How to obtain the atmospheric transmission from stellar spectra: Using Sirius as a proxy for Vega

The aim of this exercise is to obtain the absolute B-V for Sirius (α CMa) based on the low resolution spectra you obtained a few weeks ago with the ALPY600 and Celestron C11. You'll recall that the idea was to observe Sirius at two different airmasses, and to compare the transmission properties of the atmosphere by ratios of the spectra. Now you'll use the same two spectra for a very different purpose.
Just a few points:

1. You'll first have to flat field the spectra using the mean flats from the night's sequence. This removes the broad sensitivity variation and some CCD defects but not all and what you have still has residual chip response biases. The darks have to be subtracted from both sets of spectra before any normalization i done.

2. Extract the flatted spectrum having found the proper orientation. The spectra you have should be very close, as a first pass you could eliminate the orientation step. For the two spectra, you may not have the same extraction slit, the centring – and seeing – are very different between thethe two but for now you won't need to worry about the detailed psf. It's enough to be sure you have sufficient signal to noise ratio for what will follow.

3. Wavelength calibrate both it's the same lamp, so you only need to extract the lamp once. One thing. If you haven't aligned the spectrum (or fine-aligned it), don't align the comparison lamp spectrum. Be sure to extract the lines over the same width (cross-dispersion direction) you used for the star.

4. Now you're in the position to apply the magnitude difference through the special ratios (interpolate to 50Å bins, the standard used for ESO and KPNO, to avoid having to interpolate.

5. Extrapolate the ratio to *zero* airmass. his is the delicate part and what we won't explain in detail other than to remind you that for a plane parallel atmosphere, assuming no strong stratification in the thermal properties, you can use a simple exponential absorption-scattering law for the optical depth that you then link to the enough distance. You have the times in the header and, knowing $((\alpha, \delta)$ for Sirius you can use this to compute the zenith distance (or airmass) for each observation. Use a simple linear extrapolation in airmass, taken to zero.

6. This will give you a measured transmission coefficient for each wavelength band. Now take the spectrum and compute the UBVR filter differences, e.g., B-V, V-I. You *can't* get the absolute calibration unless you have more information. But you can compute the color indices using the bandpasses you already have. Compare them.

7. As a last step, you'll find in the files the absolute spectrophotometry of Vega. This is a "close enough for government work" match for Sirius (now said the other way around) so you can obtain the multiplier (transmission $\times$ response function) for the two spectra. The airmass was similar for *alpha* Ori as the second observation of Sirius, so you might try applying the response correction to that star.