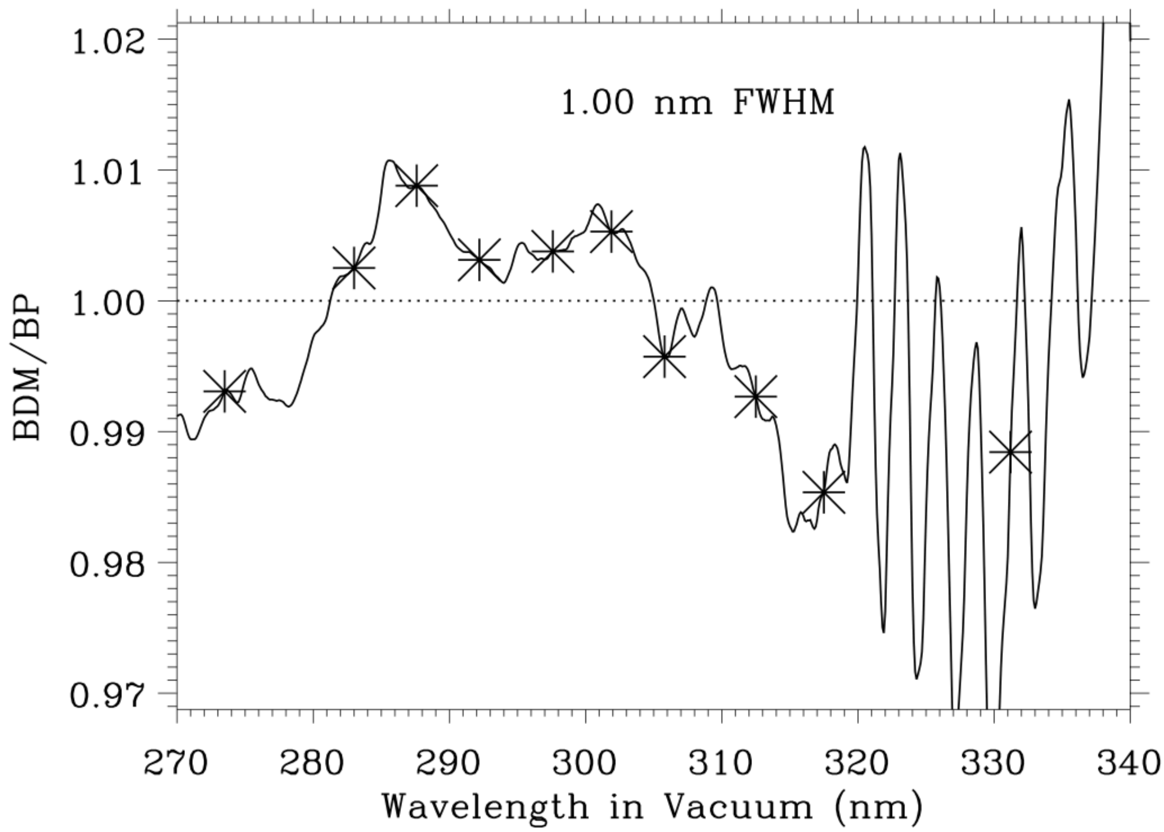
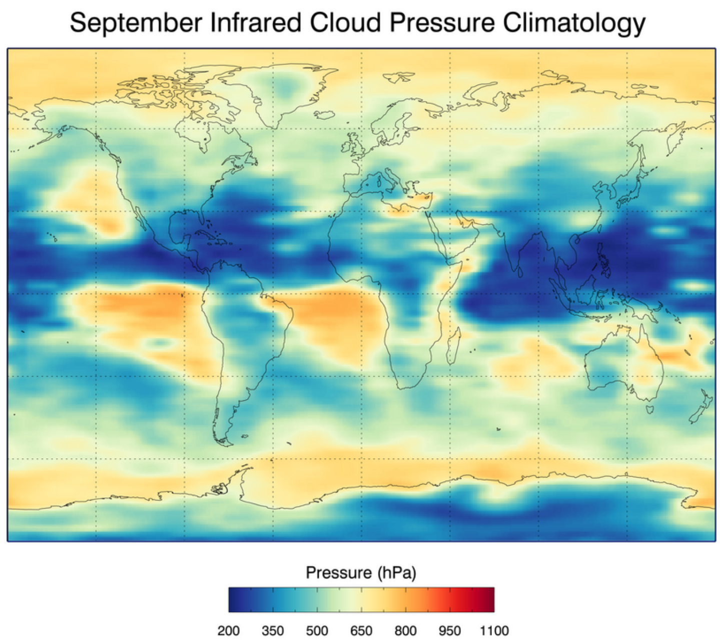


<u>Figure S1</u>: Ratio of ozone absorption cross-sections from Bass & Paur (1984) (BP) and Malicet et al. (1995) (BDM). Before taking the ratio each dataset was convolved with a triangular slit function of 1 nm full-width at half maximum (FWHM). SBUV wavelengths are marked with a star. Differences between the two datasets are less than 1% at the shortest 8 SBUV wavelengths that are used for ozone retrieval at most solar zenith angles. Difference is 1.5% at 318 nm, which is used only at very large solar zenith angles. The 331 nm wavelength is used only to derive reflectivity and cloud fractions. The decision to switch to BDM was driven largely by the evidence (Liu et al., 2007) that the BDM values are more consistent with satellite measurements at the longer wavelengths.



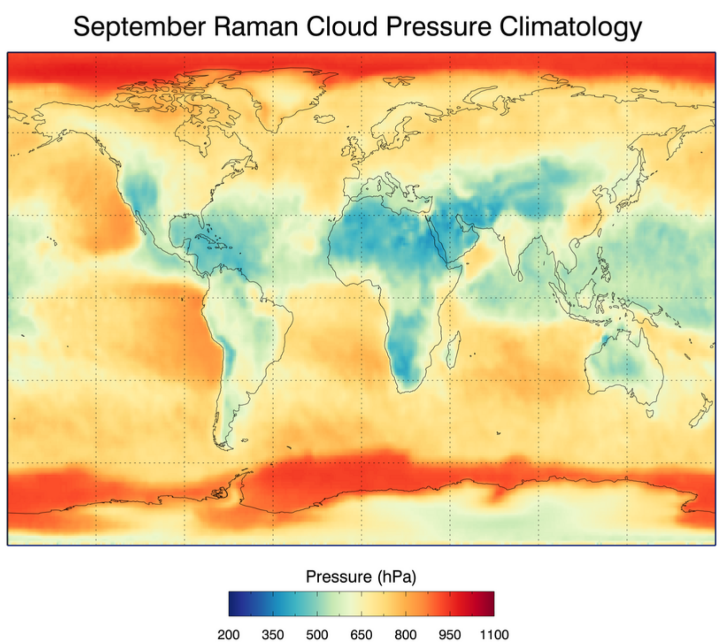
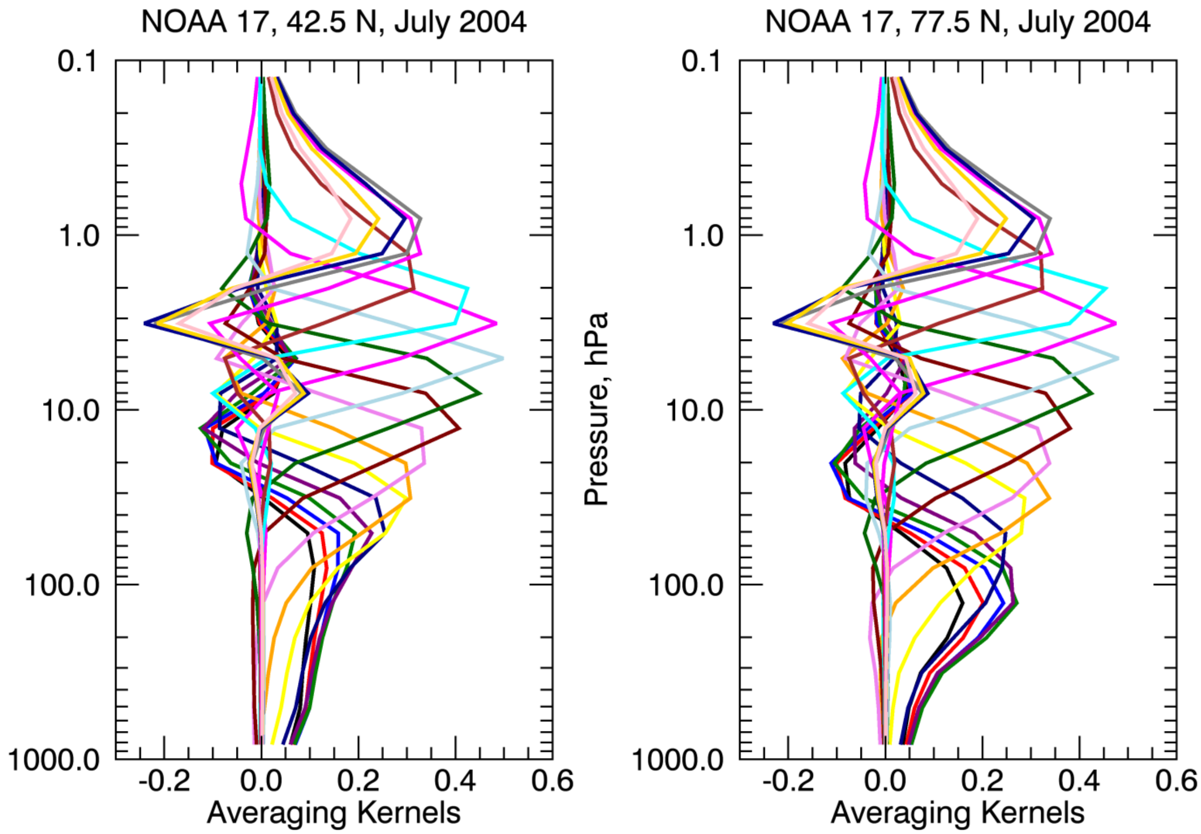
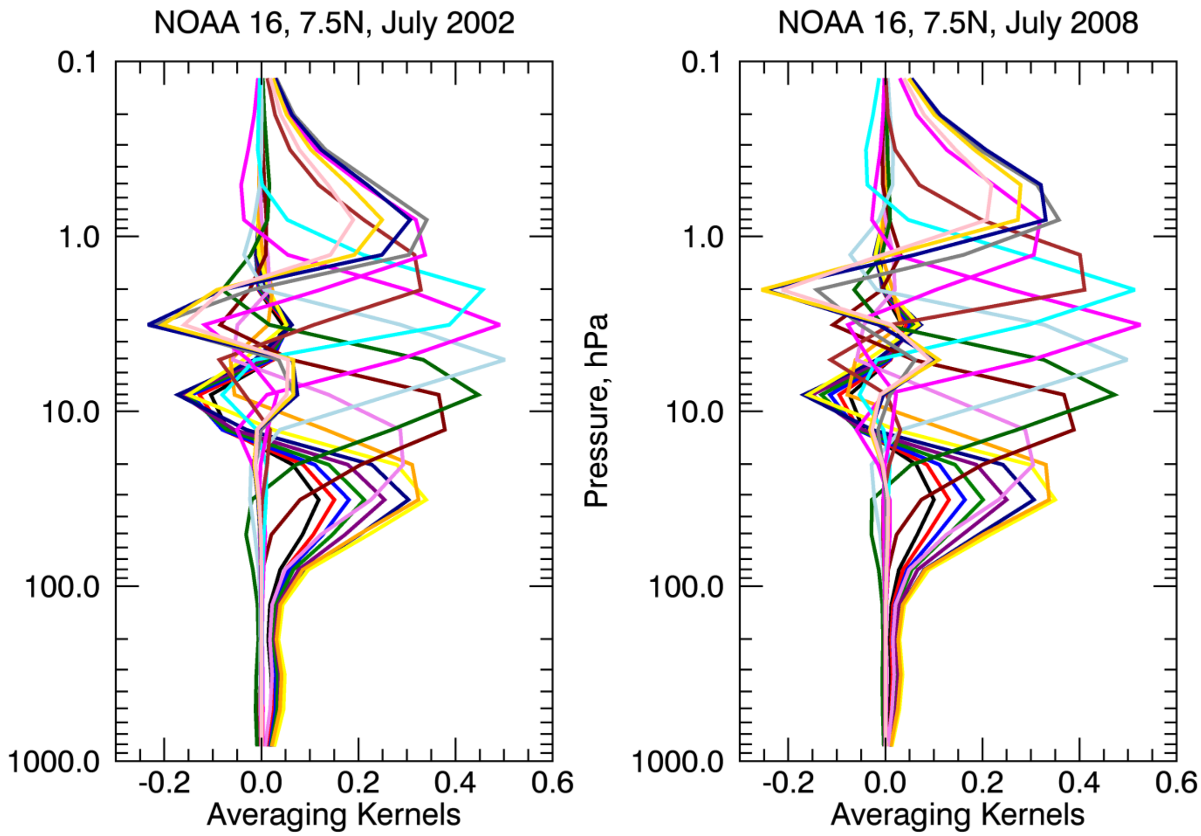


Figure S2. September cloud-pressure climatologies for V8 (top) and V8.6 (bottom) algorithms. V8 climatology was based on cloud heights derived from thermal infrared sensors, which typically measure cloud-top height. The V8.6 climatology (Haffner, 2011) reflects the fact that the UV radiation penetrates the ice clouds and is mostly reflected by the thicker water clouds below (Vasilkov et al., 2008).



<u>Figure S3.</u> Typical SBUV Averaging Kernels for mid (40-45° N, SZA= 26°, Total DFS=4.9) and high latitudes (75-80° N, SZA= 57.5°, Total DFS=5.2), obtained from NOAA-17 in July 2004. The SBUV AK for layers between 16 and 1 hPa have sharp maxima at nominal altitudes. Since AKs apply to fractional changes, this means that the SBUV algorithm is capable of accurately retrieving fractional changes in mixing ratio or layer ozone amounts in this vertical range. In mid latitudes the AK for layers below 16 hPa (and above 1 hPa) have broad peaks, which are shifted upward (downward) from the layer nominal altitude, showing that the SBUV retrievals cannot provide reliable information about fractional changes in ozone at these altitudes. In higher latitudes information in lower altitudes is better. It should be noted, however, that AKs do not provide information about the ability of the algorithm to track changes in total and partial ozone columns. One needs to look at the integrating kernels to obtain such information, as discussed in the paper.



<u>Figure S4.</u> Typical SBUV Averaging Kernels for the tropics (5-10°N) for different SZAs. The orbit of NOAA-16 drifted over time and as a result the SZA increased from 28.6° in July 2002 to 75.8° in July 2008. The SBUV retrieval algorithm uses larger numbers of wavelength to retrieve ozone profiles at higher SZA, therefore, the total DFS has changed from 4.4 to 5.1 implying that there is more information in the measurements. But the increase in total DFS is related primarily to increased sensitivity in the upper layers (above 1 hPa). In the lower layers the AKs change little with the SZA.