

Name: _____

ATOC/ASTR 5560 Radiative Processes — Lab 4
September 21, 2001

The purpose of this lab is to make your own simple line-by-line model and compare results with LBLRTM.

You will need the following files on nit:

/home/rt/lbl/mylbl.f	line-by-line model Fortran program
/home/rt/lbl/runmylbl	script for running mylbl.f
/home/rt/lbl/runlblrtm	script to run LBLRTM
/home/rt/atmos/mcatmmls.dat	midlatitude summer standard atmosphere file
/home/rt/lbl/plotlbl.pro	IDL plotting file
/home/rt/lbl/lbl_read.pro	IDL file for reading LBLRTM output

1. Look over the mylbl.f program to see how it works.
Notice the method used to calculate the absorber amount in molecules/cm².
What method is used to compute the partition function?

2. Put in the Fortran code for line strength, line halfwidth, etc. to compute the optical depth spectrum. You only have to add code to the section after comment “Code the line strength and line shape stuff here”.
You can compile mylbl.f with `pgf77 -O2 -o mylbl mylbl.f`.

3. You will test your line-by-line model using the P branch of the 15 μm CO₂ band. Compute the optical depth spectrum from 625 to 665 cm⁻¹ at 0.002 cm⁻¹ resolution using the runmylbl script. Compute the LBLRTM reference optical depth spectrum using the runlblrtm script.
First compute the optical depth spectrum for the 1.0 to 0.0 km layer in the midlatitude summer atmosphere. Write down the absorber amount in molecules/cm² for H₂O and CO₂.
Compare the mylbl and LBLRTM spectra with the plotlbl.pro IDL script.

4. When you think you have your line-by-line model working, plot the 0-1 km layer comparison using the optical depth ratio. The ratio won't be exactly 1, but it should be close at most wavenumbers.

For extra credit, explain the few large up/down spikes in the ratio spectrum.

Hint: look at the `fort.3` file of lines used and the HITRAN file.

5. Now compute optical depth spectra with LBLRTM and `mylbl` for the layer from 17 to 16 km (same MLS atmosphere and spectral region).

Make the comparison plot between LBLRTM and `mylbl`.

Explain the differences in the optical depth spectra between the 0-1 km and 16-17 km layers.

What are those extra lines that appear in the 0-1 km spectrum?

Please turn in your plots along with the answers to the questions.