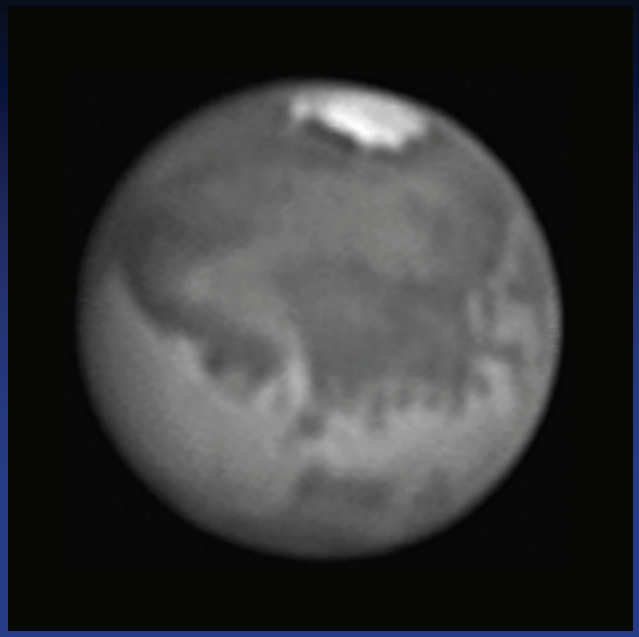
D. Licchelli, July 17, 2003



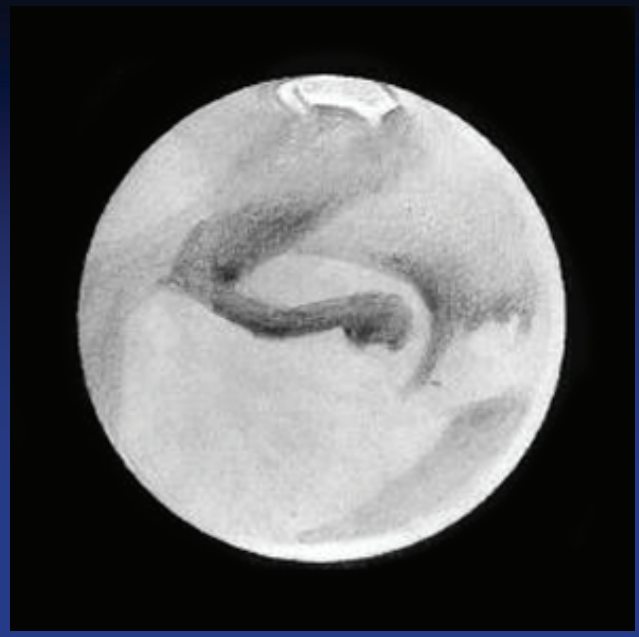
L. Comolli, Aug 12, 2003



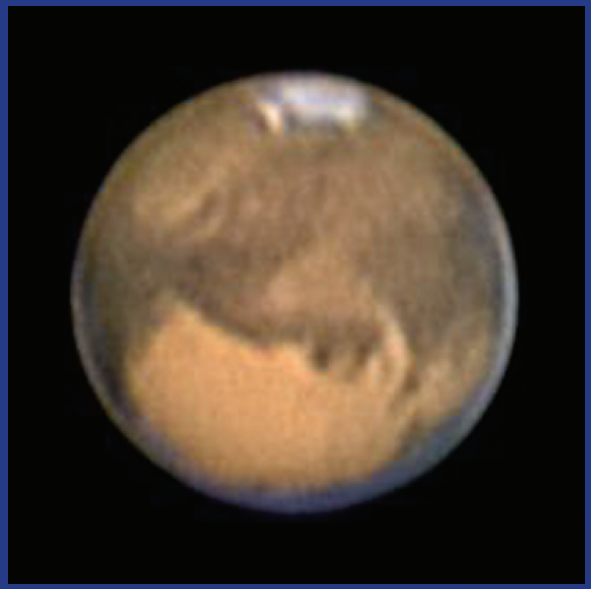
M. Frassati, Aug 19, 2003



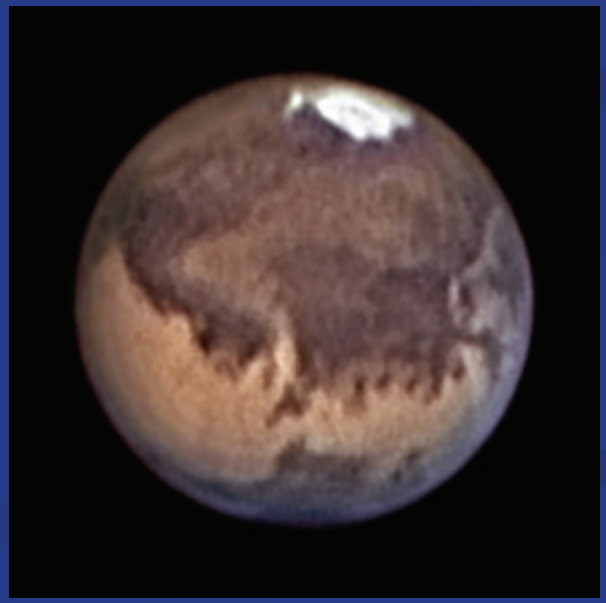
P. Lazzarotti, Aug 19, 2003



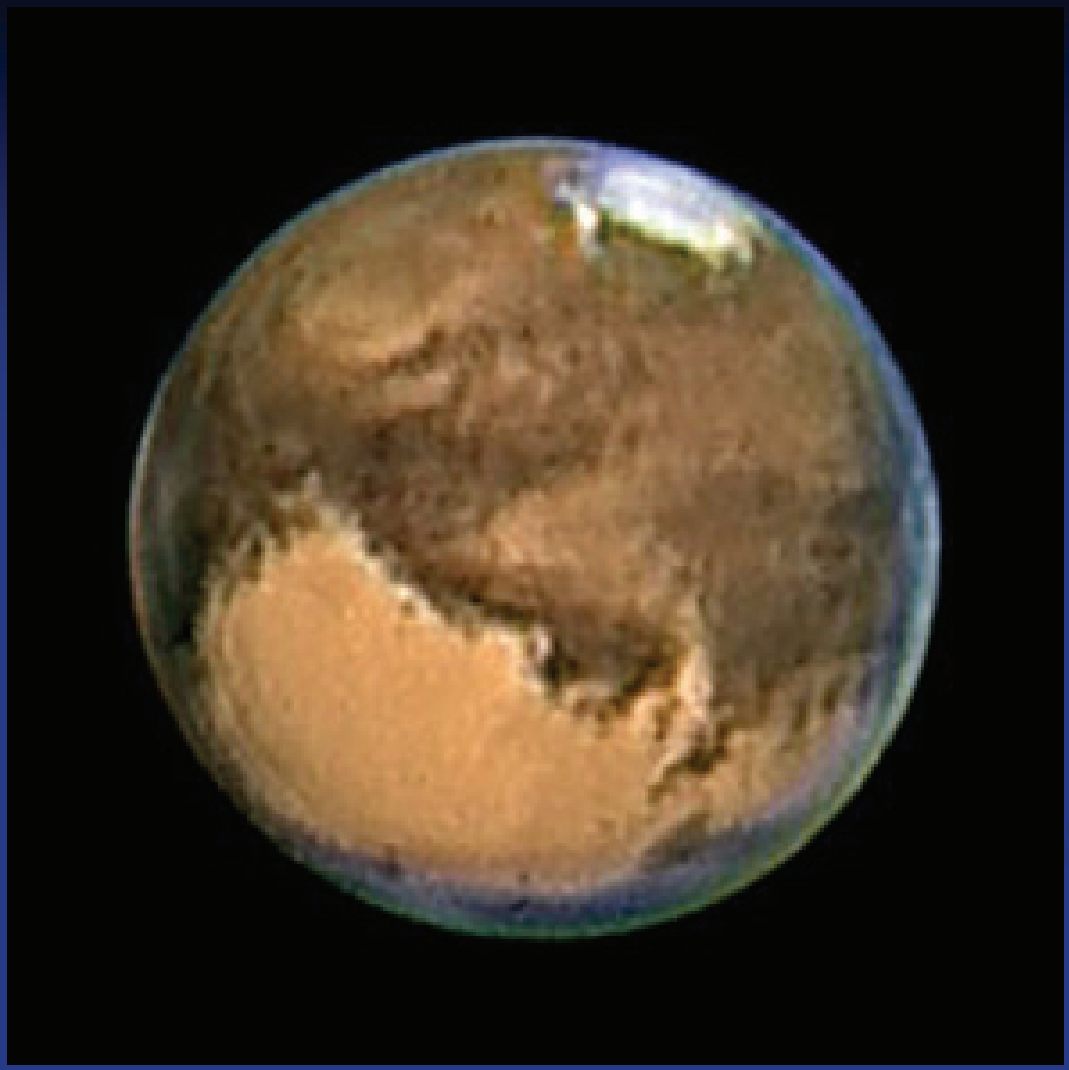
P. Tanga, Aug 21, 2003



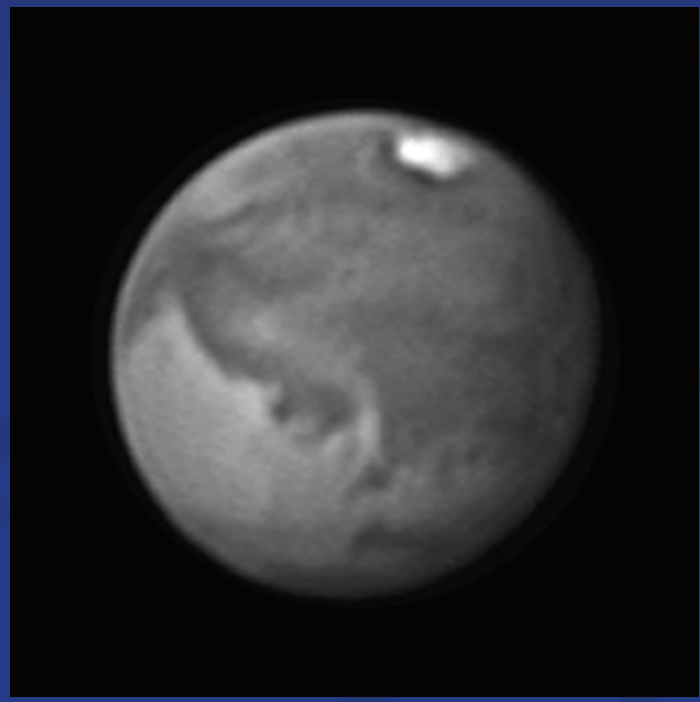
P. Baldoni, Aug 23, 2003



C. Zannelli, Aug 24, 2003



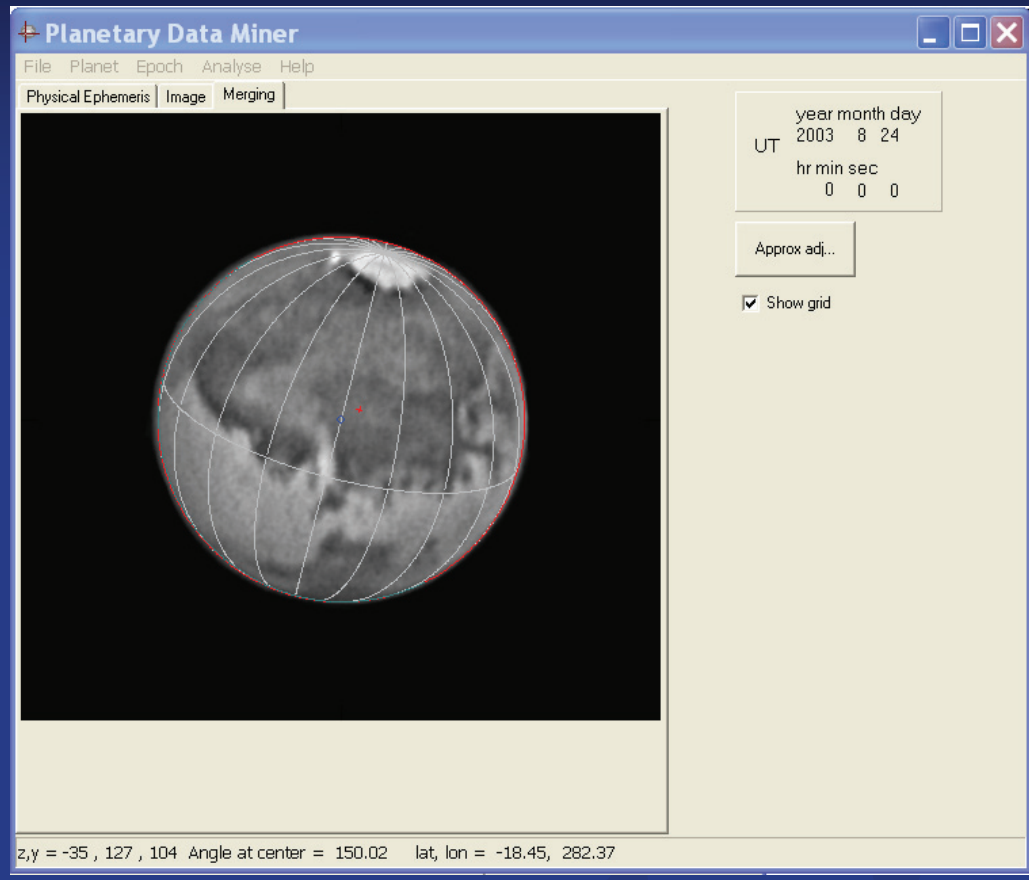
F. Zanotti, August 27, 2003



P. Lazzarotti, September 26, 2003

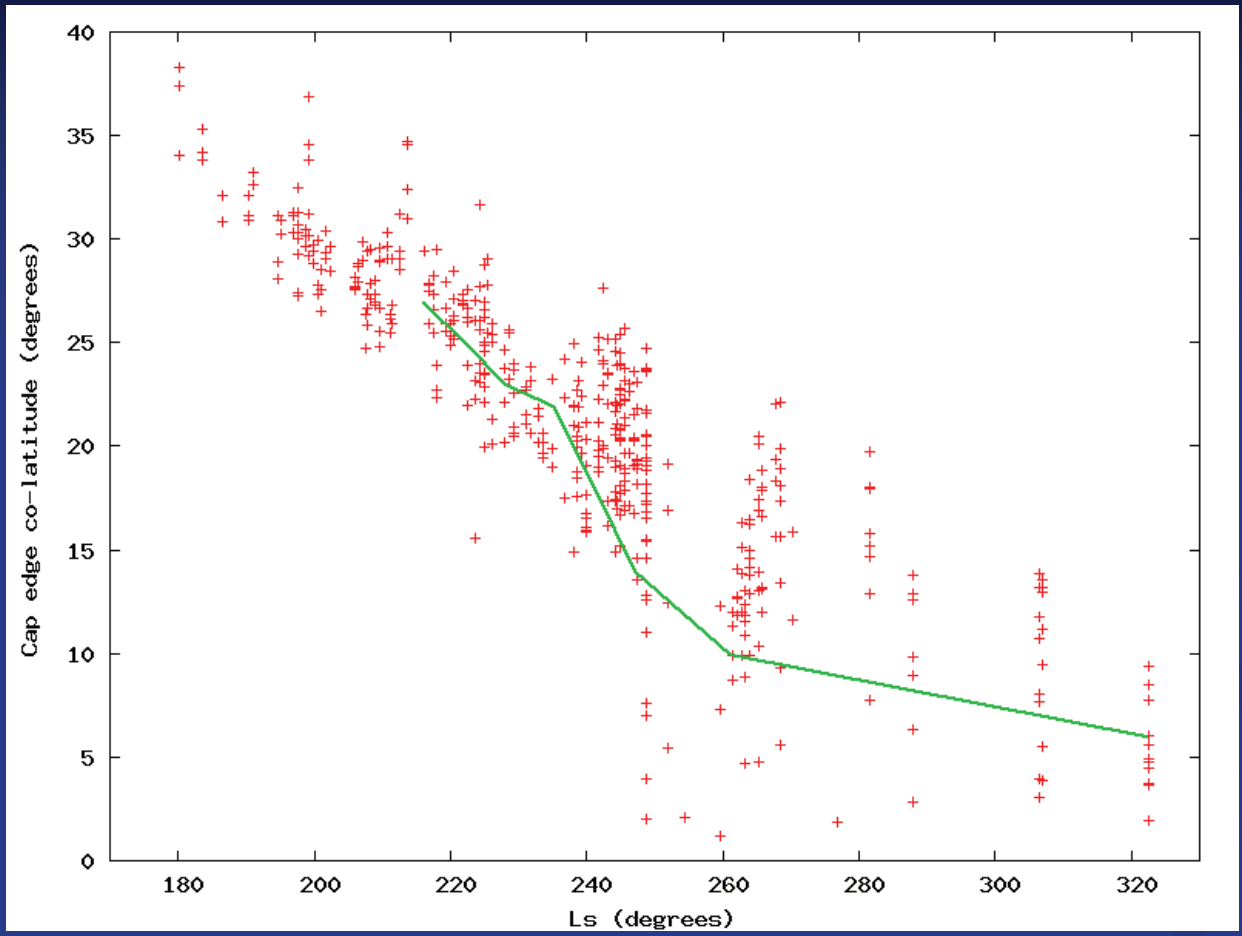
Our method

- Dedicated software to:
  - Compute physical ephemeris
  - Fit the disk with the coordinate system
  - Convert image coordinates to planetocentric
  - Quantify and propagate uncertainties
- Measurements within 40° from the CM of the contour + features



« Planetary Data Miner »

Measurements in 2003-05



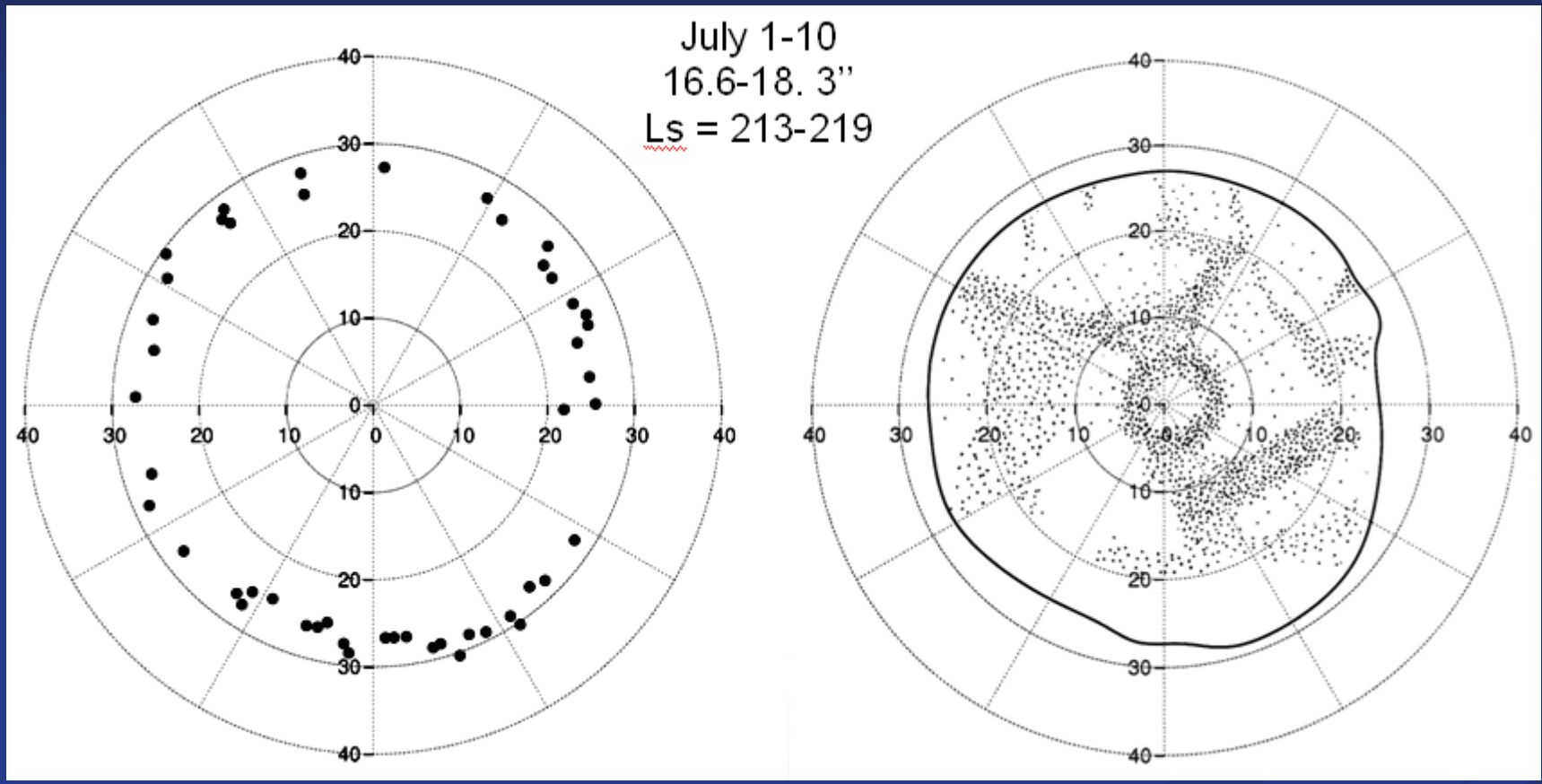
- 5 observers in Italy (C. Comolli, C. Fattinnanzi, P. Lazzarotti, D. Licchelli, G. Uri, F. Zanotti, C. Zannelli
- +2 (Donald Parker, Tan Wei Leong)

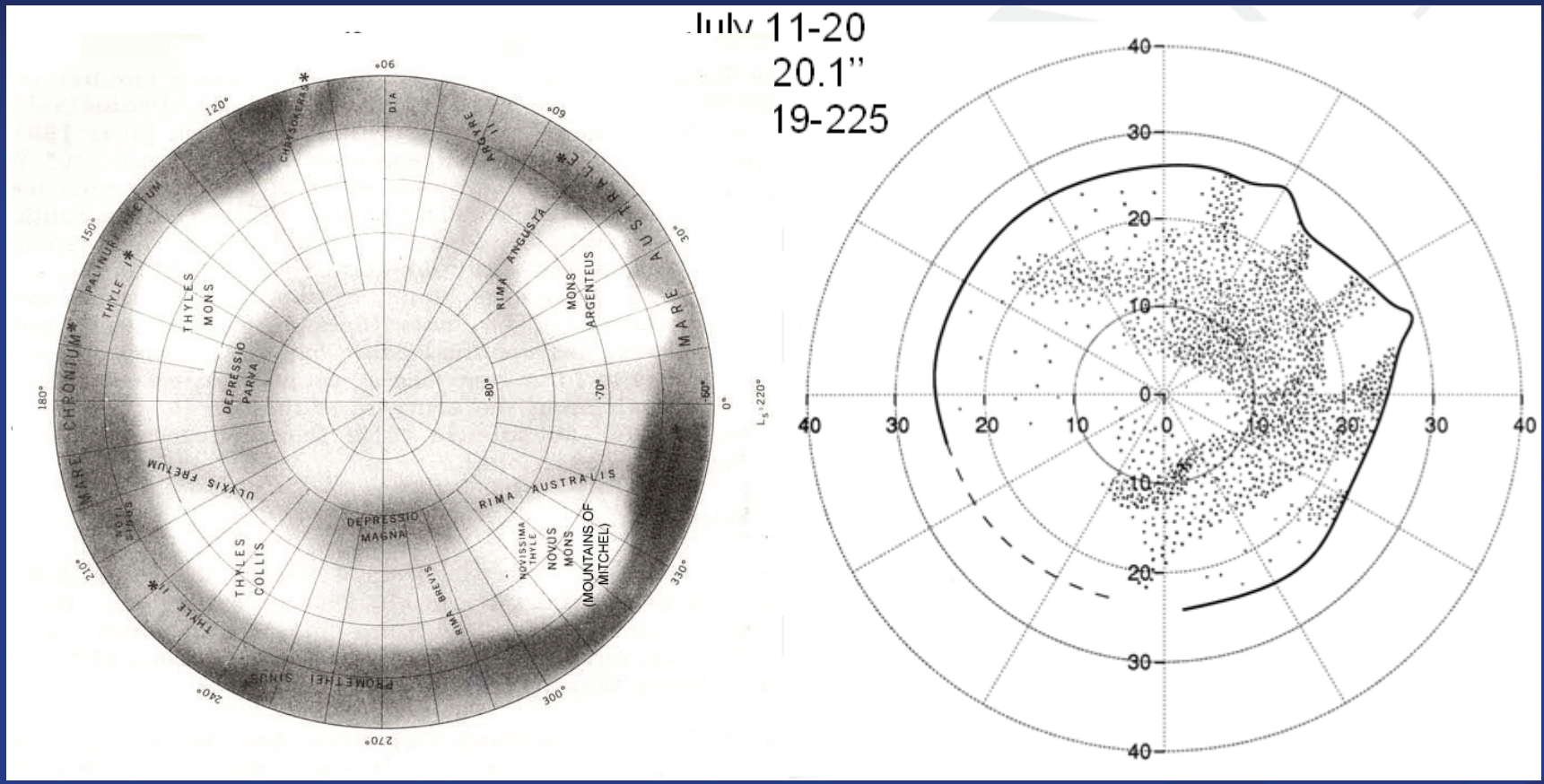
Building polar maps

- Same set of measurements
- 7 x 10-days intervals + 20-days
- Polar projection

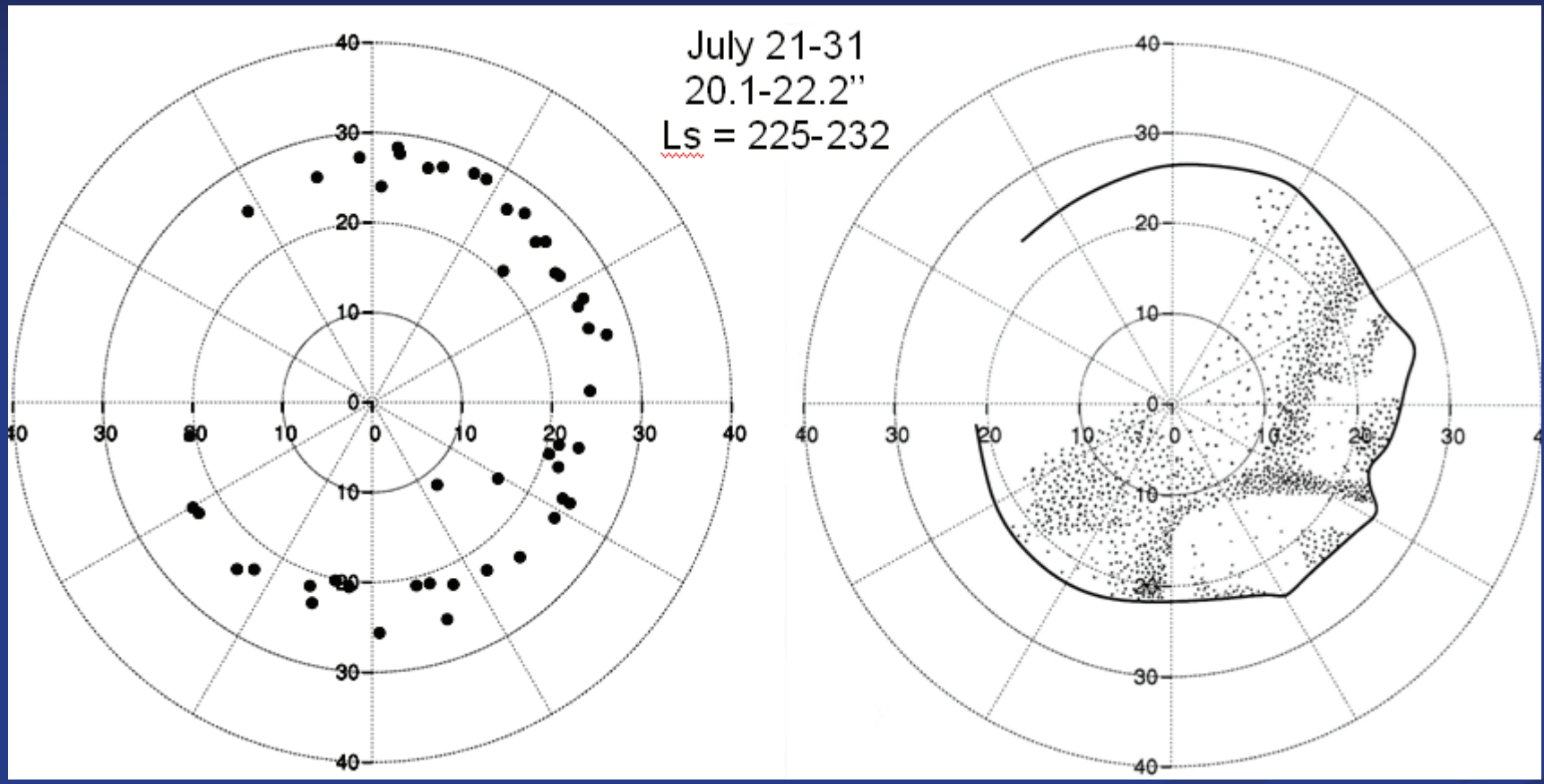
- Addition of measured albedo features

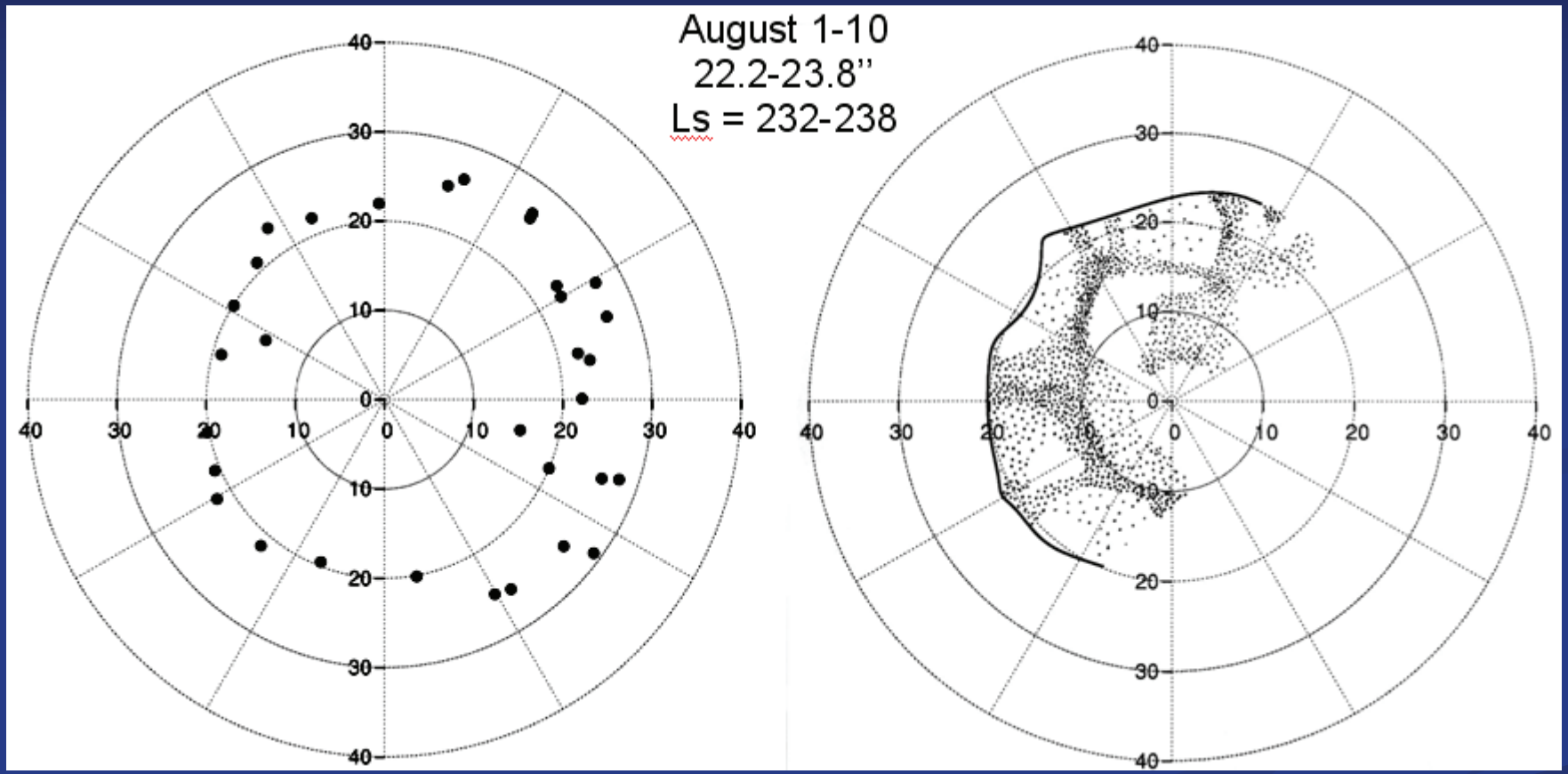
July 1-10
16.6-18. 3''
Ls = 213-219

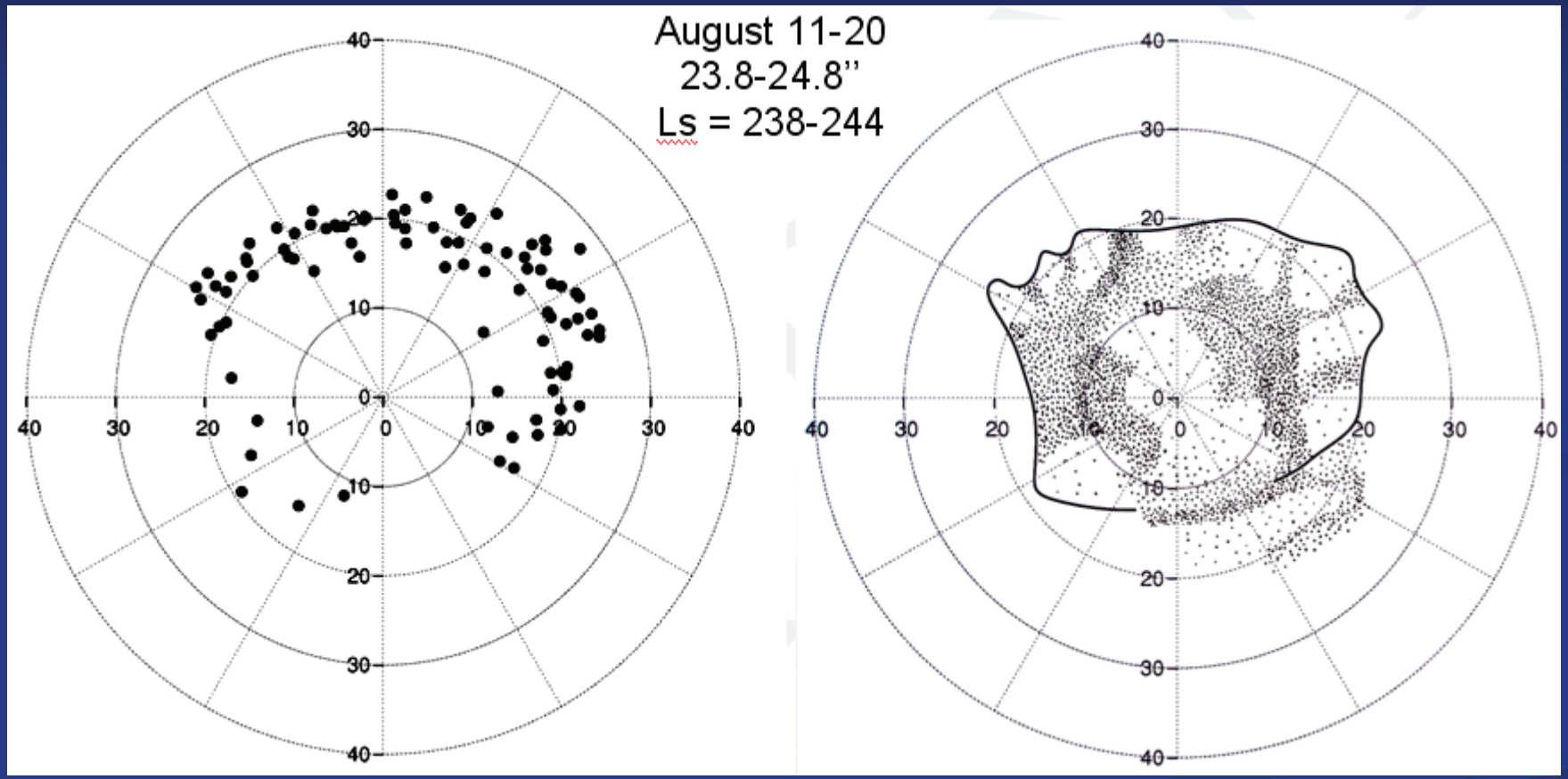




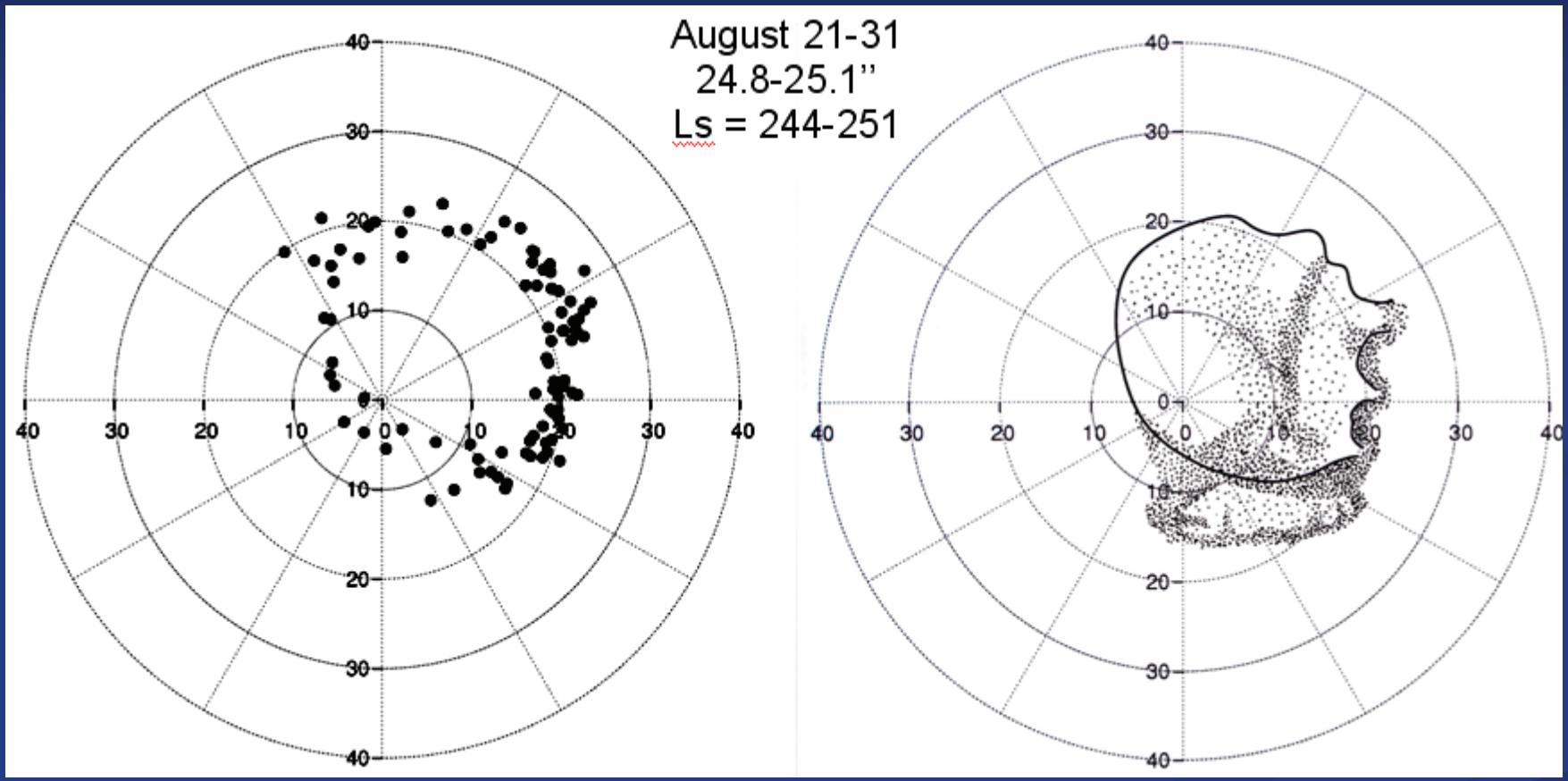
De Vacouleurs, 1950

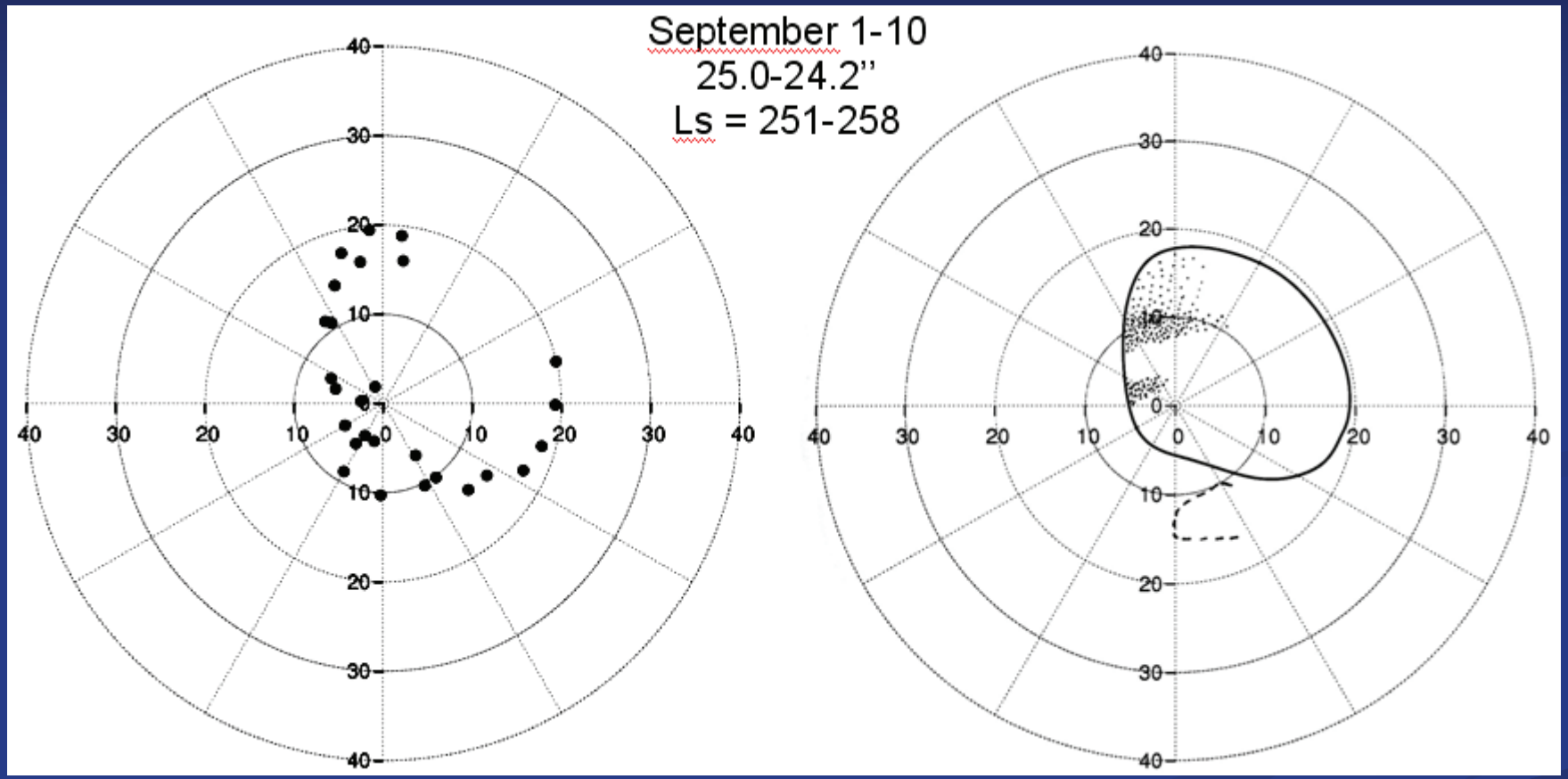

July 21-31
20.1-22.2''
Ls = 225-232
40
30
20
10
0
10
20
30
40

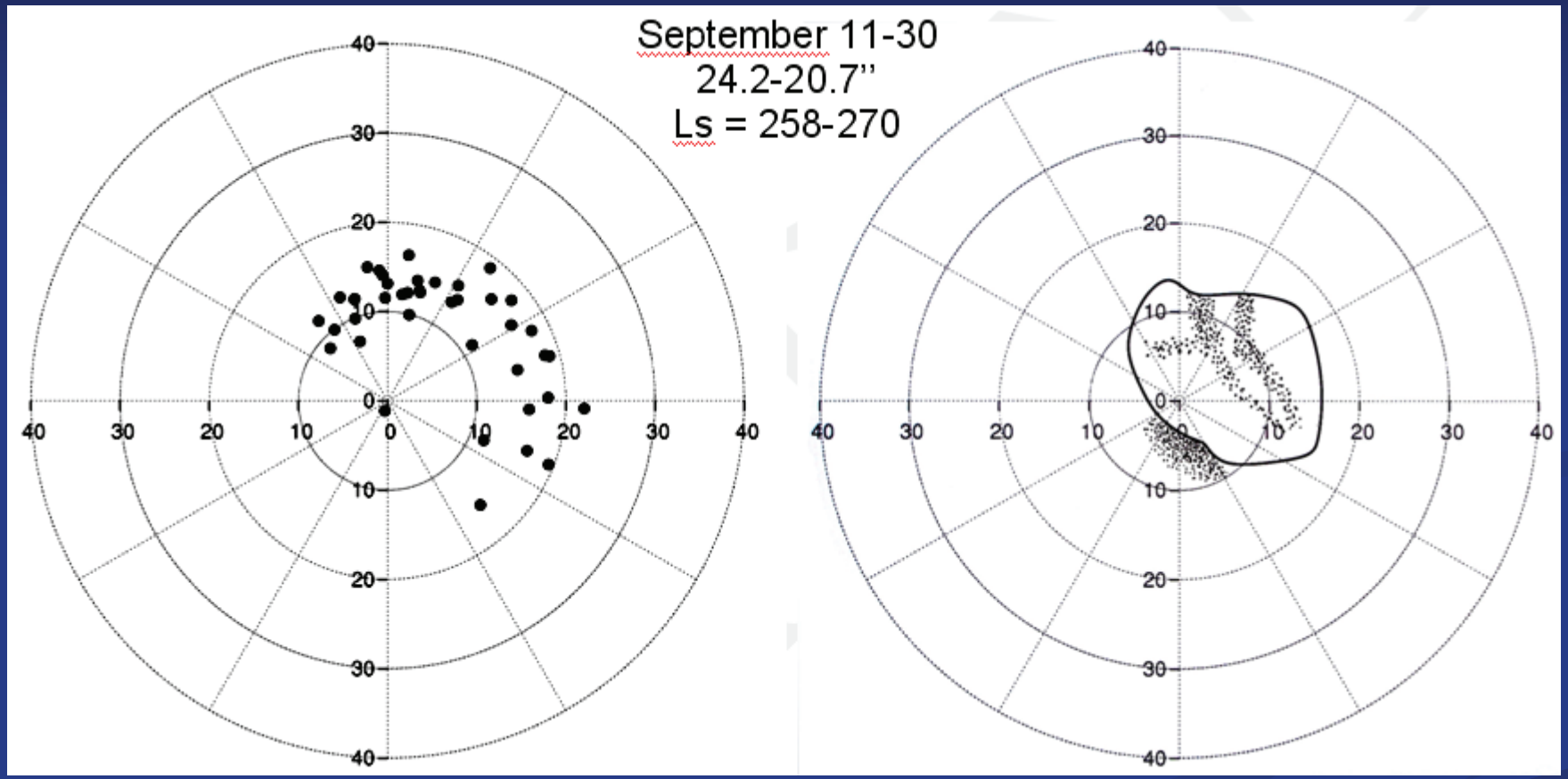

August 1-10
22.2-23.8''
Ls = 232-238
40
30
20
10
0
10
20
30
40


August 11-20
23.8-24.8''
Ls = 238-244
40
30
20
10
0
10
20
30
40

August 21-31
24.8-25.1''
Ls = 244-251

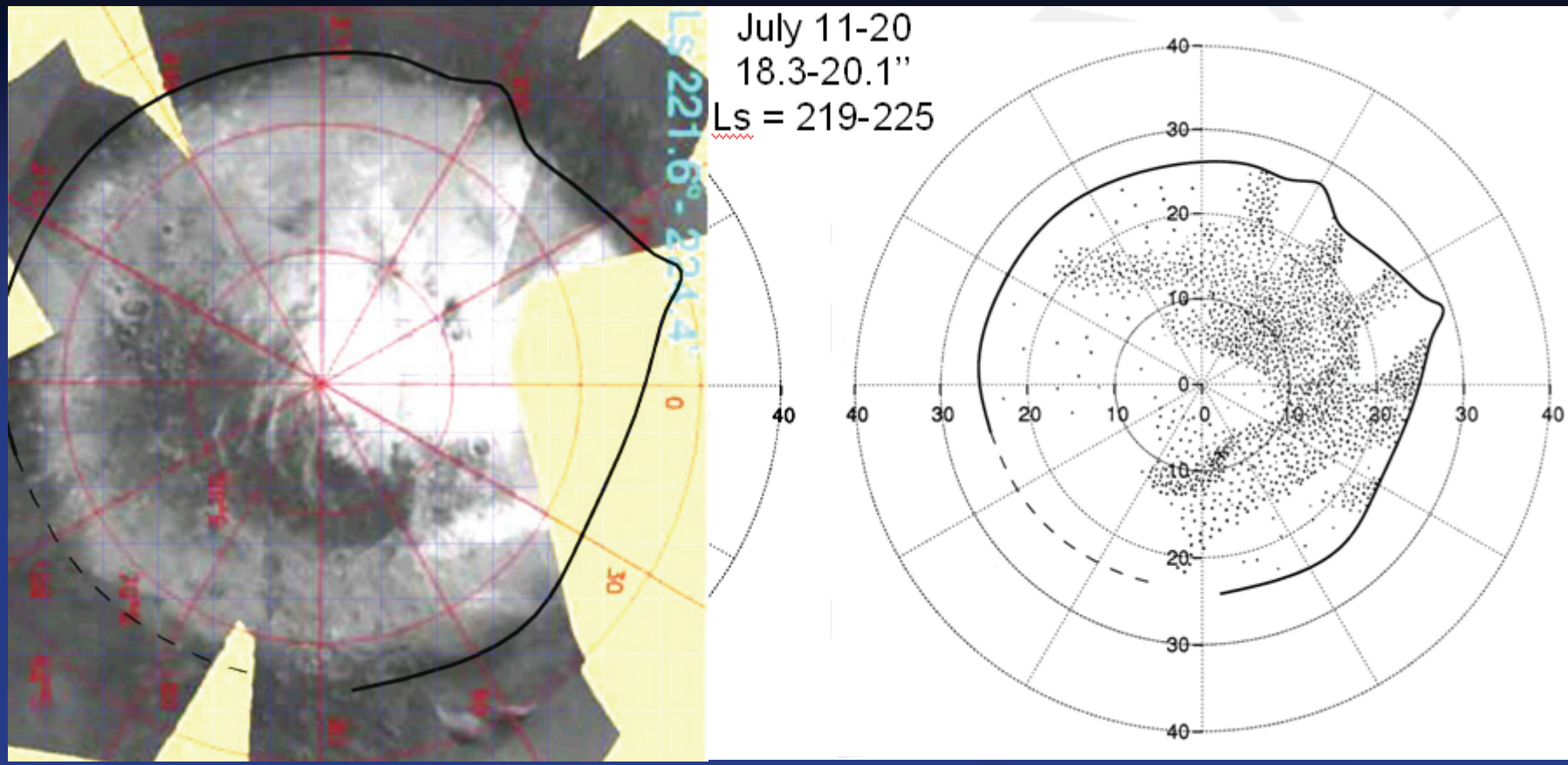



September 1-10
25.0-24.2''
Ls = 251-258
40
30
20
10
0
10
20
30
40

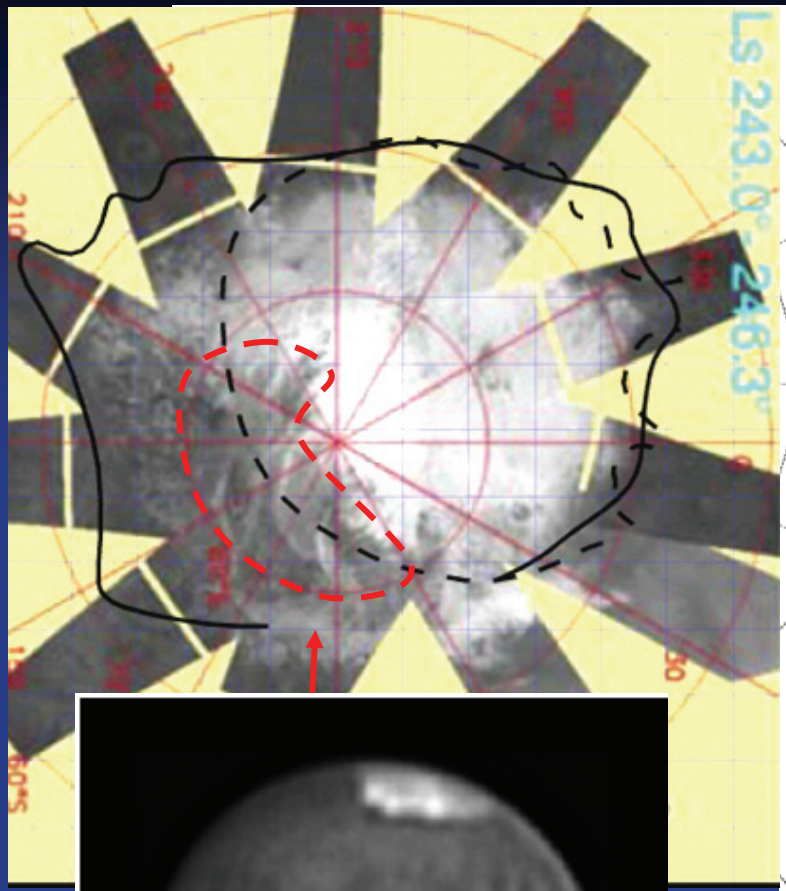

September 11-30
24.2-20.7''
Ls = 258-270
40
30
20
10
0
10
20
30
40

Comparison to Mars Express (ESA) imaging

- Polar albedo maps published in Langevin, Journal of Geophysical Res. (2007) 112, E8, E08S12
- VIMMS, 1.08 μm (CO_2)
- Obtained during the *2005* SPC regression



- Maximum discrepancy: ~3 degree
- « Soft » cap boundary in Mars Express images



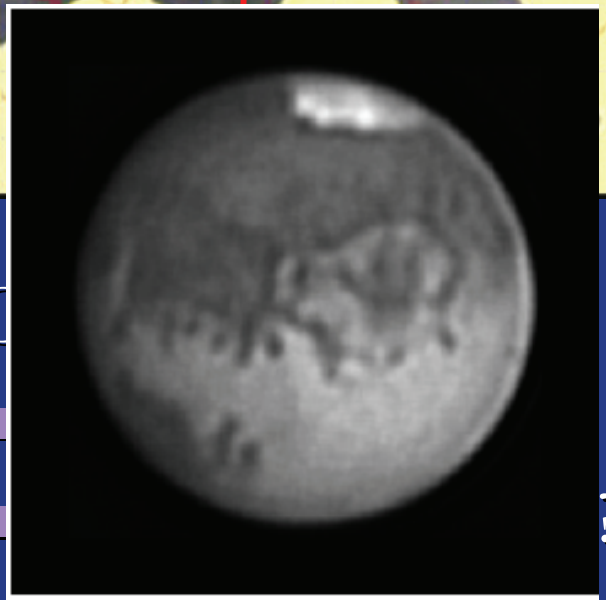
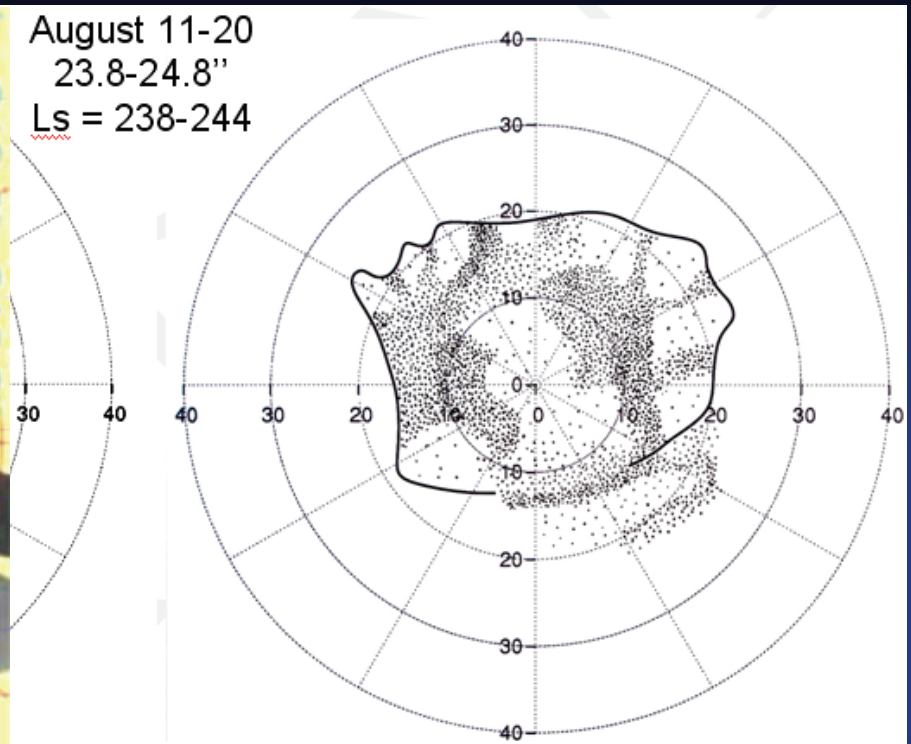
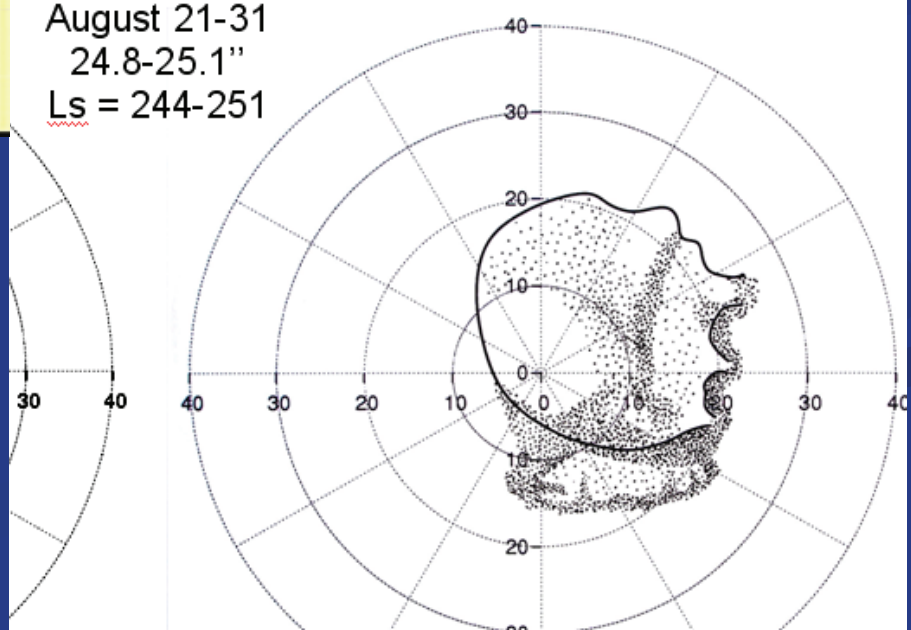
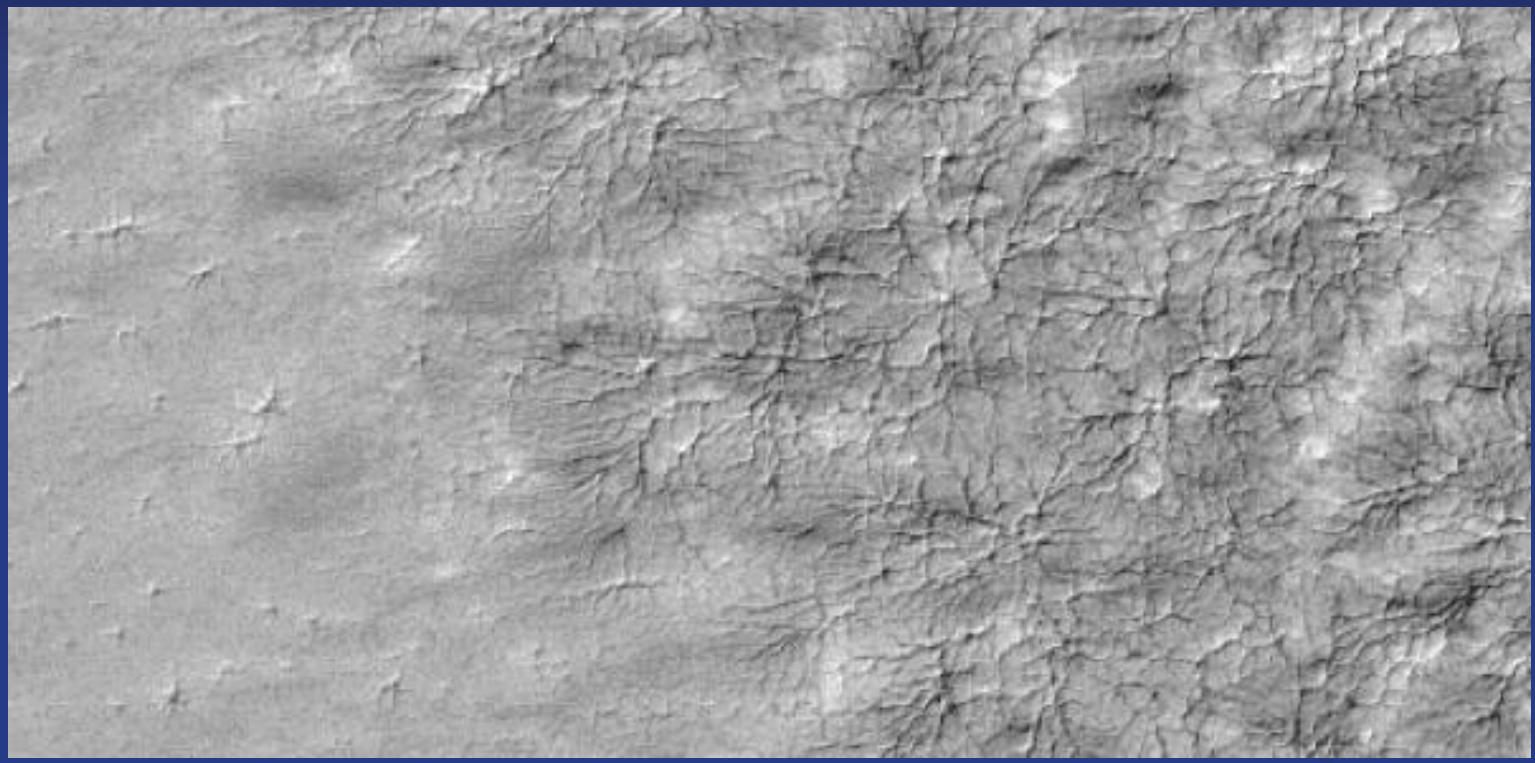


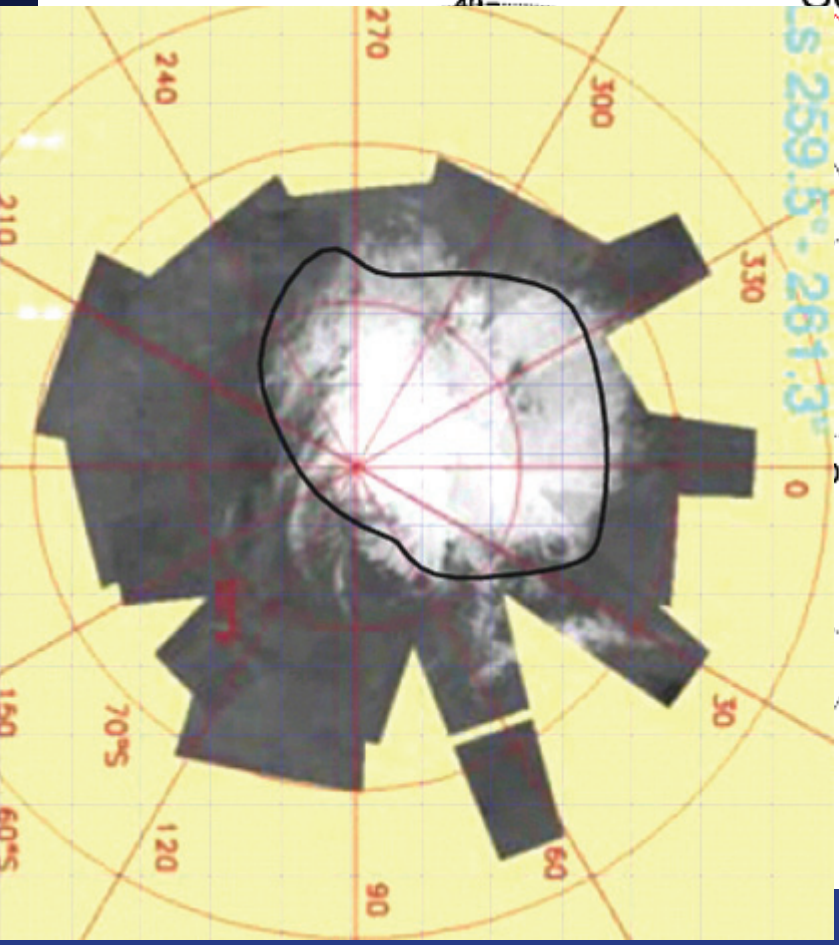
Figura 10. D. Licchelli, 15/08/2003



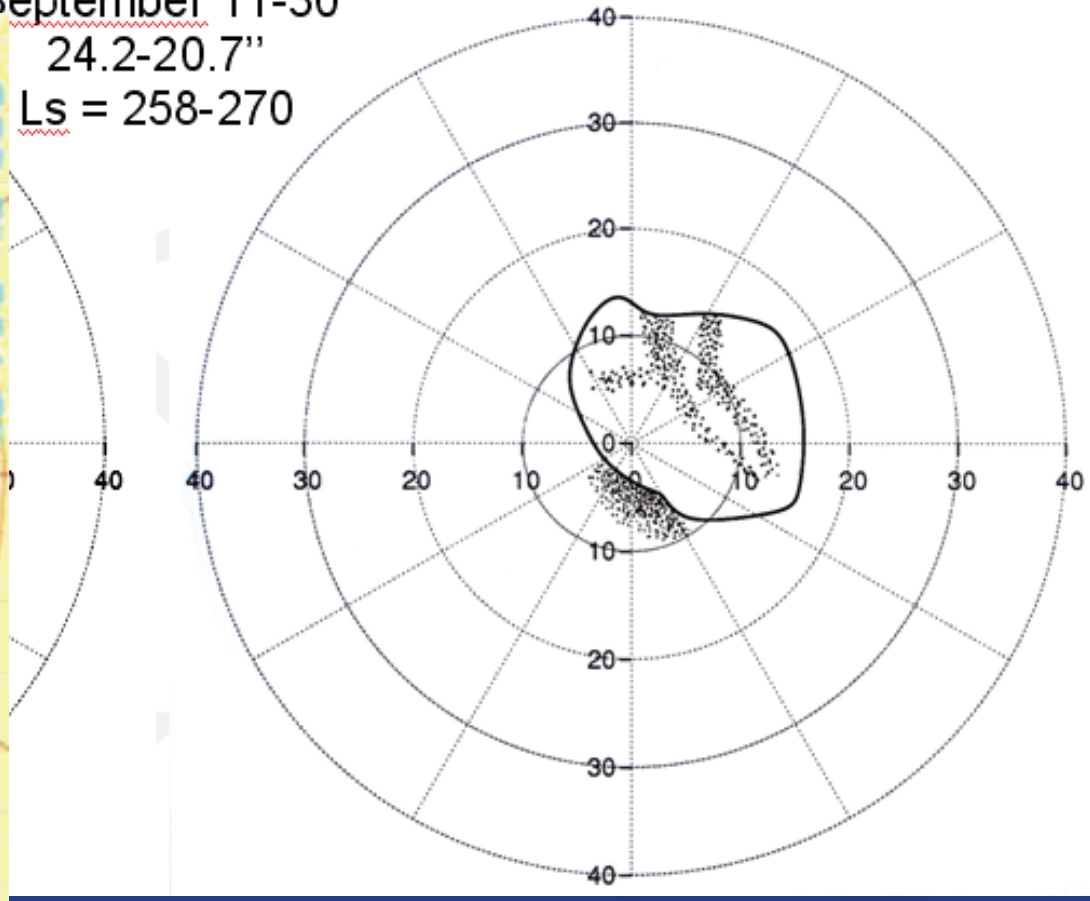


Cryptic region « spiders »





September 11-30
24.2-20.7''
Ls = 258-270



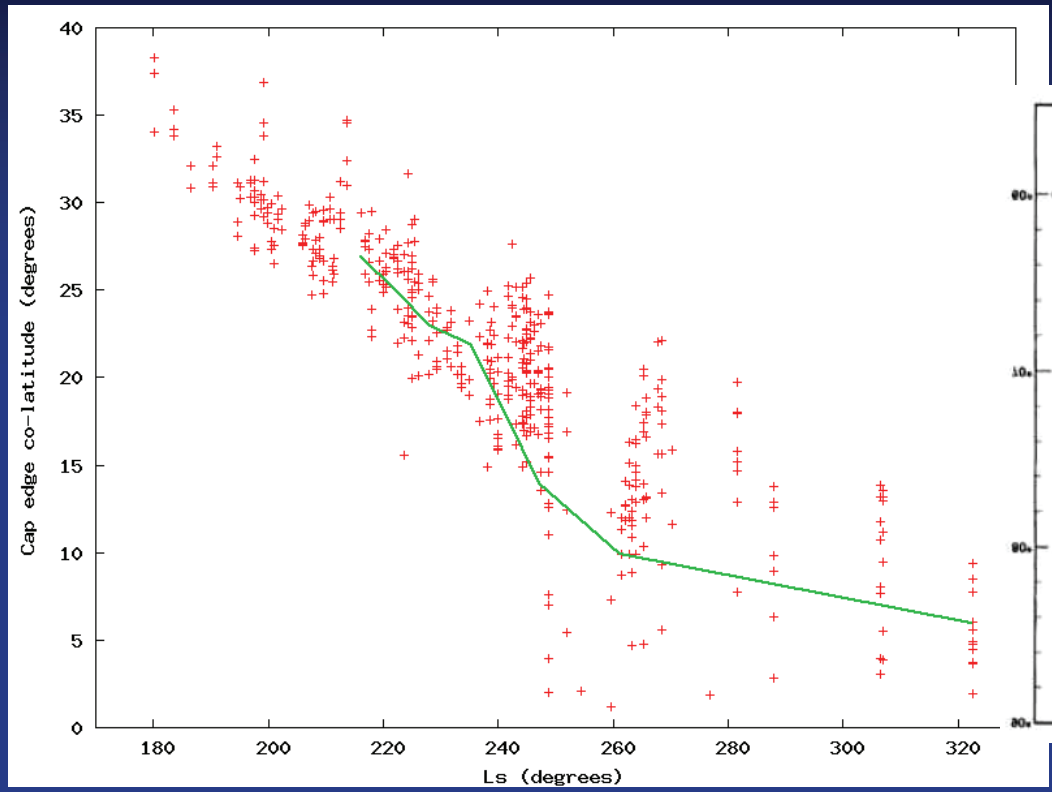
Comparison to Mars Express (conclusion)

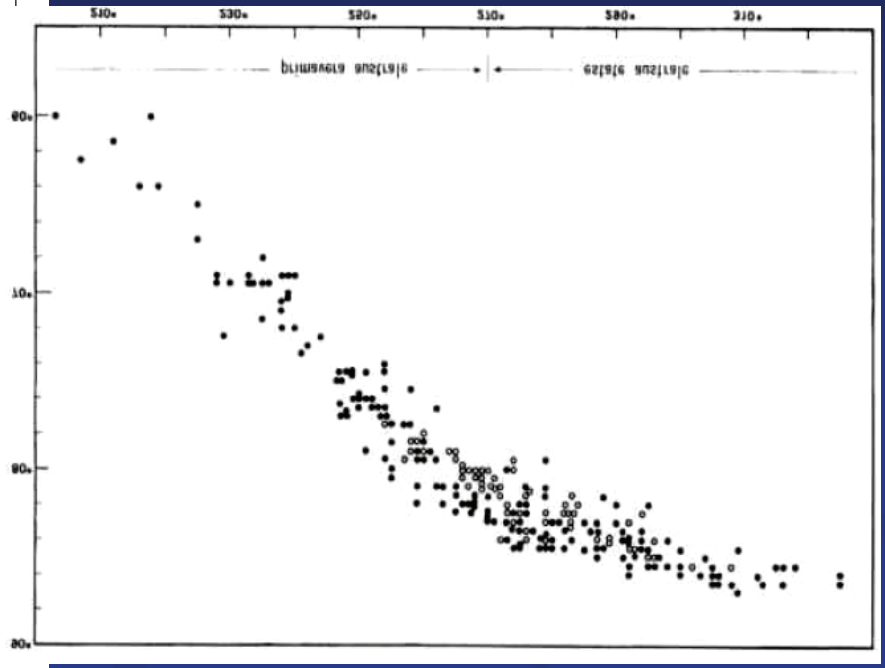
- Several analogies, general agreement on the cap boundary
- Details differ: exact location of the boundary, shadings…

Why?

- Different geometry of observation
- Calibration
- Image enhancement (dark collar, contrast alteration…)
- Different wavelength

Average regression curve





Falorni, 1988

- Modern CCD measurements compare well to « old » visual data (less with photographic ones!)

Conclusions

- The exploitation of information in CCD images requires appropriate software and techniques
  - Do we have the needed tools? Do amateurs follow the appropriate procedures?
    - For measuring intensities, colors
    - For mapping features
    - …
- Comparison of data is always hard (differences in approach)…
- …but successful, at least in part