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Rainbow Horizons
High Altitude Visible Spectrum Analysis

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Overview

Rainbow Horizons is a high-altitude ballooning atmospheric observation project with the UAH Space Hardware Club. The goal of the project is to observe absorption lines in the solar spectrum caused by the presence of oxygen, ozone, and water vapor in Earth's atmosphere and investigate how their concentrations change with respect to altitude.

Figure 1

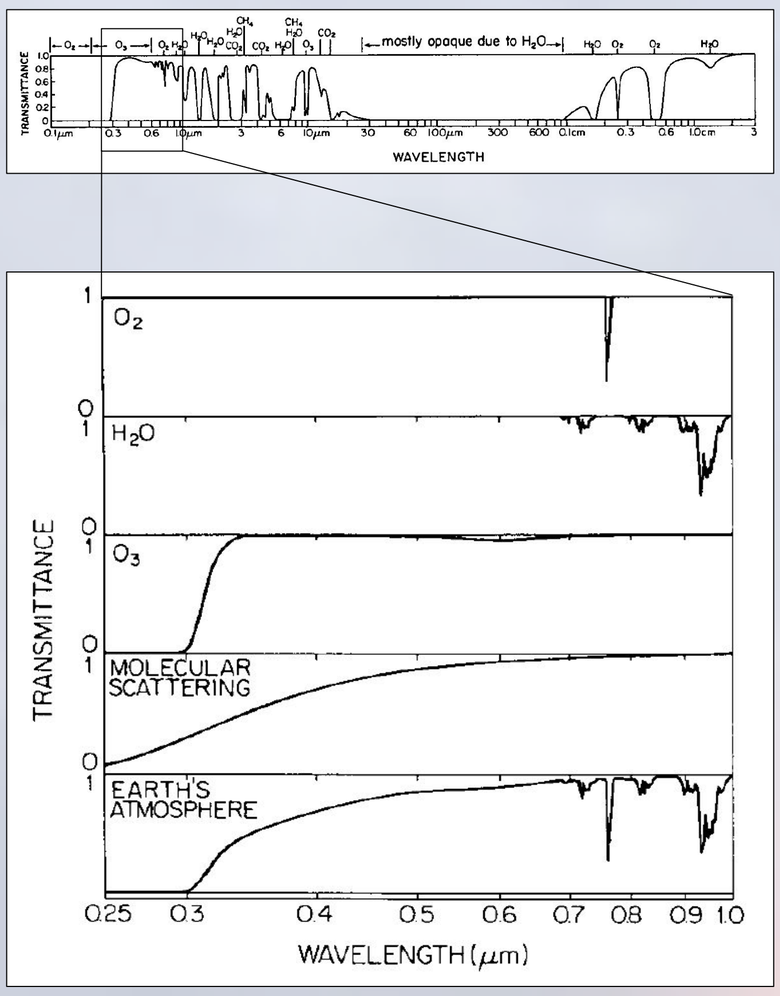


Figure 1 A diagram of strong absorption features which has allowed us to further observe the spectrum and have a bases for our discoveries.

Findings

Figures 2 and 3 display the spectrums observed by our spectrometer. Figure 1 illustrates the spectrum observed near ground level, both as a color bar, absolute intensity, and relative intensity from top to bottom. Unfortunately, the spectral resolution of the spectrometer on our first flight was unable to detect distinct spectral features, however, it was able to illustrate an overall black-body-like curve in the solar spectrum, as is expected. Interestingly, with a peak intensity at ~450nm, Wein's Law would indicate that the temperature of the sun is ~6400K, 600K hotter than the expected ~5800K. We are currently looking into two possibilities as to why this may be:

1. Inaccuracies in the instrumentation are causing what would normally be a green peak to be shifted towards the blue end of the spectrum
2. The presence of Rayleigh Scattering in the atmosphere is resulting in an overall increase in intensity in the bluer part of the spectrum due to the fact that shorter wavelengths are scattered more than longer wavelengths.

Figure 2

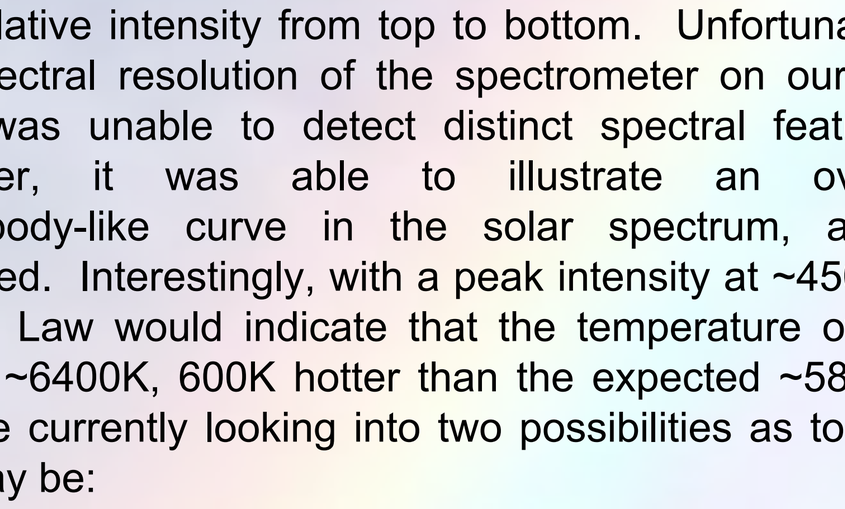
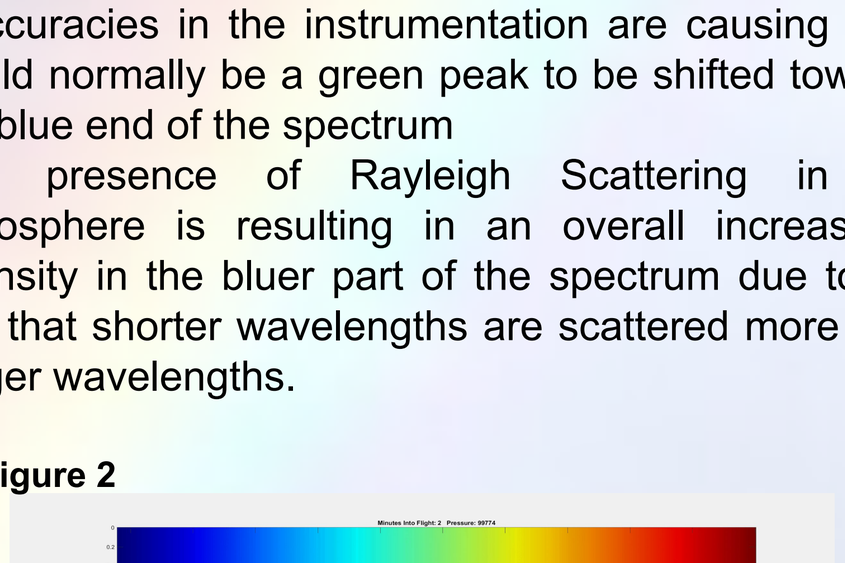


Figure 3



Figures 2 - 3 As the altitude of the payload increased, we observed shifting of radiance in the spectrum a shorter wavelength. This could have been due to minor errors in the instrumentation.

Future Plans

In the future this project will continue to be flown many times in order to observe the spectral characteristics of Earth's atmosphere over time. Another potential objective could be to observe more spectral features of the Sun's corona and photosphere at our maximum altitude of 30 km. The data collected would show changes in the spectral characteristics of the Sun over time.

Acknowledgements

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1. Kidder SQ, von der Haar TH. Satellite meteorology - An introduction. Amsterdam: Academic Press; 1995.
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