THE COLOURS OF JUPITER IN 2021

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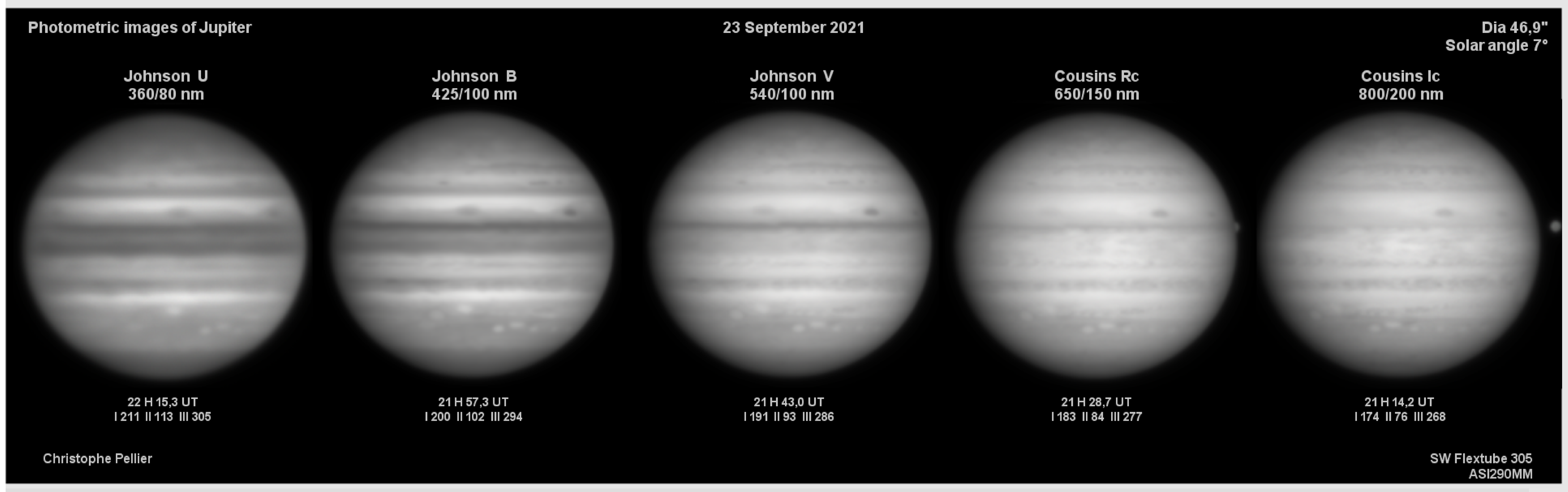
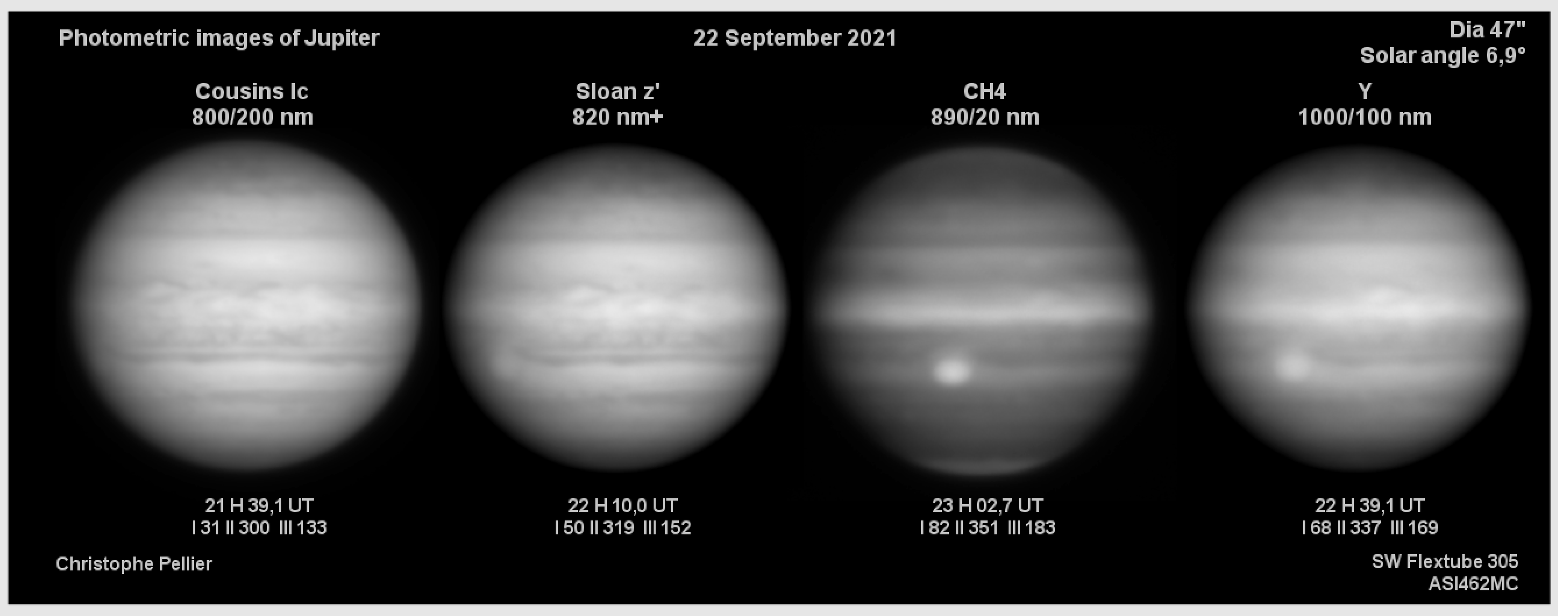
INTRODUCTION

The colours of the belts, zones, and individual features of Jupiter are known to encounter significant variations either on short or long time scales. Those variations are the results of chemical or physical changes of the planet's meteorology that are of much interest. In order to try to precisely describe the colours of the planet beyond simple assessments (either visually or from images), the author presents results obtained with tools found in the scientific litterature, to characterize the colours of Jupiter during the apparition of 2021. Results rely on the calculation of the geometric albedo of Jupiter in various bands of light, As will be described in the EPSC-20 oral intervention from the author (ODAA3), the values for the geometric albedo of the planet in 2021 have been mainly calculated with the magnitudes of the Galilean Moons taken as references.

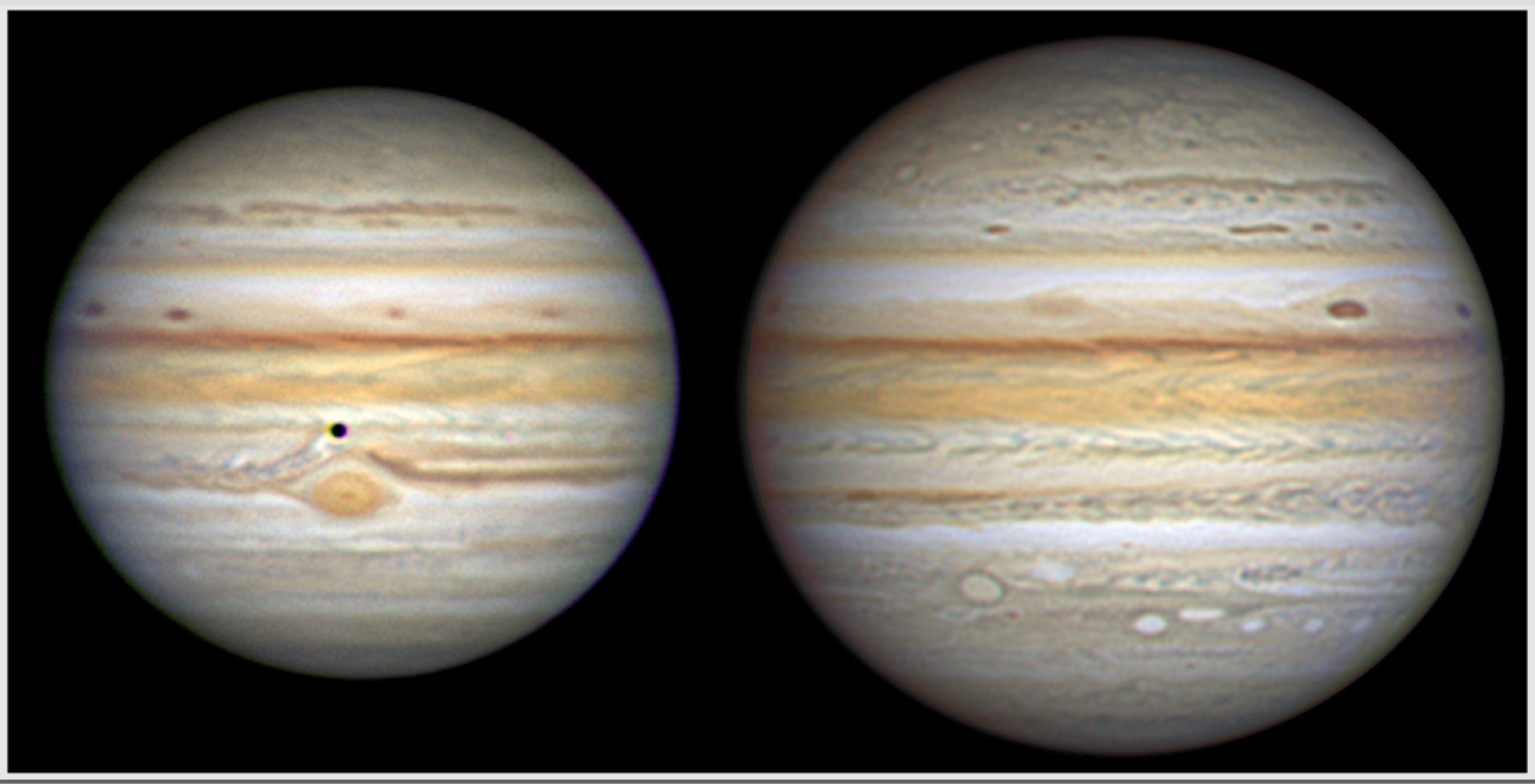
IMAGES AND ALBEDO VALUES

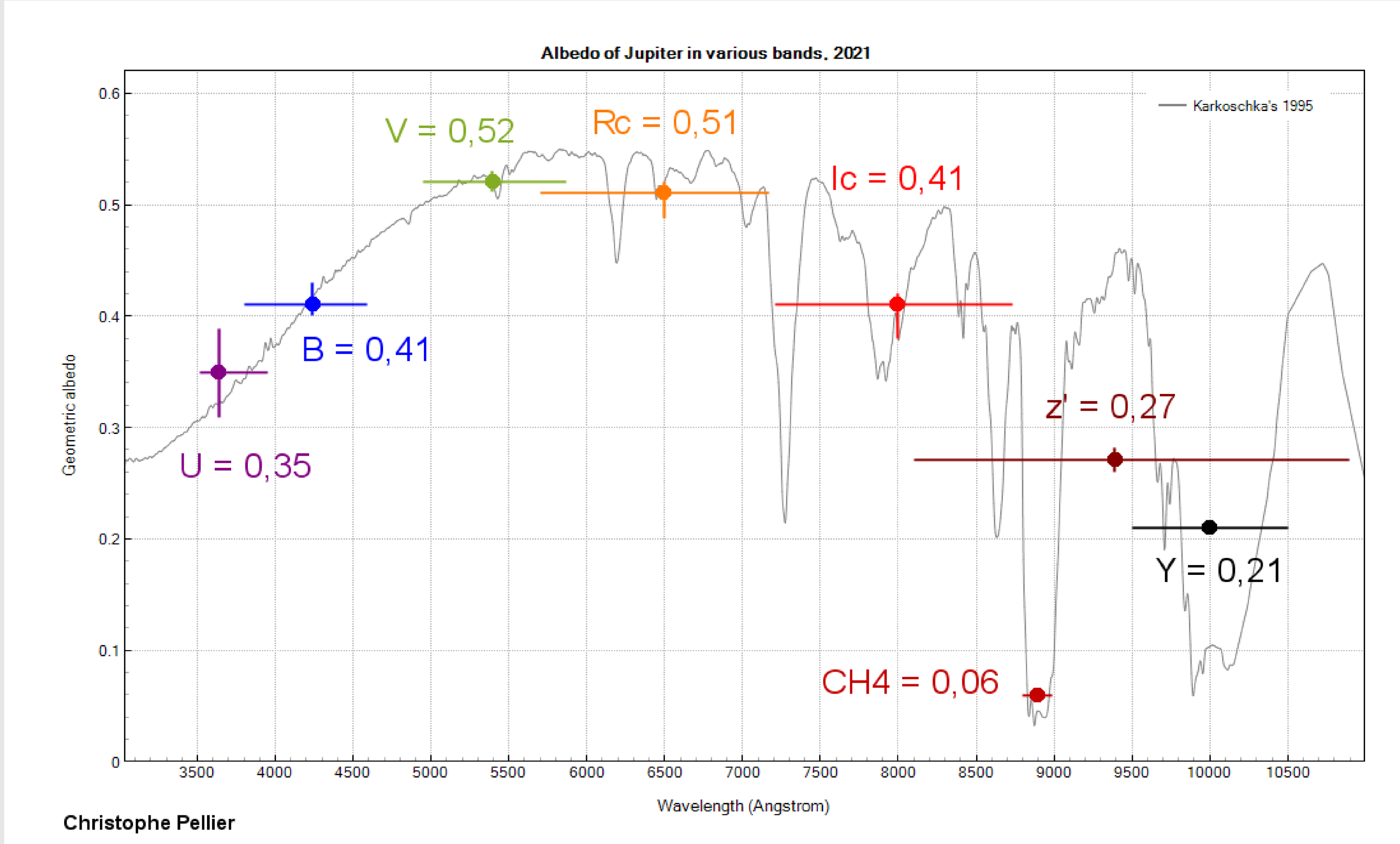




Photometric images are stacked raw frames, kept from any sharpening (to the contrary of usual amateur images). They preserve the real natural contrast and albedo of features. The filters used come from the Johnson-Cousins series + z' and Y from the Sloan series, and the CH4/890 nm. Here is a set of such images taken in 2021.

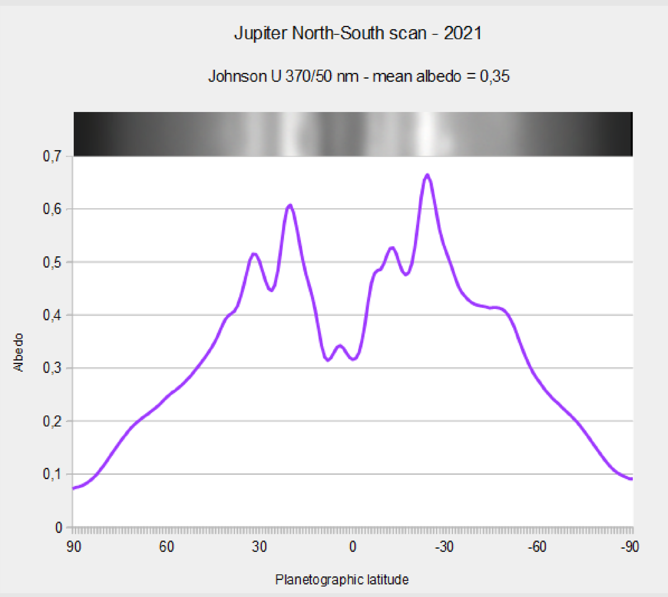
The bands present different types of information. The U and B filters are particularly affected by changes in the clouds'albedo, and are the best one to monitor mid to long-term evolution of colours. At right are all the albedo values calculated for 2021, and below are colour compositions using RcVB filters.

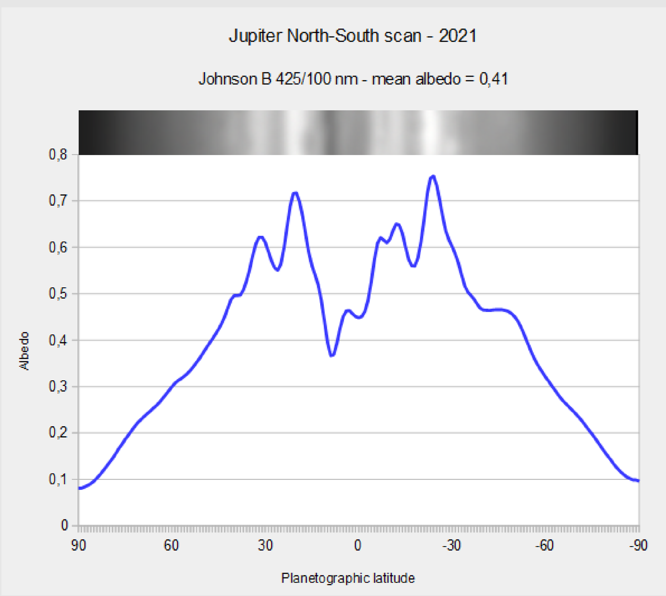


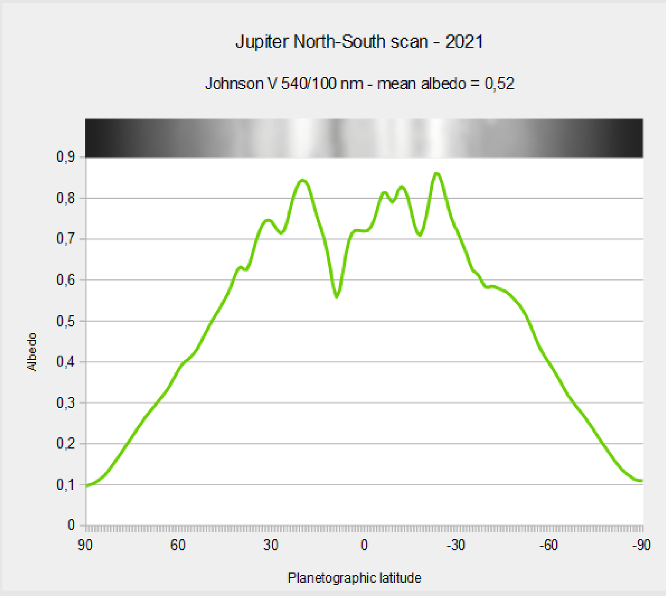


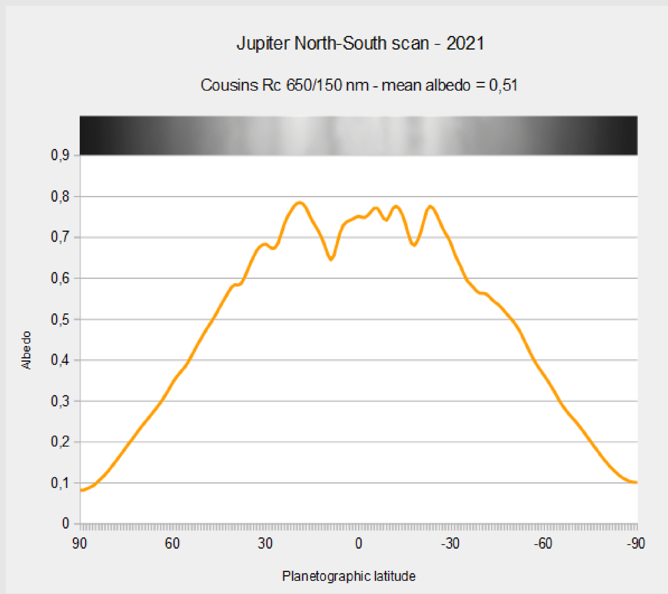
RESULT 1: NORTH-SOUTH SCANS

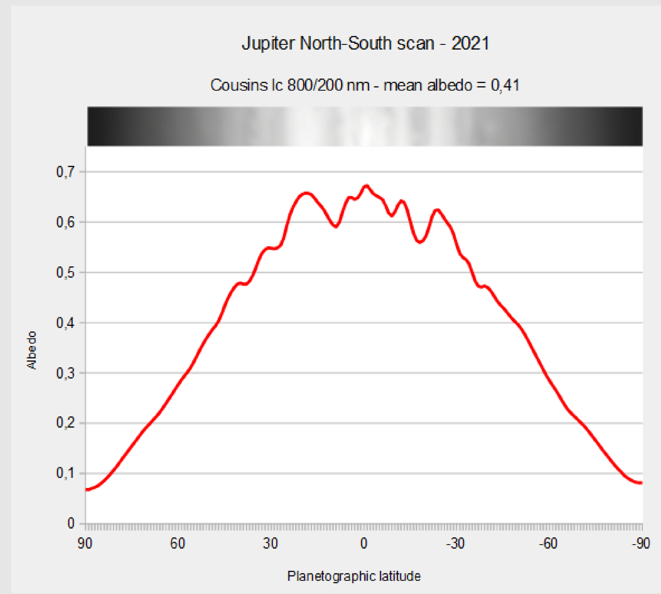
Images are mapped under WinJupos with equirectangular projection, and the albedo profile is then retrieved with the RSpec software. The profile is scaled in albedo using the global values previously found, and by calculating the albedo of a relevant zone of the disk (see Result 2). Such scans are suited to observe the albedo of the global pattern of belts and zones. In 2021, we observed an impressive drop of albedo of the whole System I in the short wavelengths (B and U, V is also affected).

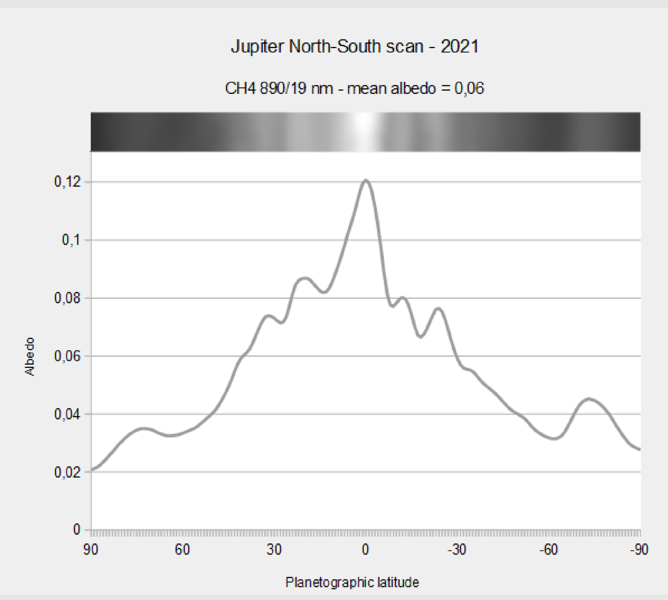


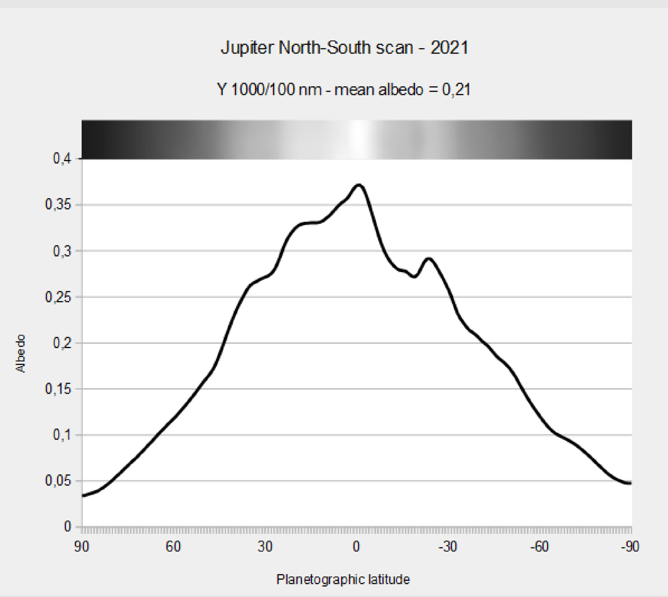








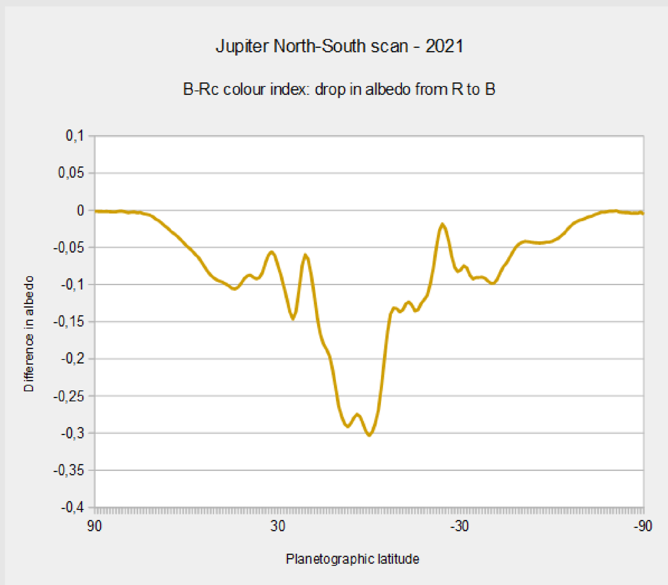


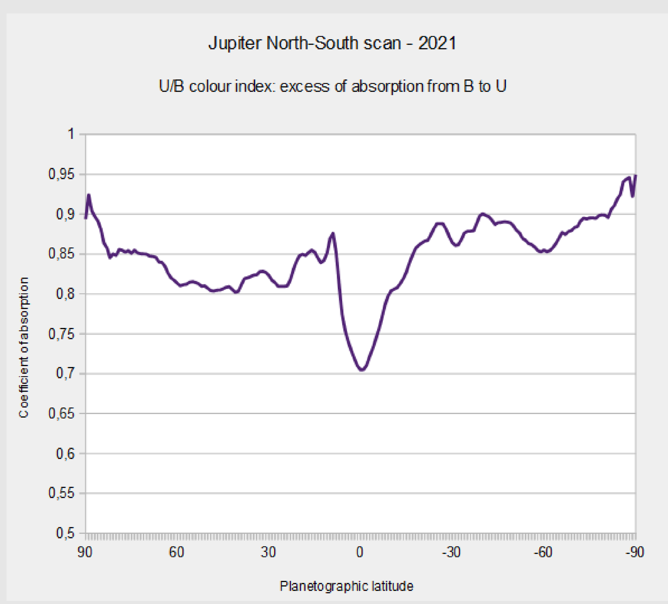


The figures show that the albedo of the System I fell around 30% in U and 40% in B, which is far below the values reached during the more usual whitish state, where it is the brightest part of the planet (up to 70/80% in B).

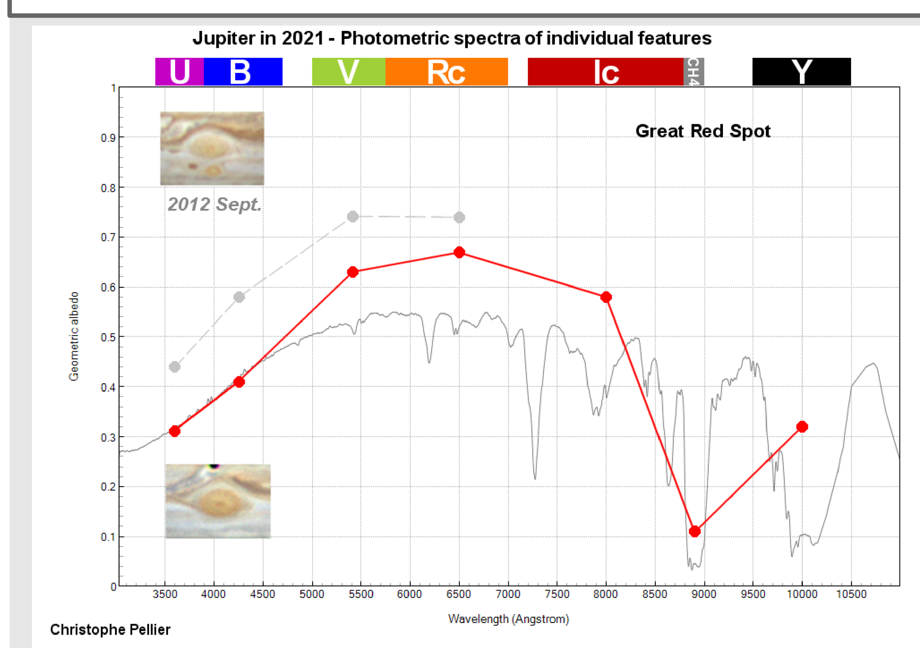
In the meantime, the albedo of the pseudo equatorial *belt* reached a very high 12% of albedo in the CH4 band (for a global albedo of 6%). This correlates with a very low UV value of 30%.

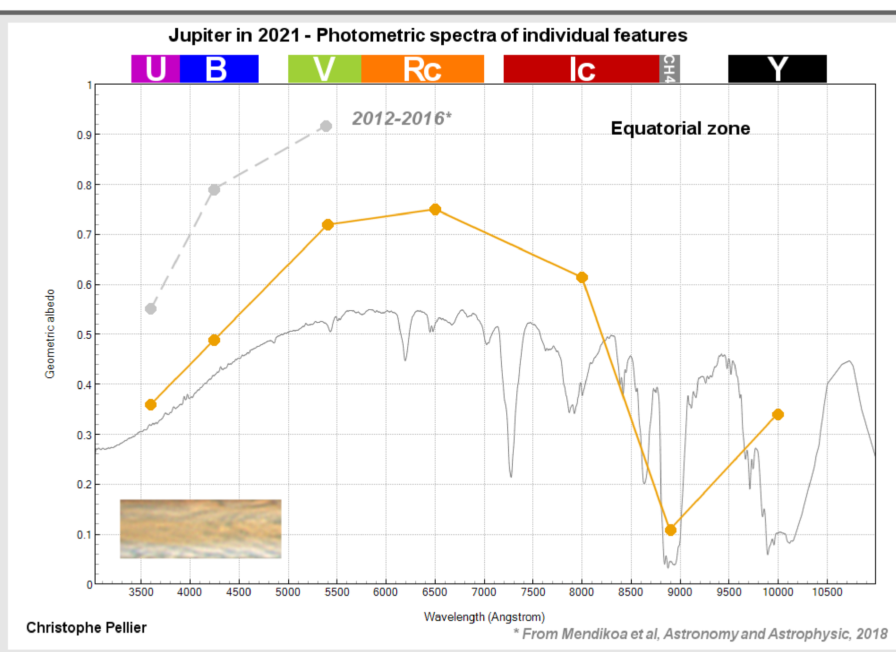
At right are useful colour index : B-Rc shows how much light is absorbed from R to B. U/B measures the excess of absorption from B to U, which characterizes strong coloured events (yellow/orange/red) of some features, such as the EZ in 2021.

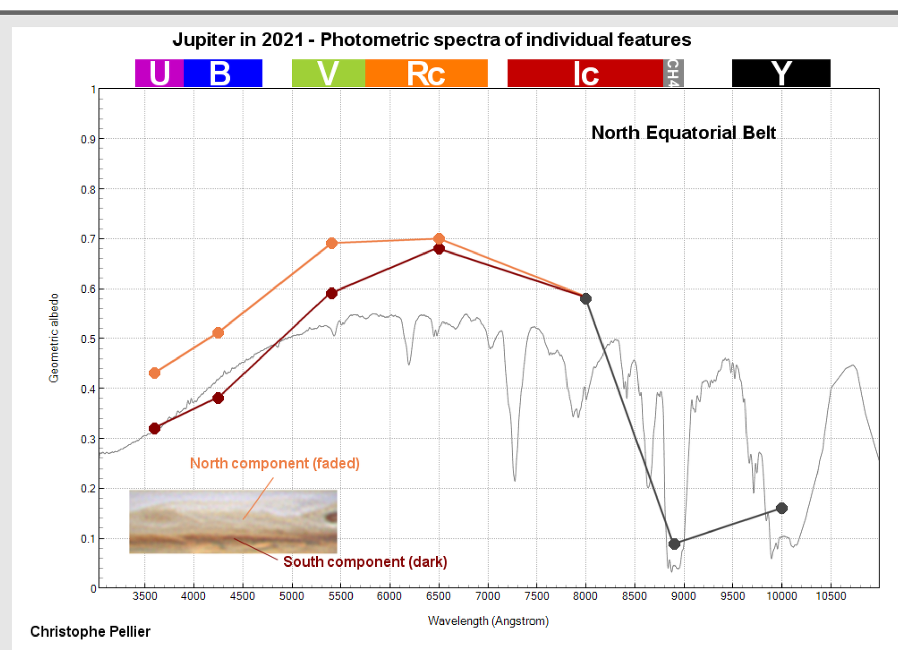


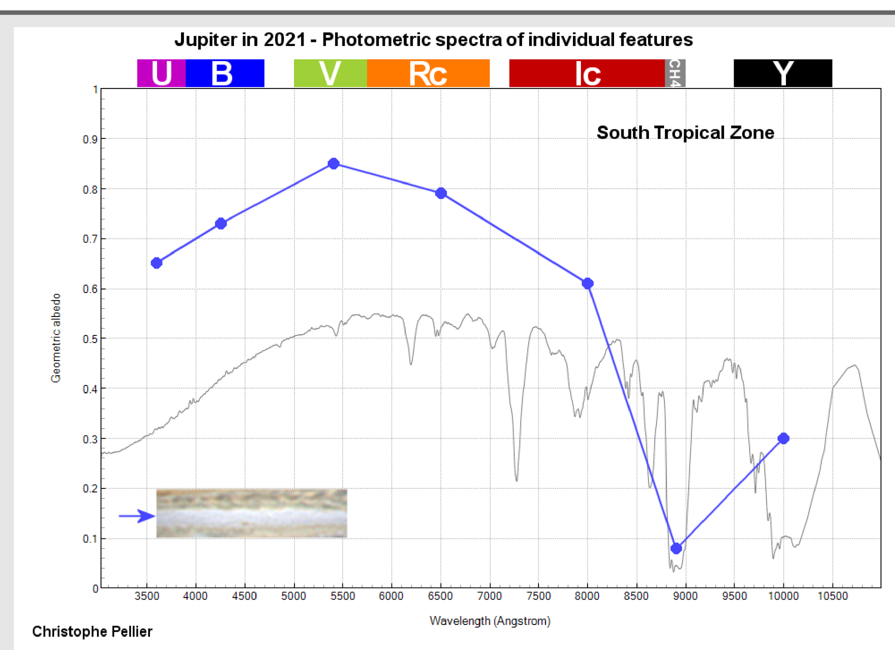


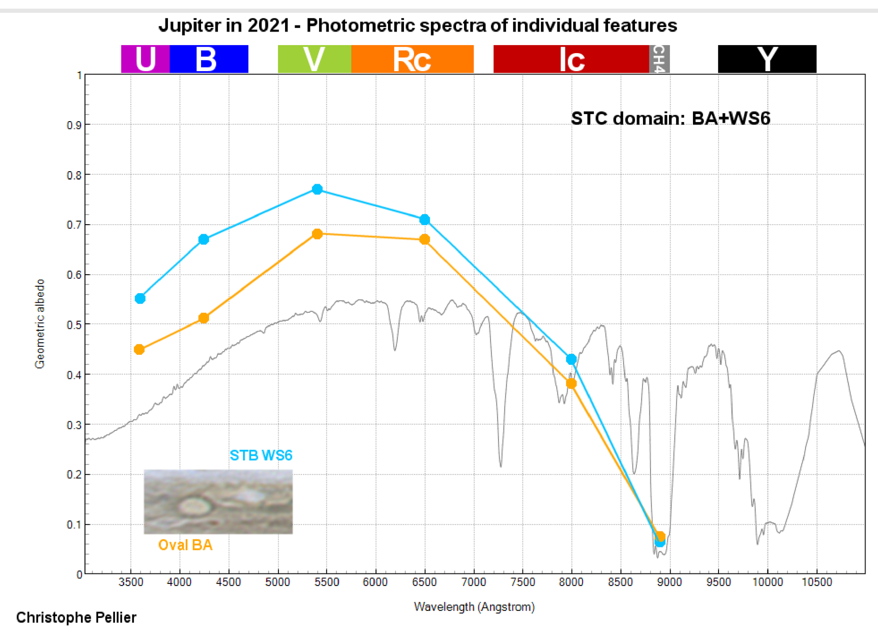
RESULT 2: PHOTOMETRIC SPECTRA OF INDIVIDUAL REGIONS











North-South scans are ill-suited to measure the albedo of individual regions or features, such as the Great red spot. The albedo of those details can be presented through photometric spectra such as these.

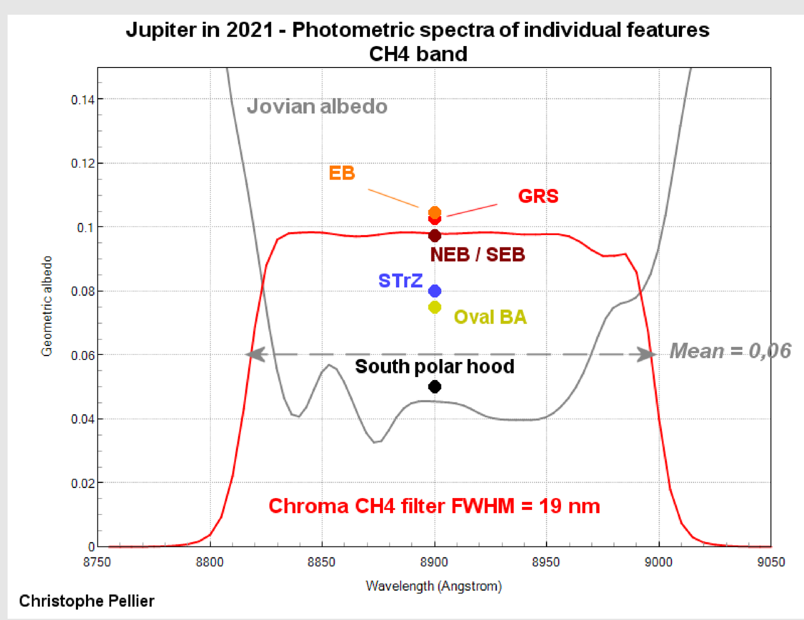
The albedo value of a given feature is calculated for each desired band with a simple ratio :

Intensity of the feature / Intensity of the whole globe X by the geometric albedo of the globe

The instensity of the feature is recalculated as if it had the same geometric surface than that of the globe. The features are measured as much as possible when they pass the central meridian ; if they are found quite away from it, a coefficient is evaluated to adjust the intensity to that it would reach on CM.

This method is fine both for individual spots (GRS, BA) or homogeneous belts or zones. More complicated regions are harder to measure if they vary a lot following the longitudes. The SEB is an example.

The values are not corrected for the gradient of light between the poles and the equator. It is then not really possible to compare the albedo of features found at too different latitudes (ex GRS vs BA). It will however be possible to make comparisons from one opposition to the next one.



References

My website where the complete methods of observation are described: http://www.astrosurf.com/pellier/

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