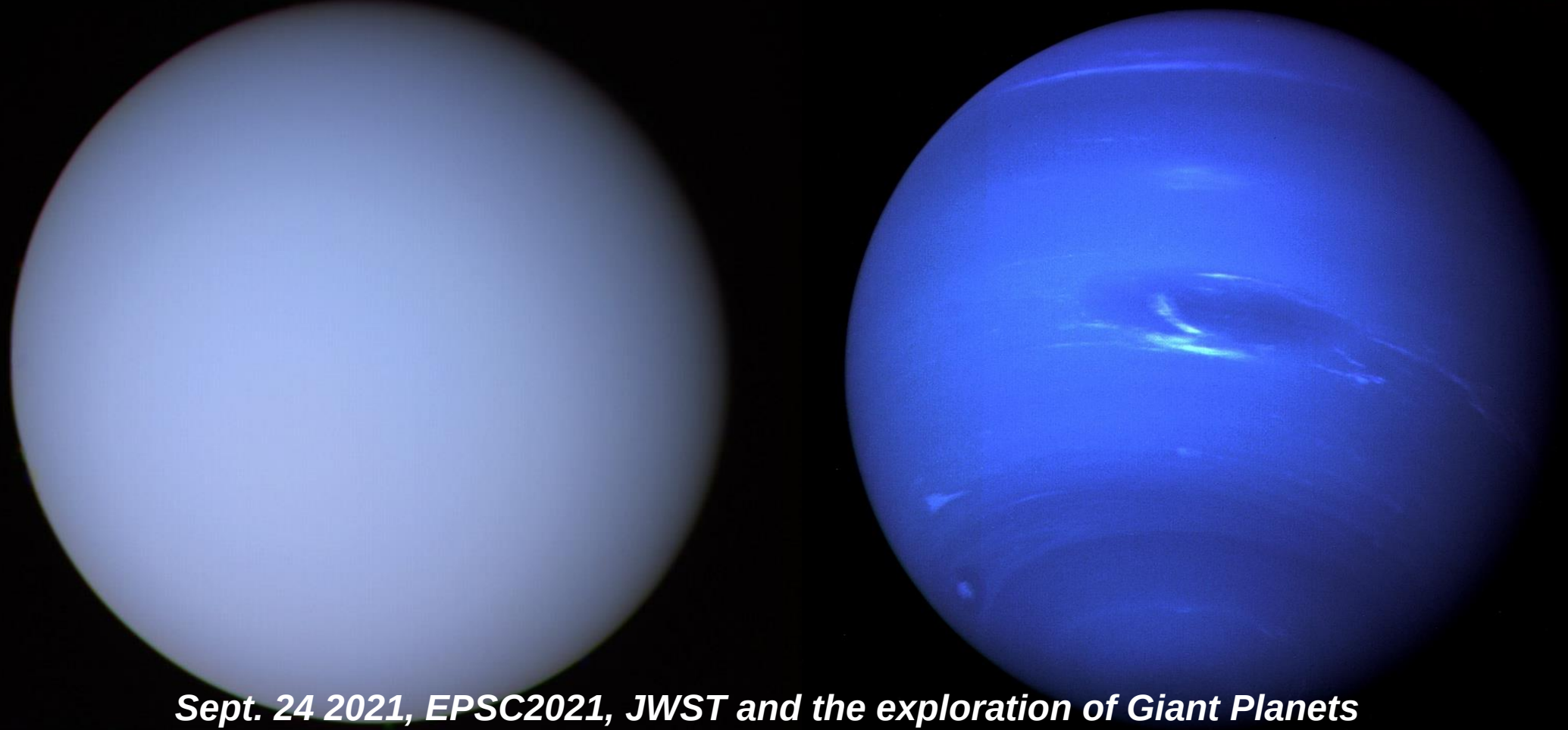
Uranus and Neptune amateur observations



Sept. 24 2021, EPSC2021, JWST and the exploration of Giant Planets

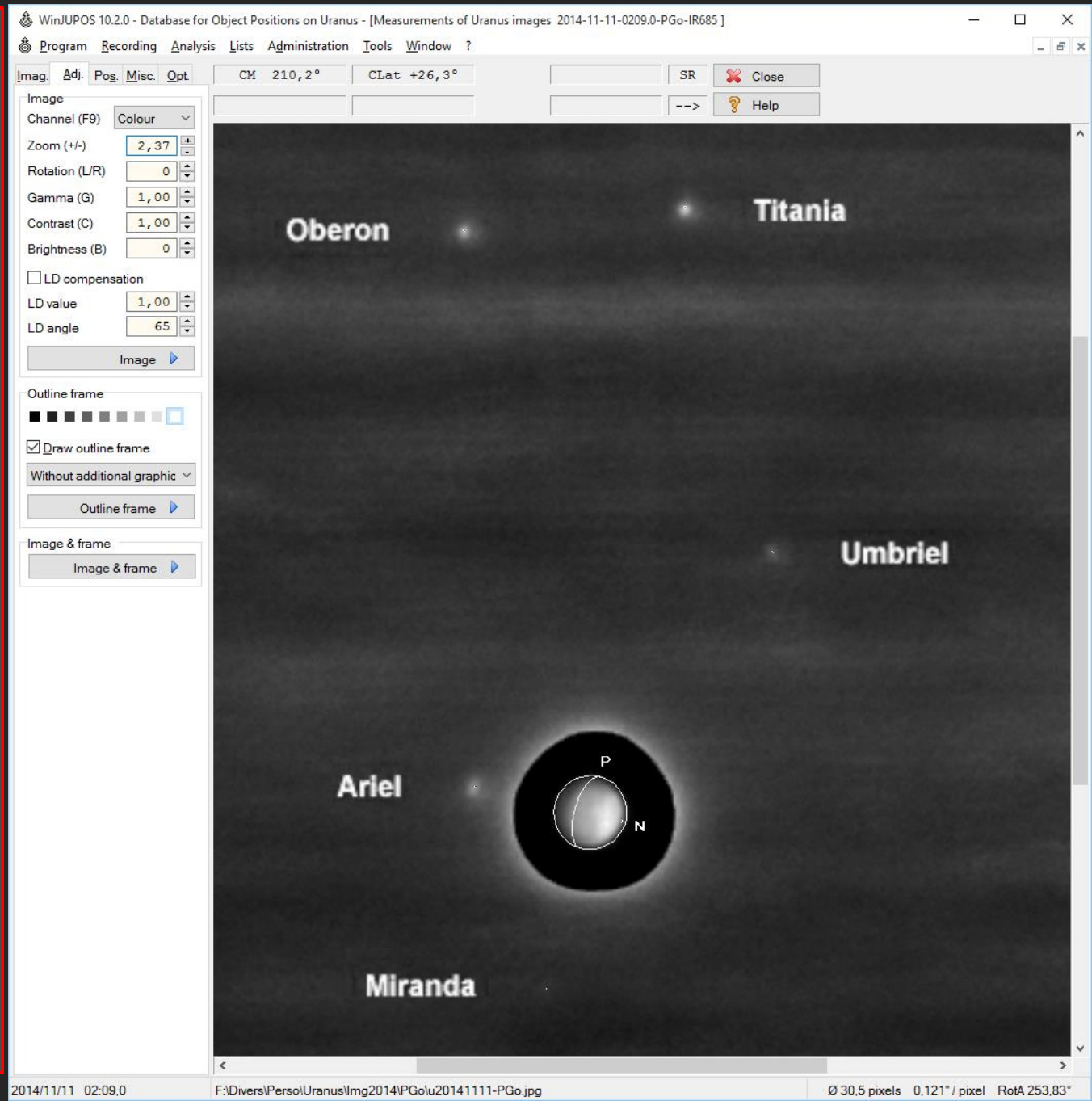
Marc Delcroix *(delcroix.marc@free.fr),*

Planetary Observations section, French Astronomical Society (SAF)

© NASA (Voyager)

Prerequisites required for best measurements

- acquisitions **duration limit** (~10-15min for Uranus, 20-25min for Neptune) to avoid elongation of potential feature
- **Mid-time** acquisition information (7.5min difference implies 2.6° long. difference on Uranus !)
- **Satellite(s) visible** for calibrating contour orientation (not enough features visible on the planet) and size (turbulence and processing makes it very variable). **Don't touch histogram black level!**



© NASA (Voyager)

1986: faint activity (Voyager 2)

1994: discrete clouds (HST)

1997+: growing # of clouds (HST, IRTF)

2000+: regular Keck detections

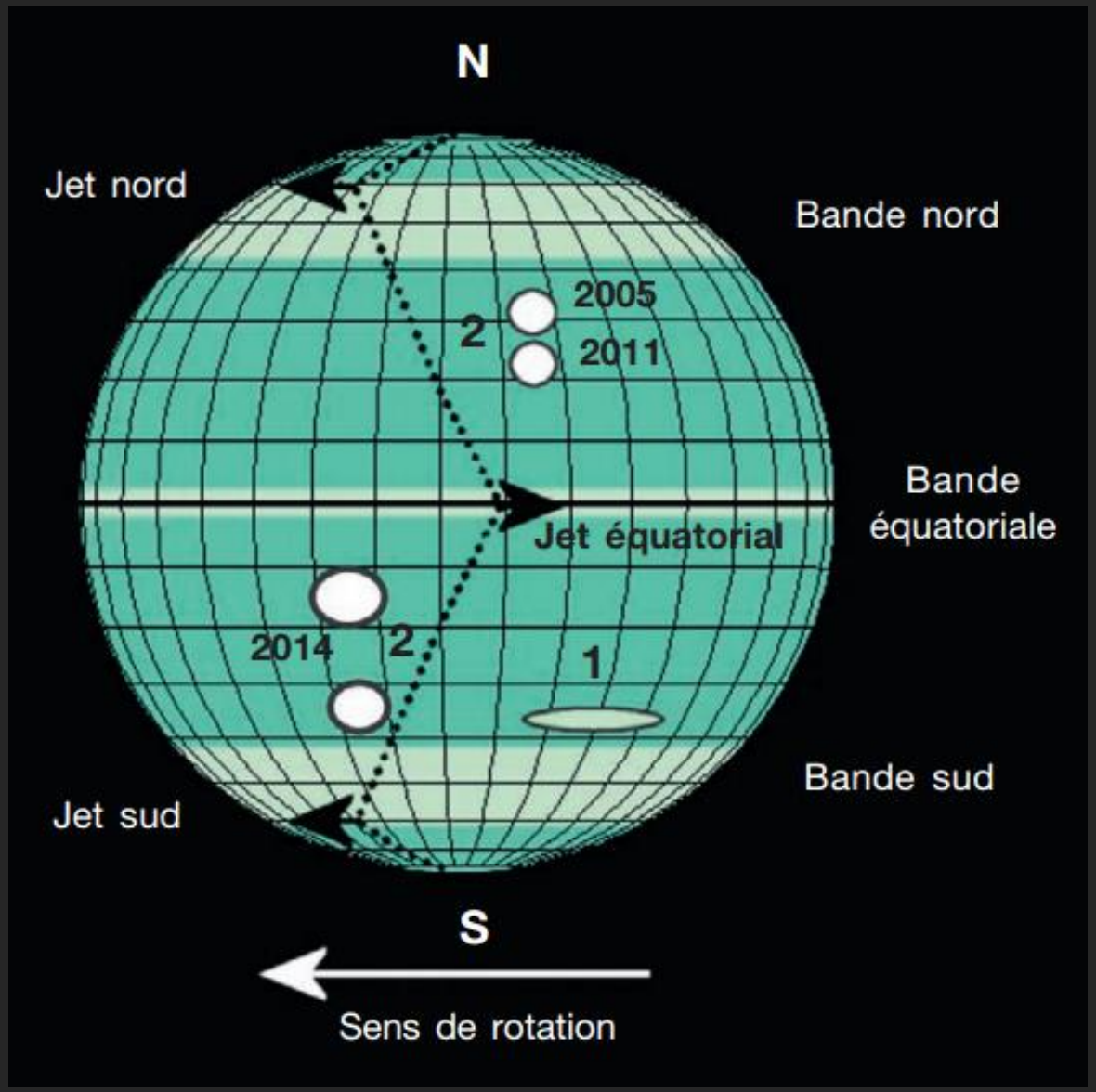
2004-2009: major long-lived storm “the Berg” in Southern hemisphere

2005: convective eruption detected (Keck) in Northern hemisphere

2007: **spring equinox**

2011: convective eruption detected (Gemini) in Northern hemisphere

2014: **major outbreak detected in Southern hemisphere** (Keck on Aug. 5th), retrieved by amateurs



© Pellier C., Delcroix M., Viladrich C. et al. 2015 - Astronomie planétaire observer, comprendre et étudier les planètes – Axilone – available in English!

Hammel H. et al. 2005 - New Cloud Activity on Uranus in 2004-First Detection of a Southern Feature at 2 .2 microns - Icarus jan. 2005
Sromovsky L. et al. 2012 - Episodic bright and dark spots on Uranus - Icarus vol.220 issue 1 pp 6-22, 2012
de Pater I. et al. 2015 - Record-breaking storm activity on Uranus in 2014 - Icarus vol.252 pp121-128 2015

Uranus - 2014-09-11 - R>685nm (30min acquisition of 300ms exposures, gain 95%, orientation detfined from Ariel/Umbriel/Oberon)
diam. 3.7" - mag. 5.7 - alt. 48° - L_{sun}=14°, D_{sun}= 26.2°, D_{earth}= 27.5°

02h51UT CMI 254.6°
(unsharp mask, resized x200%, 30min acquisition, 2500 frames)

First amateur confirmation
Sept. 11th, 2014

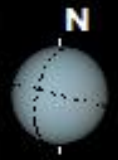
Measures of spot's position:
(longitude, planetographic latitude)
02h51.0 UT: 271.8° +/-5° L1, 35.1°N +/-5°

02h43.5UT: 273.5° +/-5° L1, 34.8°N +/-5°
02h58.5UT: 271.0° +/-5° L1, 35.1°N +/-5°

02h43.5UT CMI 252.0°
(slight unsharp mask, resized x200%, first 15min)

02h58.5UT CMI 257.2°
(slight unsharp mask, resized x200%, last 15min)

Régis DE-BENEDICTIS (analysis by Marc Delcroix) - France
Schmidt-Cassegrain 356mm - PLA-Mx - 0.067"/pixel (0.115"/pixel at acquisition)



Uranus 2014/09/27 01h43 ut
CM 329,6°

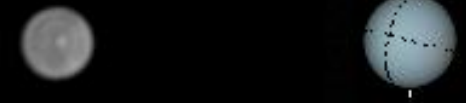
Redim 200%

LE GALL YANN
NEWTON 374mm F/D 23
MANTA 283
FILTRE IR 685 BAADER
ADC

Uranus 2014/09/27 02h13 ut
CM 340,1°

Redim 200%

LE GALL YANN
NEWTON 374mm F/D 23
MANTA 283
FILTRE IR 685 BAADER
ADC

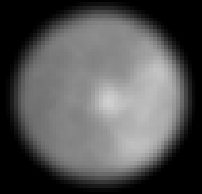


Uranus

2014-10-01
23:07.0 UT CM 261,1°

Redim 200%

LE GALL YANN
NEWTON 374mm F/D 23
MANTA 283
FILTRE IR 685 BAADER
ADC

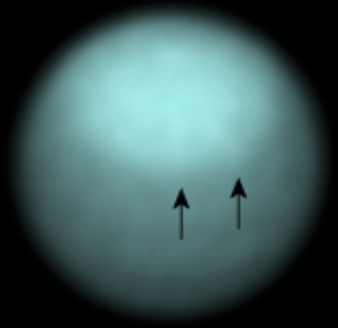


A bright storm on Uranus
Filter: 650 - 850nm
Capture time: 15 minutes @ 6.6fps

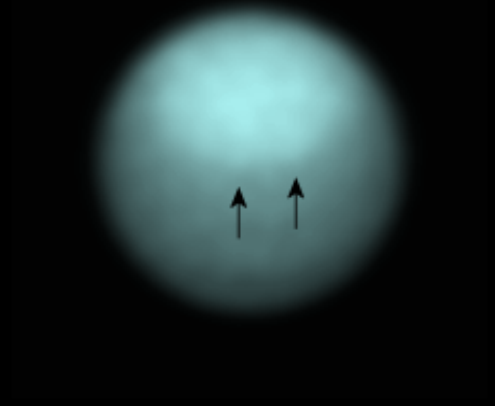
Uranus 2 Oct 2014 15:18.8 Z CM:240.0
Anthony Wesley, Murrumbateman Australia


Uranus - 2014-10-04 - IR>685nm 00h52.7UT (24.0min derotation)
diam 3.7'' - mag 5.7 - alt. 51° - CM 220.2° - D sun = 26.5°, D earth = 26.7°, L sun = 14°
Oct. 4th, 2014
Amateur using 1 meter
Pic du Midi telescope
N
106cm Cassegrain, Pic du Midi, France - ZWO ASI120MM-S - 0.043"/pixel
(c) S2P/IMCCE/OMP/M. Delcroix/F. Colas

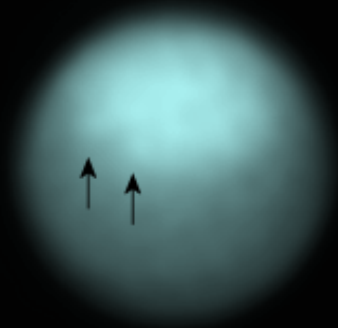
2019
example of projections outside of North polar hood



Stack of best 15% of 6min video centred at 21-59UT on 2019-12-03 610nm filter
Spots estimated at;
L166° B" 44°
L138° B" 46° (v.difficult)

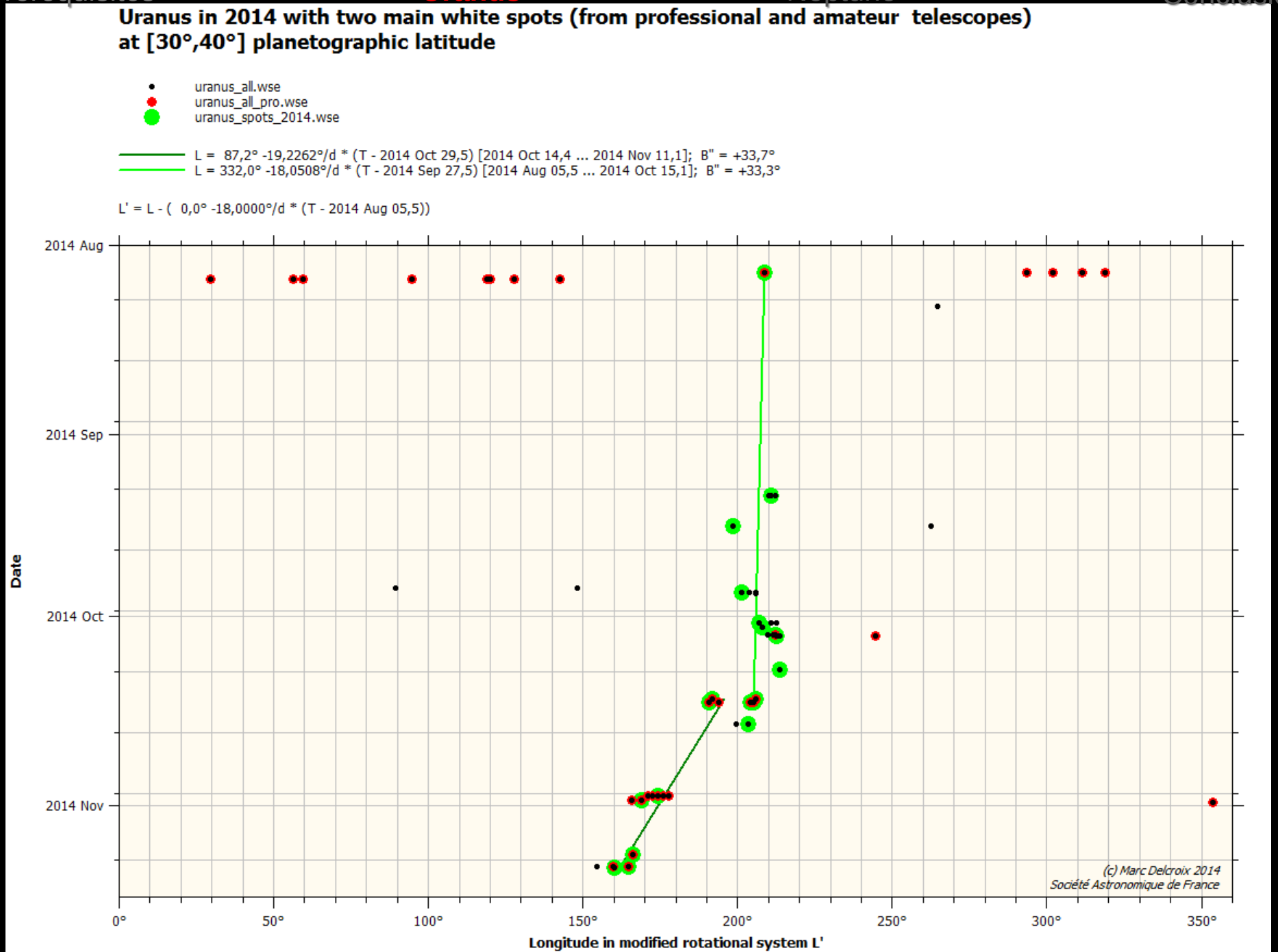


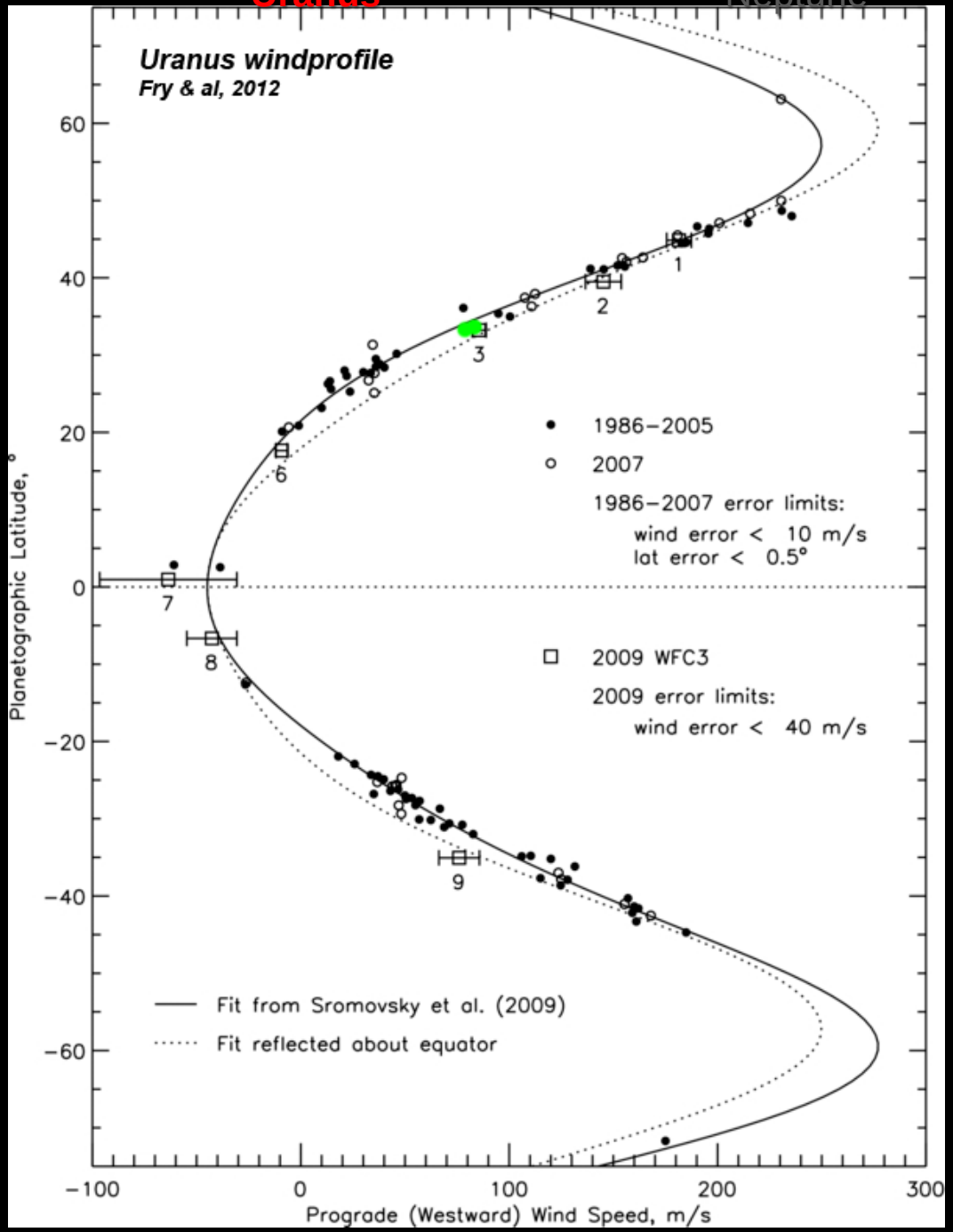
Stack of best 15% of 8min video centred at 22-32UT on 2019-12-03 610nm filter
Spots estimated at;
L168° B" 45°
L138° B" 46°

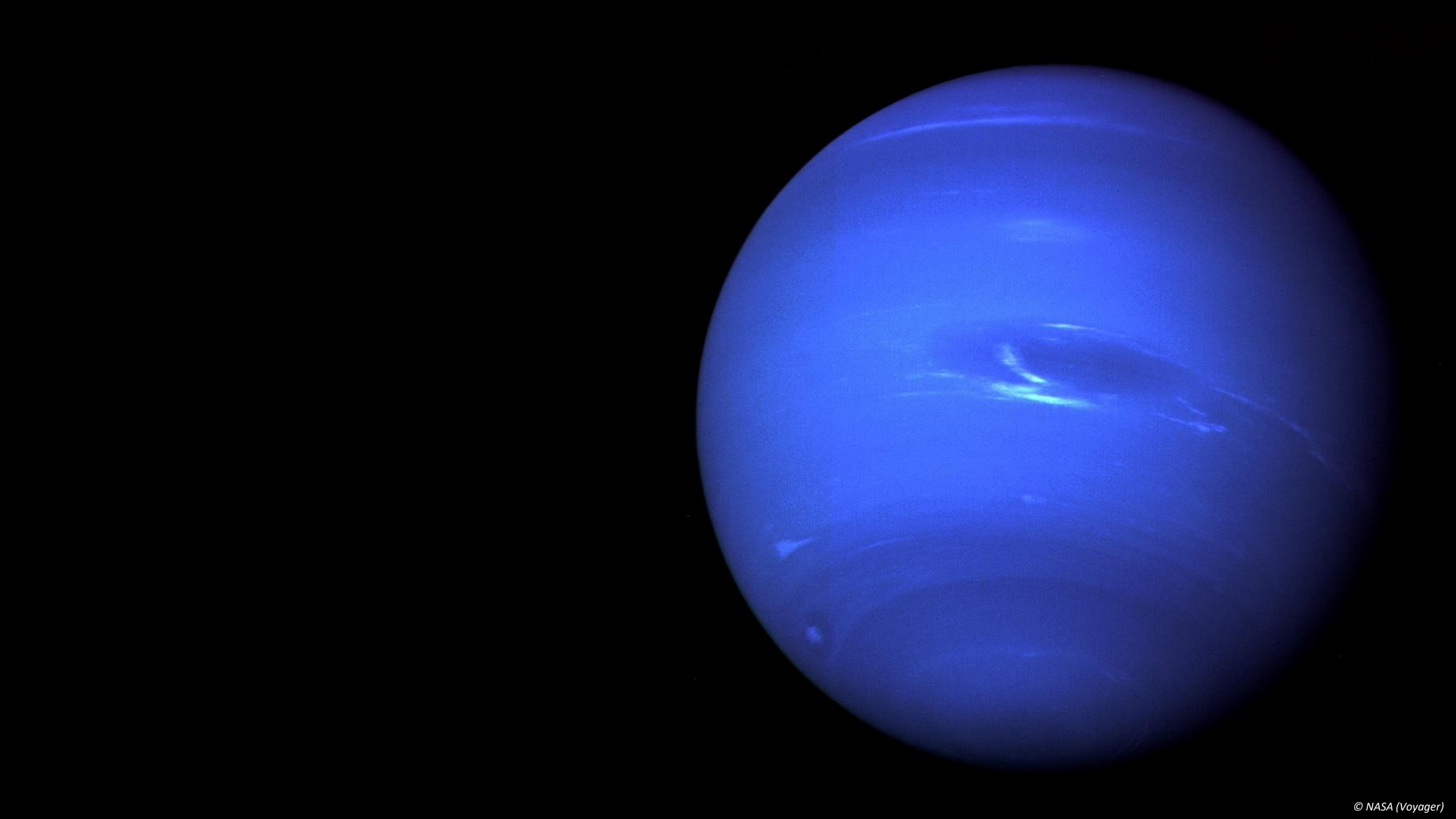


Stack of best 27% of 6min video centred at 00-13UT on 2019-12-04 685nm filter
Spots estimated at;
L159° B" 51°
L128° B" 50°

Uranus in IR 2019-12-03/04 *MRLewis StAlbans, UK 444mm Dobsonian imaged at 0.11"/pix with ASI290MM camera and 610nm 685nm filters. Dia 3.7" Alt 49°*


Uranus in 2014 with two main white spots (from professional and amateur telescopes)
at [30°,40°] planetographic latitude
uranus_all.wse
uranus_all_pro.wse
uranus_spots_2014.wse
L = 87,2° -19,2262°/d * (T - 2014 Oct 29,5) [2014 Oct 14,4 ... 2014 Nov 11,1]; B" = +33,7°
L = 332,0° -18,0508°/d * (T - 2014 Sep 27,5) [2014 Aug 05,5 ... 2014 Oct 15,1]; B" = +33,3°
L' = L - (0,0° -18,0000°/d * (T - 2014 Aug 05,5))
2014 Aug
2014 Sep
2014 Oct
2014 Nov
Date
0°
50°
100°
150°
200°
250°
300°
350°
Longitude in modified rotational system L'
(c) Marc Delcroix 2014
Société Astronomique de France


Uranus windprofile
Fry & al, 2012
Planetographic Latitude, °
60
40
20
0
−20
−40
−60
−100
0
100
200
300
Prograde (Westward) Wind Speed, m/s
1
2
3
6
7
8
9
1986−2005
2007
1986−2007 error limits:
wind error < 10 m/s
lat error < 0.5°
2009 WFC3
2009 error limits:
wind error < 40 m/s
Fit from Sromovsky et al. (2009)
Fit reflected about equator



© NASA (Voyager)

1963: spring equinox

1989: important activity (Voyager 2) (Great Dark Spot" - South of equator, "scooter" - South hemisphere, …)

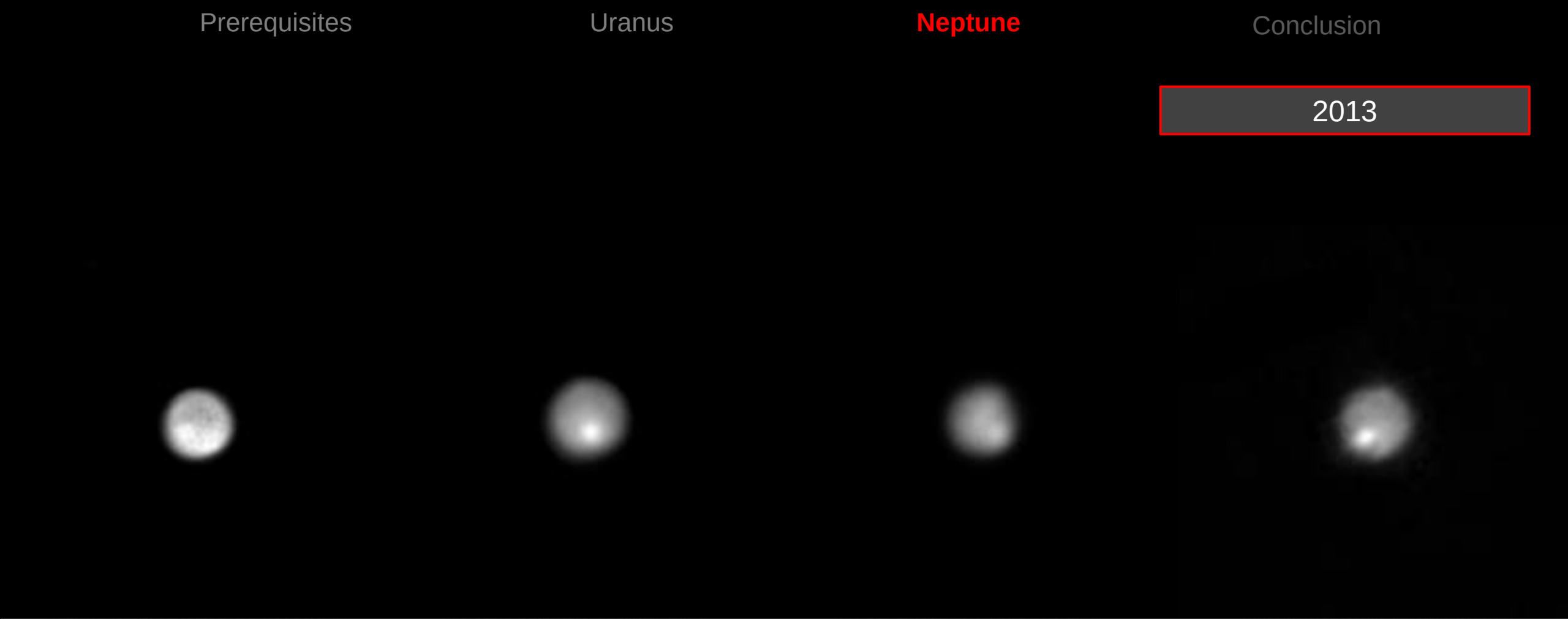
1994+: many spots (HST, ...) - increasing activity in Southern hemisphere

2005: **summer solstice**

2011: **activity observed**

2015: **Major outbreak** detected with Keck on Aug. 5th/6th

2013



2013-07-01 02h57.3UT
Marc Delcroix/François Colas
(Pic du Midi, France - 100cm)

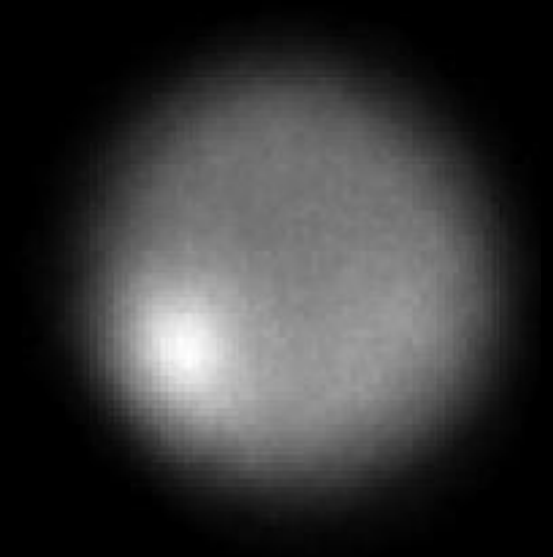
2013-08-25 04h45UT
Peter Gorczynski
(USA - 36cm)

2013-08-25 06h27UT
John Boudreau
(USA - 36cm)

2013-09-08 05h06UT
Paul Jones
(USA - 38cm)

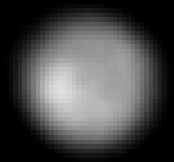
2014

Pic du Midi 1m telescope, Oct. 3rd 2014



© S2P/IMCCE/OMP M/Delcroix M./F.Colas

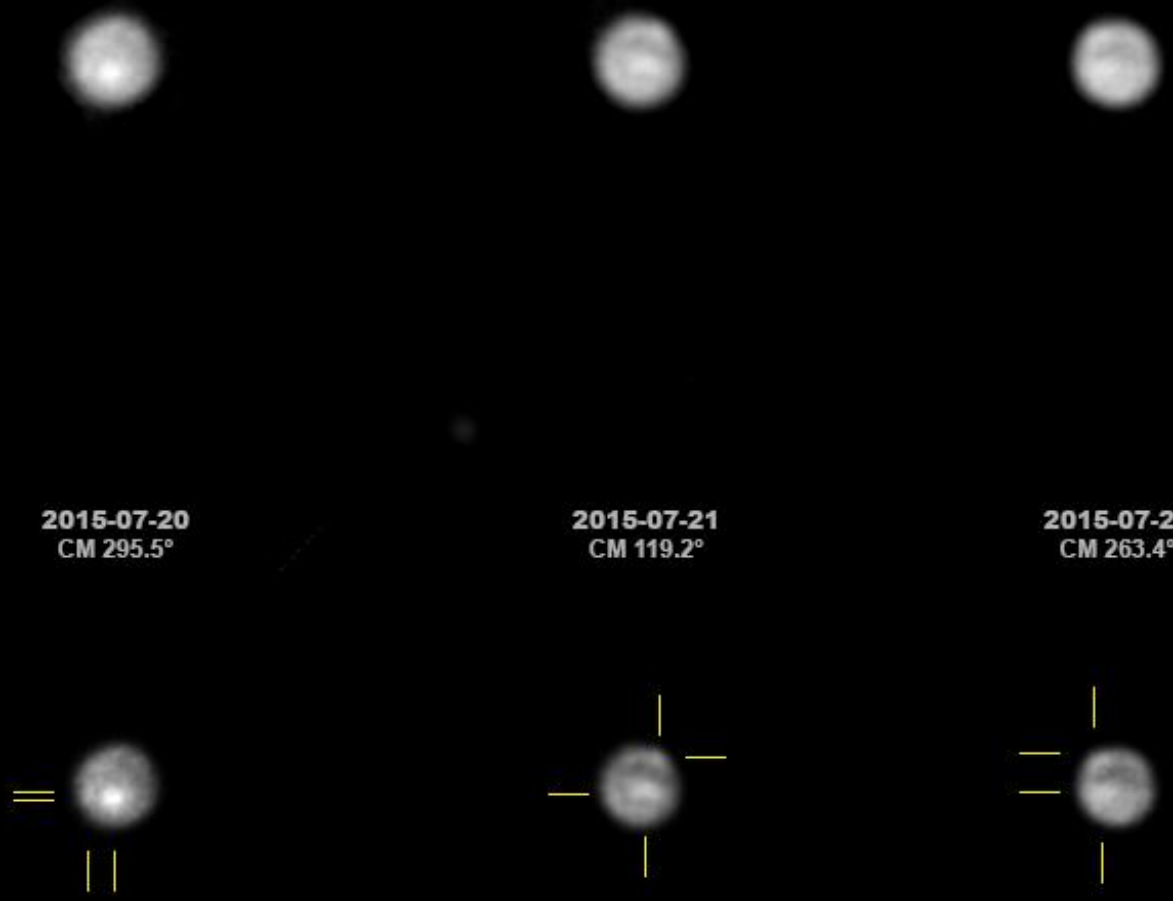
Oct. 7th 2014



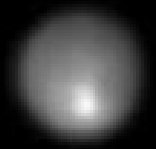
© A. Wesley

Neptune & Triton

2015



John Sussenbach



Neptune
UT 13:52:51 Sept. 18th 2015

D. Millika & Pat Nicholas

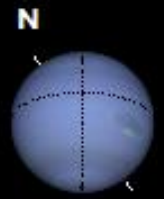
SEPTEMBER 24th, 2015
21:44 UTC (25min)
RG610 filter LRGB
N
P

1 September 2015 21.56 UT
C14 f/22, ASI224MC camera
and 742 nm filter

Triton

Diam: 2.35"

D. Peach



2019

False Colour
R + IR

Neptune 3 Oct 2019 12:46.2 Z CMIII:253.6
Anthony Wesley, Rubyvale QLD Australia

Yesterday ;)

Neptune

Triton

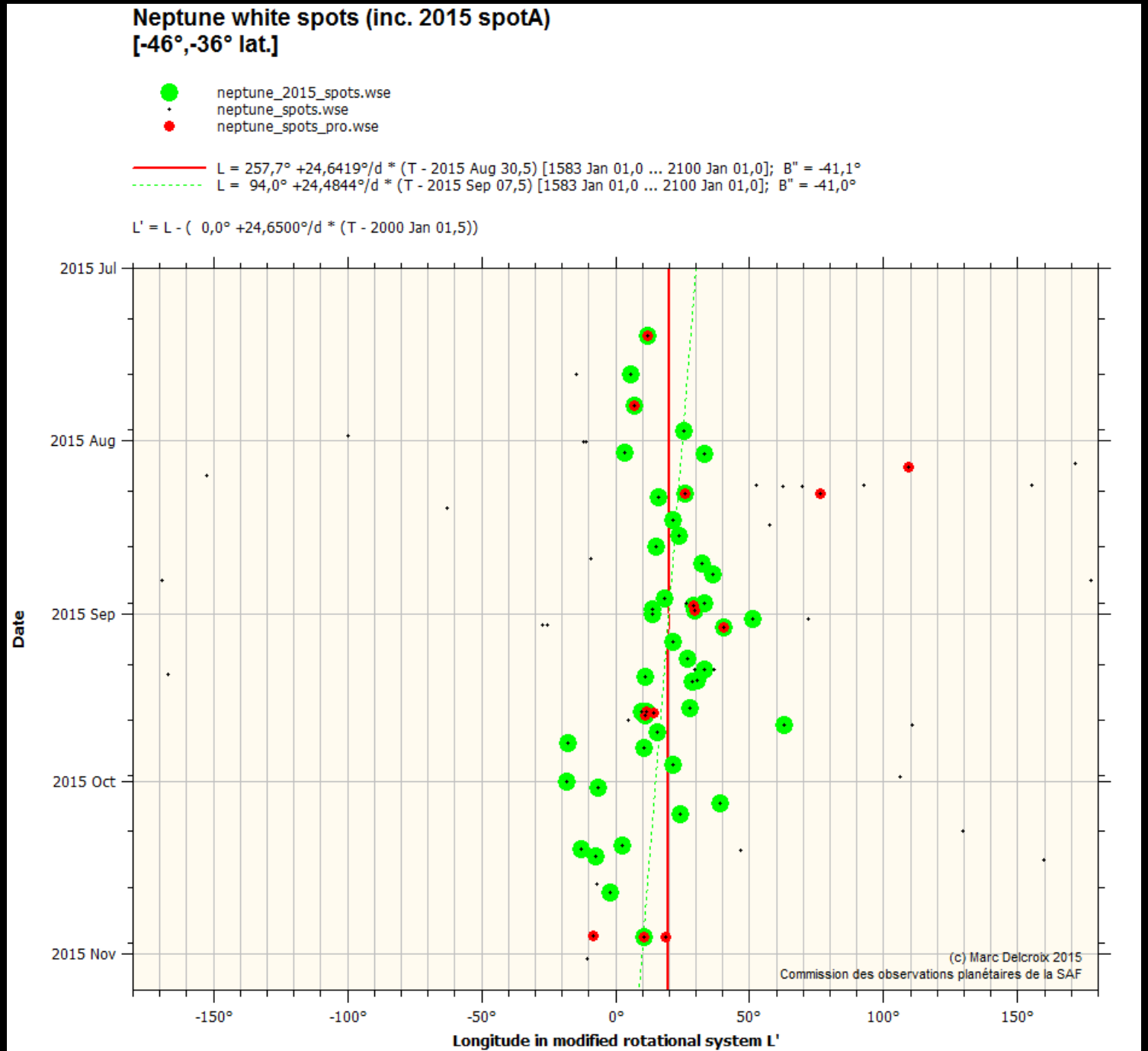
UT 20:48.6 CM=109.9°

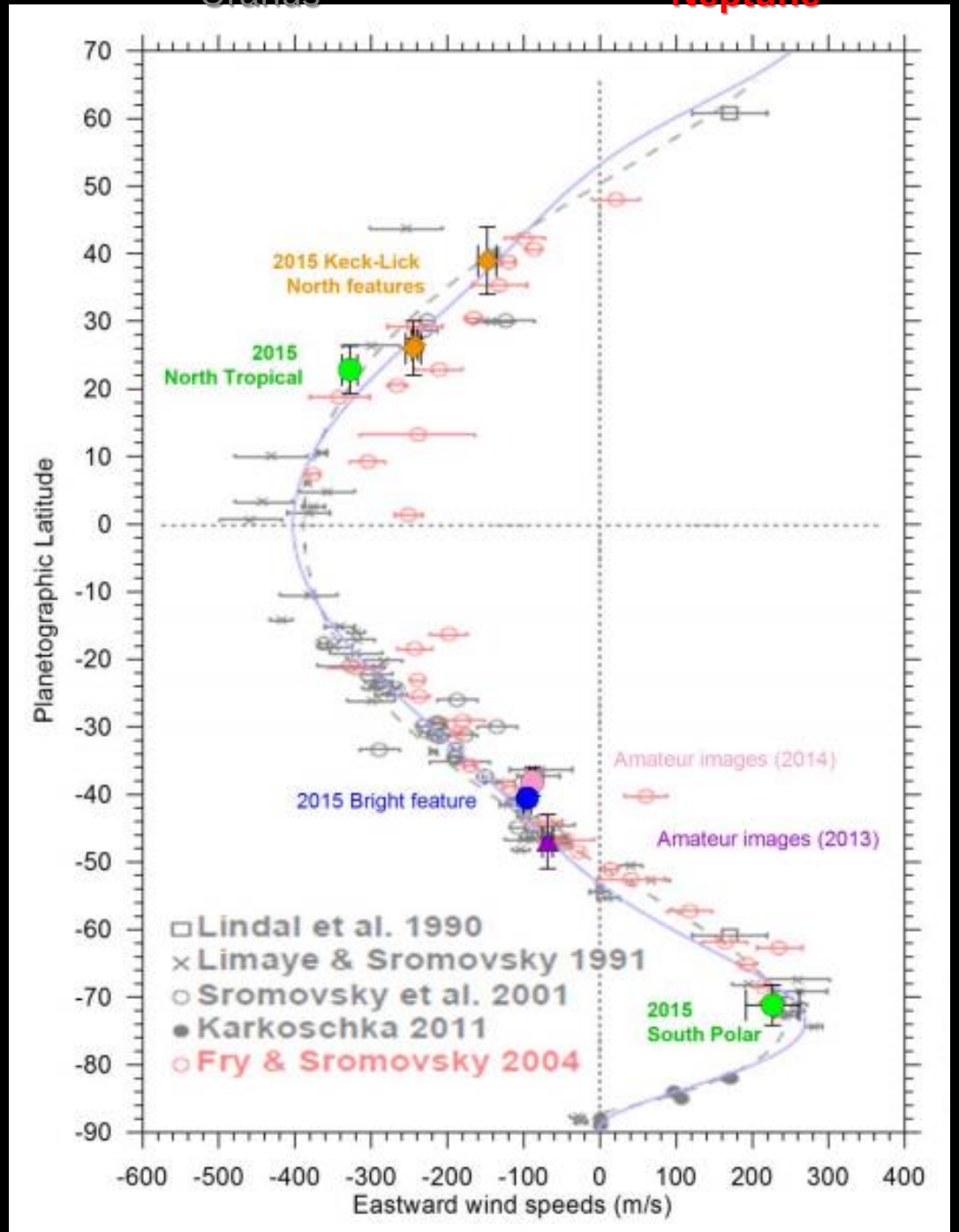
UT 21:20.0 CM=121.6°

False Colour

2021-09-23 (yyyy-mm-dd)
SCT C14 Edge HD(356mm) Fornax 52 Mount
Camera ASI290 mono R+IR 610nm
Alt.:41° App.Diam.: 2,4" Elongation: 170.4° E Mag:+7.8 - Ls 352° - De 22.6°

© Luigi Morrone
Site Agerola - Italy


Neptune white spots (inc. 2015 spotA)
[-46°,-36° lat.]
neptune_2015_spots.wse
neptune_spots.wse
neptune_spots_pro.wse
L = 257,7° +24,6419°/d * (T - 2015 Aug 30,5) [1583 Jan 01,0 ... 2100 Jan 01,0]; B" = -41,1°
L = 94,0° +24,4844°/d * (T - 2015 Sep 07,5) [1583 Jan 01,0 ... 2100 Jan 01,0]; B" = -41,0°
L' = L - (0,0° +24,6500°/d * (T - 2000 Jan 01,5))
2015 Jul
2015 Aug
2015 Sep
2015 Oct
2015 Nov
Date
-150°
-100°
-50°
0°
50°
100°
150°
Longitude in modified rotational system L'
(c) Marc Delcroix 2015
Commission des observations planétaires de la SAF



Hueso R., Delcroix M. et al., Bright features in Neptune on 2013-2015 from ground-based observations with small (40cm) and large telescopes (10m) - DPS 2015

- Uranus & Neptune atmosphere features are **accessible** to amateurs
- Prerequisites required for allowing correct measurement of the features
- Uranus activity limited (last spectacular in 2014)
- Neptune shows regularly bright spots
- Observations helpful for professionals, for targeting telescopes and measuring wind speeds

Observe, share !