Physikalisch-Meteorologisches Observatorium Davos
World Radiation Center

Investigation of the wavelength precision and stability of the ATLAS tuneable laser NT242

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Wavelength Precision

The wavelength precision of the ATLAS tuneable laser was measured using a Laser Precision Analyser (LSA) which has a nominal wavelength uncertainty of 3 pm. The measurements were performed over the wavelength range 500 nm to 850 nm on 15 December 2016 and from 300 nm to 1000 nm on 22 January 2017. The difference between the nominal ATLAS wavelength and the LSA determined wavelength is shown in Figure 1.

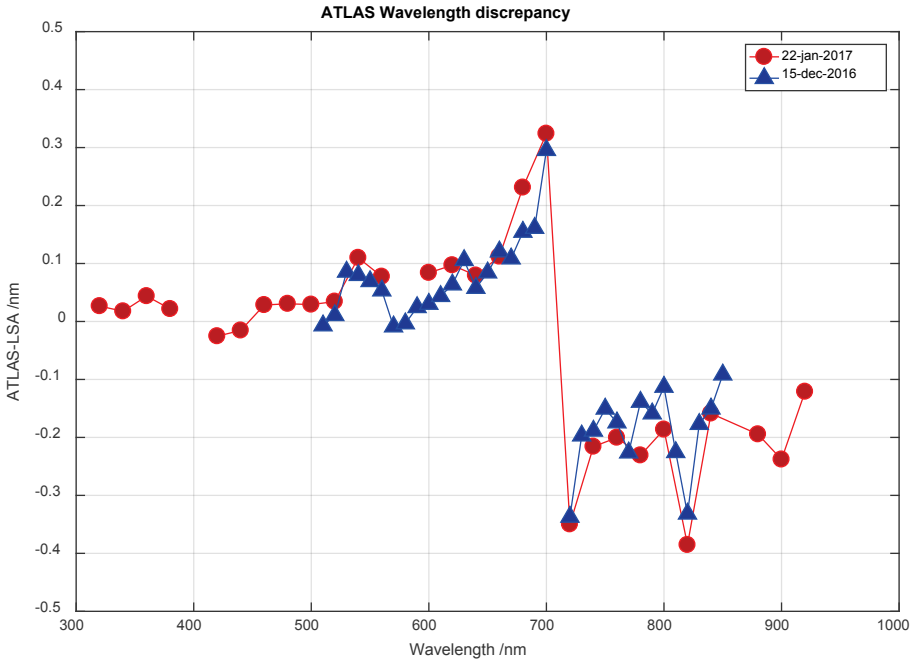

Figure 1 Wavelength difference between nominal ATLAS wavelength and LSA determined true wavelength in nm.

As can be seen in the figure, the results between the two measurements agree very well: The differences between the two measurements performed one month apart are generally less than 0.05 nm and show the same spectral pattern.

At wavelengths shorter than 650 nm the differences between the nominal ATLAS wavelength and the reference wavelength measured by the LSA is less than ±0.1 nm. At longer wavelengths, above 650 nm, the differences are larger, but still within ±0.4 nm. The discrete shift at 700 nm is related to an internal change of the tuneable laser.

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Wavelength reproducibility

The reproducibility of the wavelength setting of ATLAS was investigated by monitoring the wavelength position of ATLAS over time with the LSA, and switching between two wavelengths. The procedure was to measure for about 30 min at 530 nm, then switch to 600 nm for 30 min and repeat the cycle 3 times. The results are shown in Figure 2.

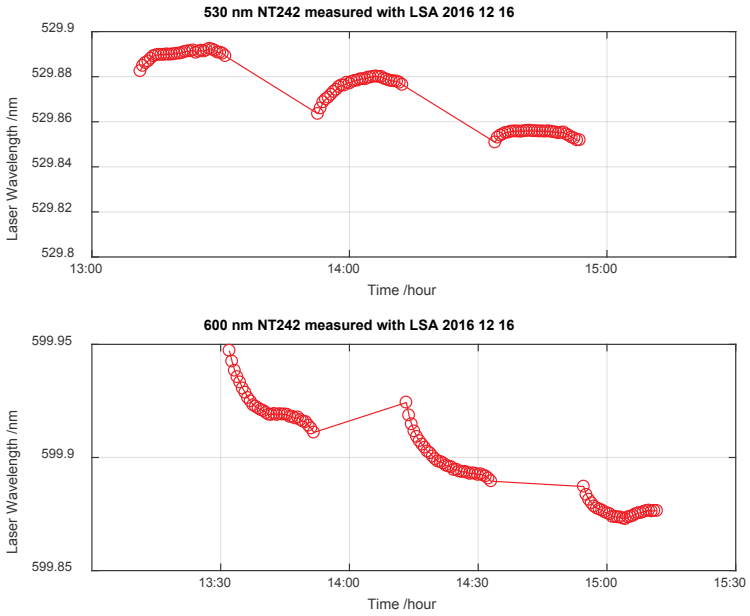

Figure 2Wavelength repeatability of ATLAS over time. The top figure shows the wavelength determined with the LSA for a nominal ATLAS setting of 530 nm, while the bottom figure shows the same at 600 nm.

The following conclusions can be drawn from Figure 2:

1) Successive settings of the same nominal wavelength show drifts over time. This leads to a wavelength reproducibility of the order of ±0.05 nm.
2) An initial drift in wavelength can be observed, which can last up to 10 min. It is therefore recommended to wait for at least 5 to 10 min before starting any measurements which require a wavelength stability of the order of 0.01 nm.

Conclusions

- The nominal wavelength setting of ATLAS in the range 300 nm to 1000 nm has an uncertainty of ±0.4 nm.
- The wavelength reproducibility is of the order of ±0.05 nm
- An initial waiting time of 10 min is recommended for the wavelength to stabilise to within 0.01 nm.

If wavelength accuracies of ±0.4 nm are sufficient then the ATLAS laser can be used as is. For wavelengths accuracies as low as ±0.05 nm a wavelength correction based on the measurements shown in Figure 1 need to be applied. If wavelength uncertainties of 0.01 nm are required then it is necessary to calibrate the wavelength setting of ATLAS using the LSA.

The data is in \\ad.pmodwrc.ch\Institute\Labs\OpticsLab2\NT242\wavelength_calibration