ASSFTS poster material

Clouds, Aerosols, and FTIR Emission Measurements

potential interferences – clouds and aerosols
differences: spectral dependence, typical OD, vertical location

clouds are complex: cirrus, altostratus, nimbostratus, stratus, cumulus, cumulonimbis vary in height, ice water path, water content, drop size, phase, crystal shape

the problem framework
aerosols
cloud detection
cloud characterization
nadir – low od
nadir – high od
limb

the simulations
nadir: CHARTS, aerosol models.....
CHARTS – code for high-resolution accelerated radiative transfer with scattering
uses LBLRTM generated optical depths for gases
can place scatterer (cloud) at any location with use defined properties
limb: exploring RT tools that include multiple scattering

nadir aerosols have impacts that are below the noise level of TES (put v2 and v3 figures here)

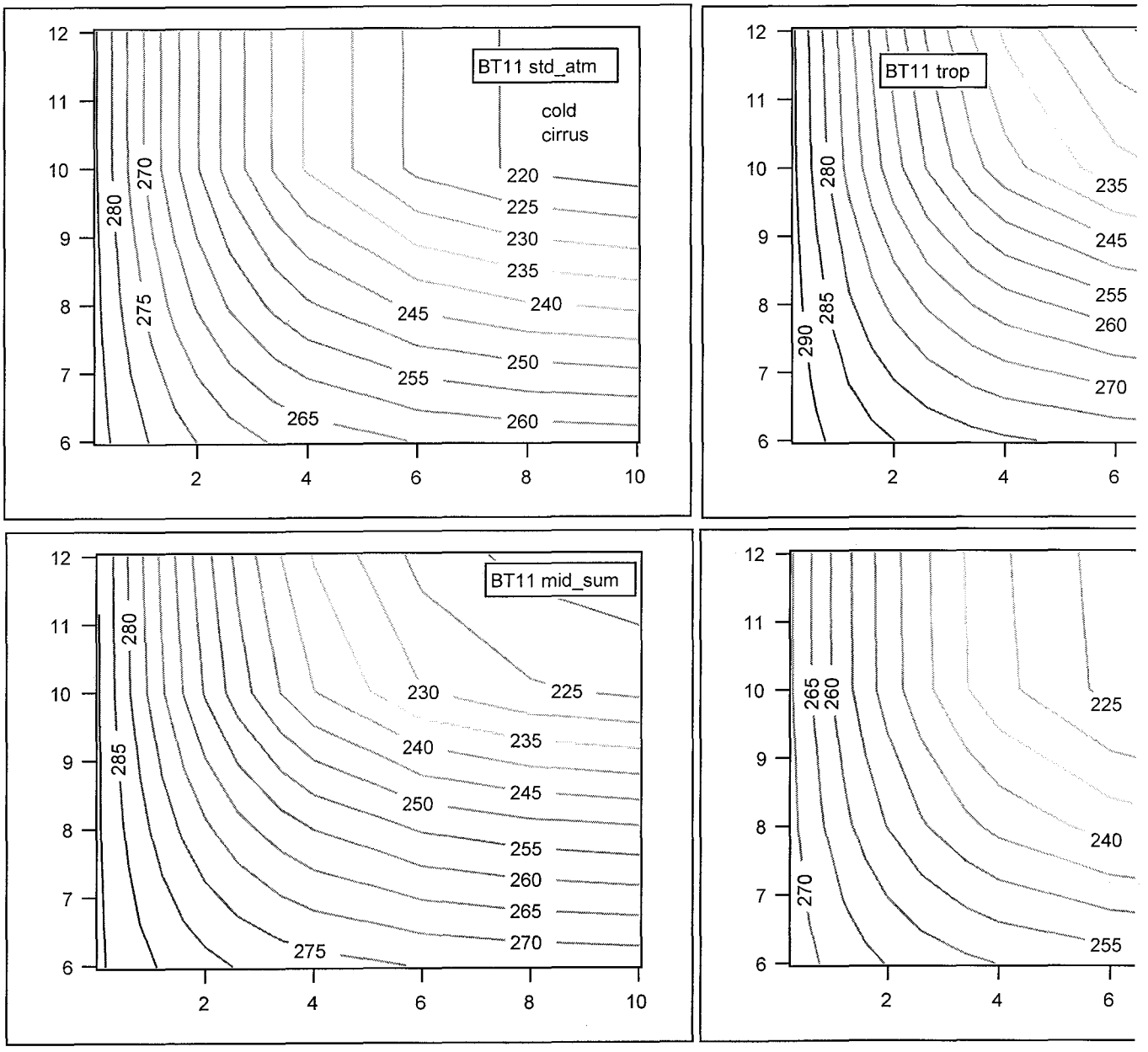
cloud detection
quick looks to determine if clouds are present
use BT tests like every other satellite project
BT – SST is primary test

cloud characterization
cloud height – will use a variation of CO2 slicing technique
concept: different regions of CO2 absorption band are sensitive to different vertical regions, can exploit this to determine cloud height
spectral resolution of TES offers and advantage over current satellites

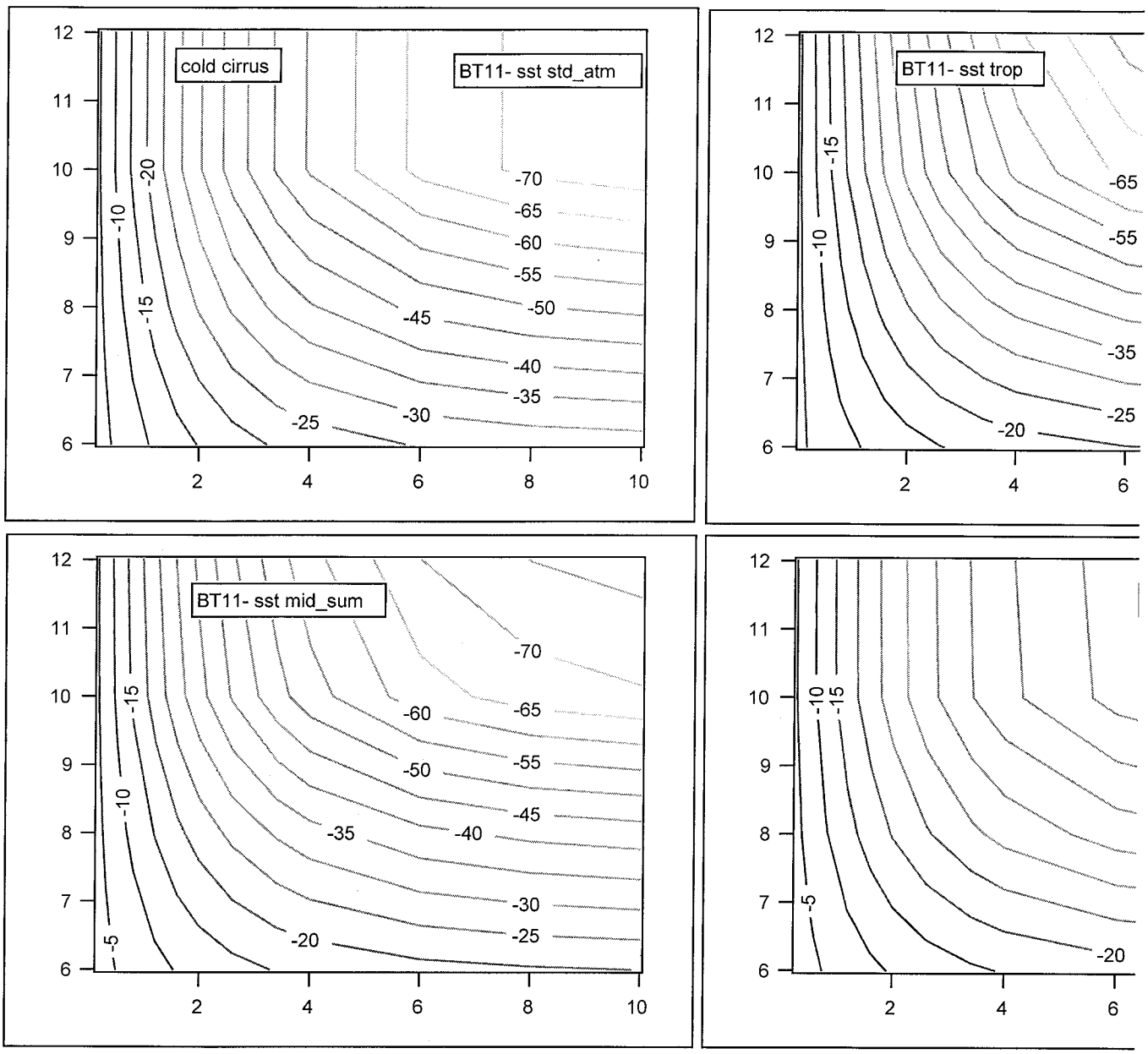
cloud emissivity for high OD – important for high OD clouds, as addressed later

nadir low OD
linearity (can we use a pseudo molecule?)
height sensitivity (see jacobian plot)
overall error to retrieval – how do clouds impact gas retrievals?
need to consider TEMP, O3, NO,.... separately

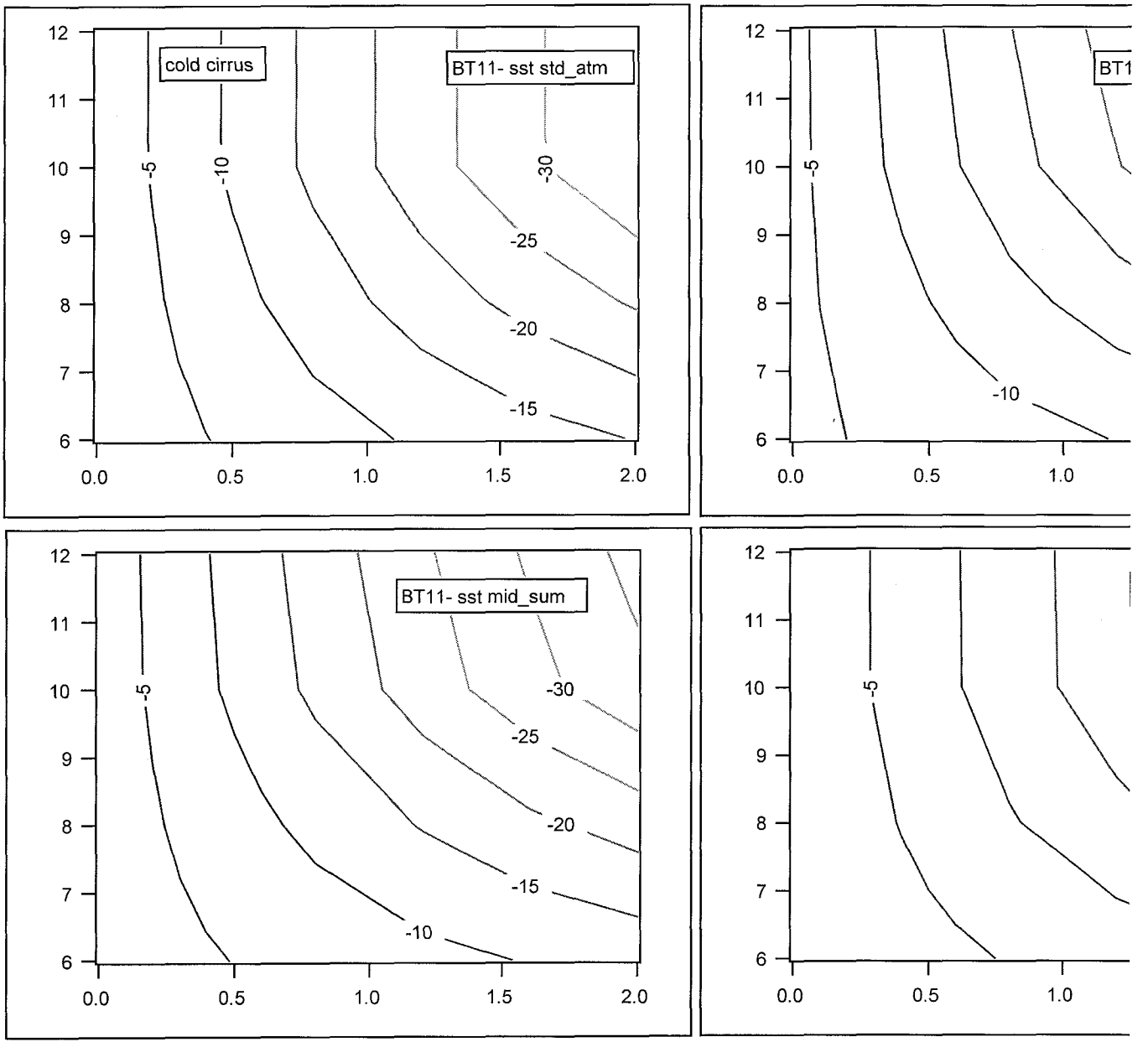
nadir high OD
  treat cloud as the surface
  need the right B(T)* emissivity term
scatter plots of BT differences indicates spectral variations in clouds
Figures:



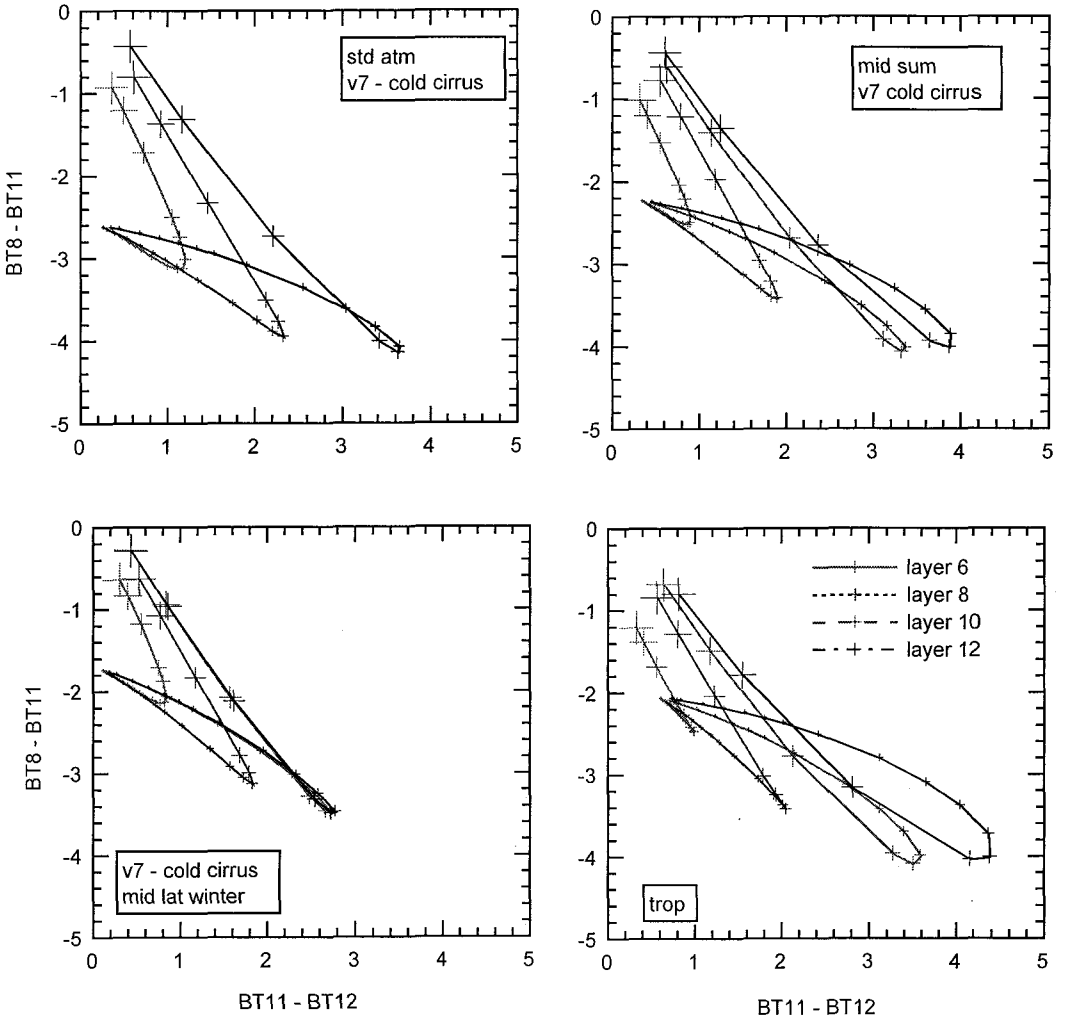
BT11 values as a function of cloud optical depth (0-10) and model layer. this set of simulations uses the cold cirrus cloud model.



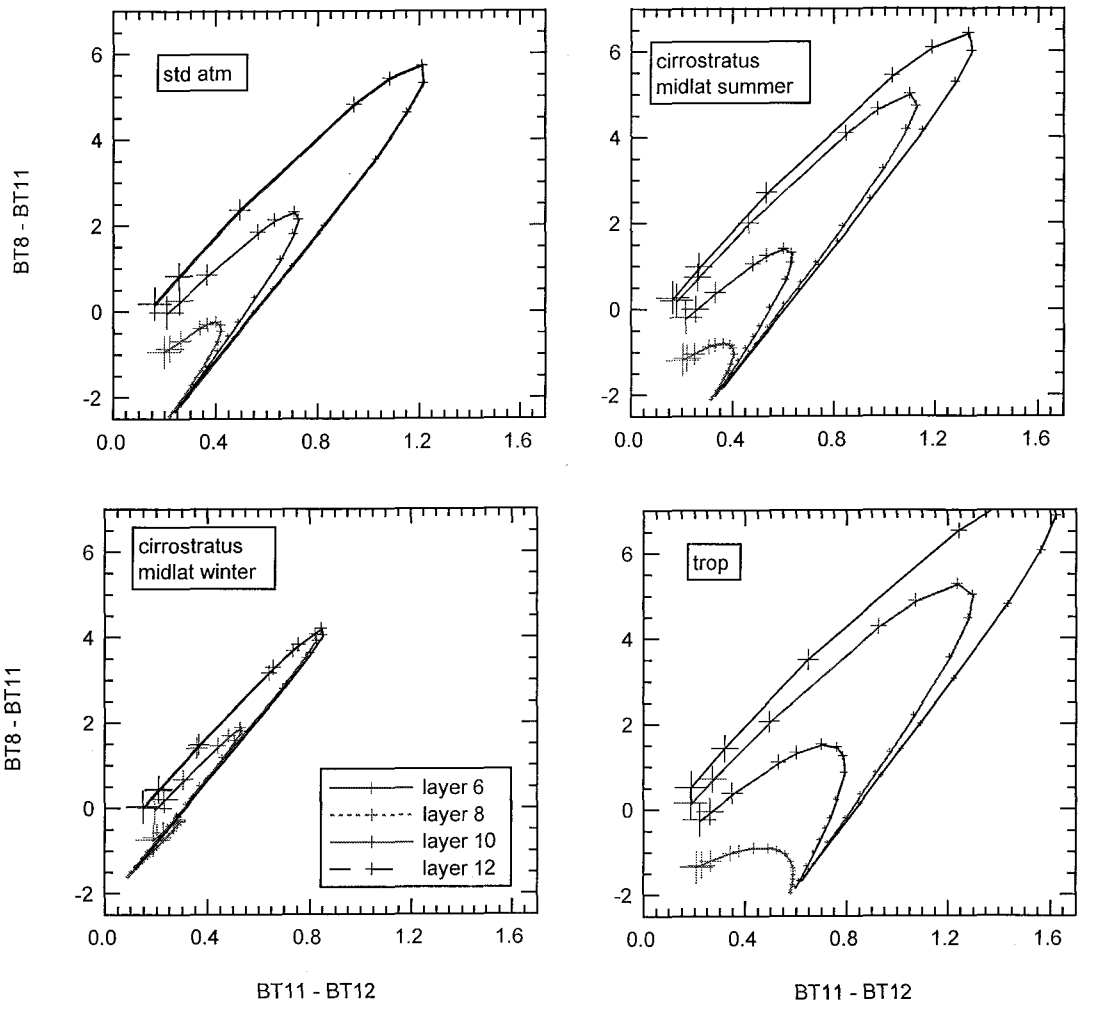
BT11 – SST as a function of cloud optical depth (0-10) and cloud model layer using a cold cirrus model.



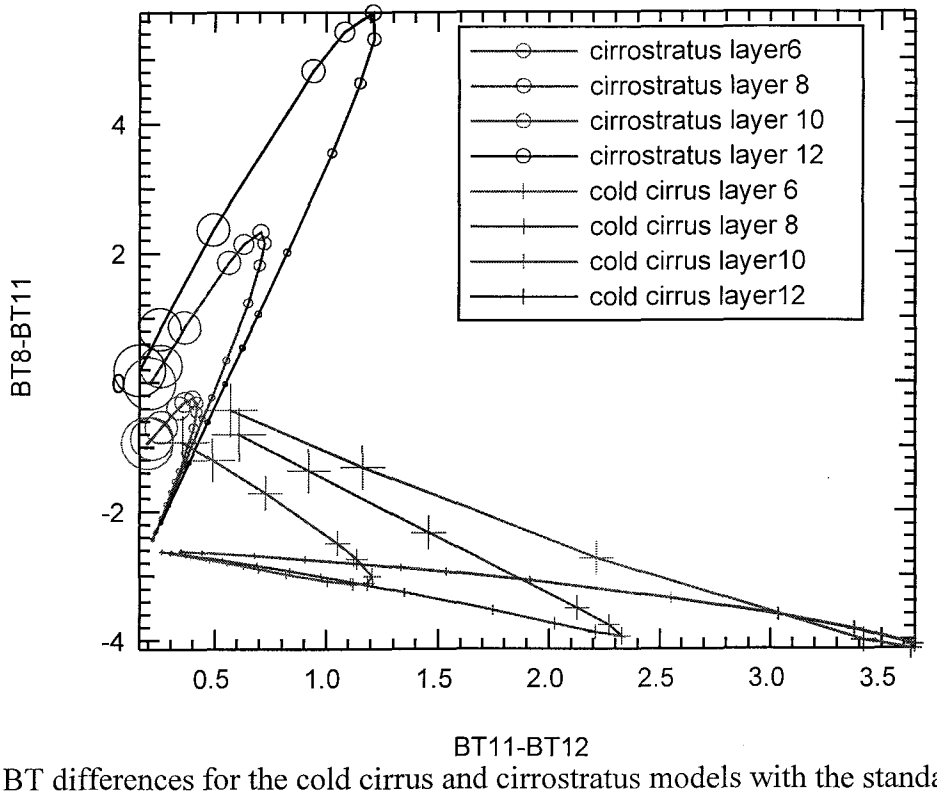
BT11 – SST as a function of cloud optical depth (0-2) and cloud model layer using a cold cirrus cloud model.



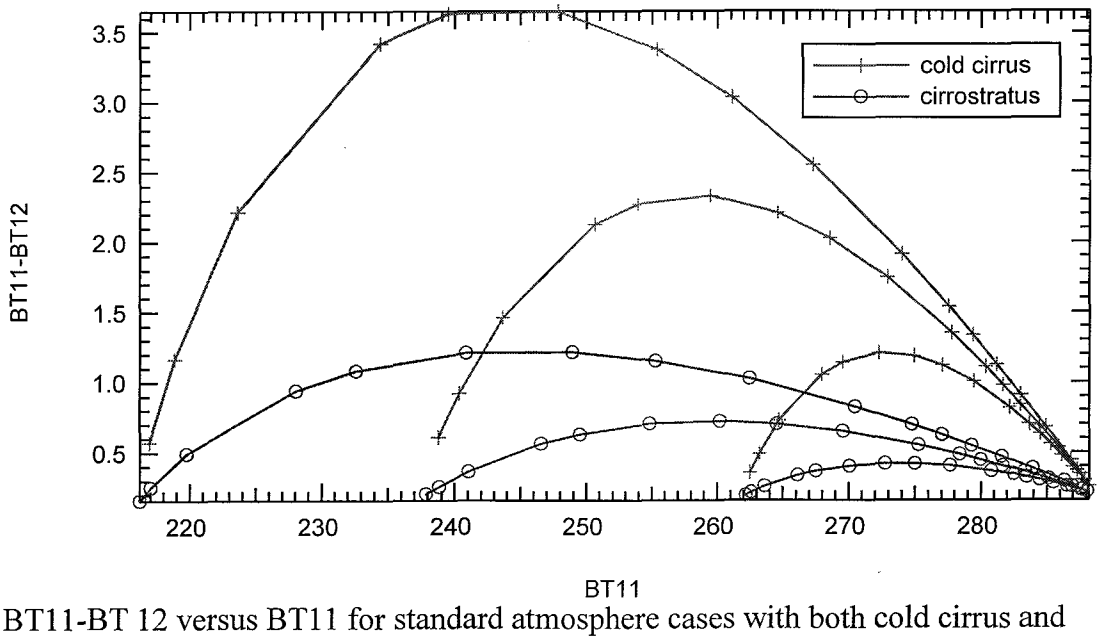
BT differences for the cold cirrus simulations. The marker size increases with increasing optical depth.



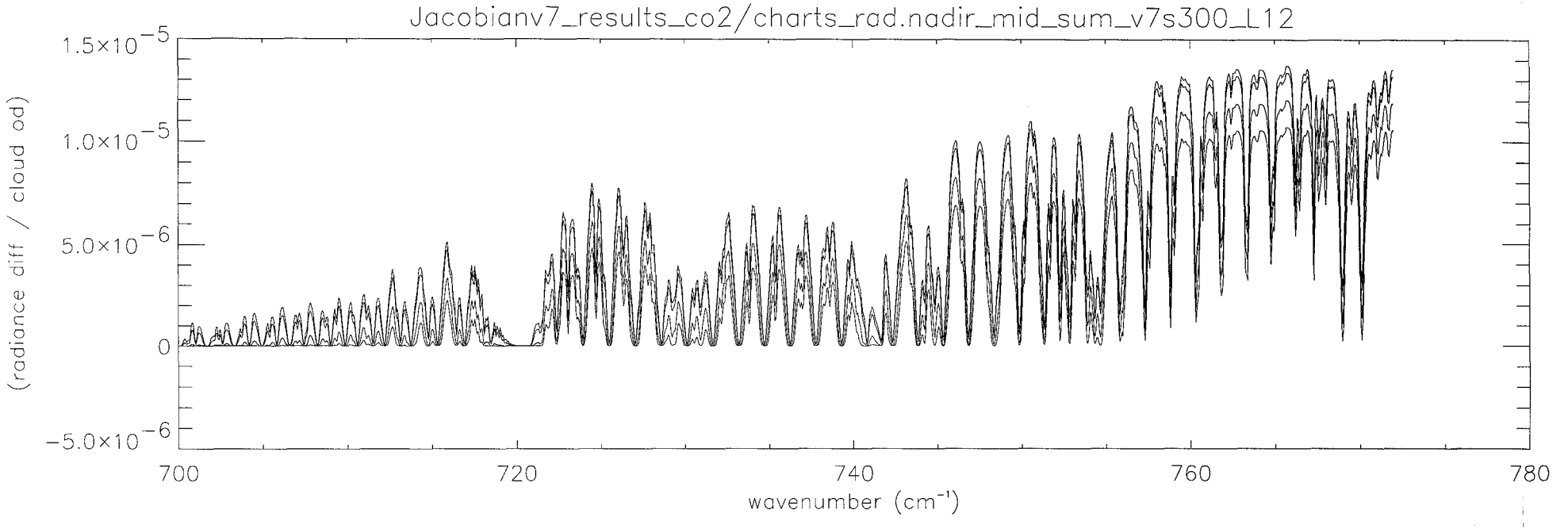
BT differences for the cirrostratus simulations. The marker size increases with increasing optical depth.

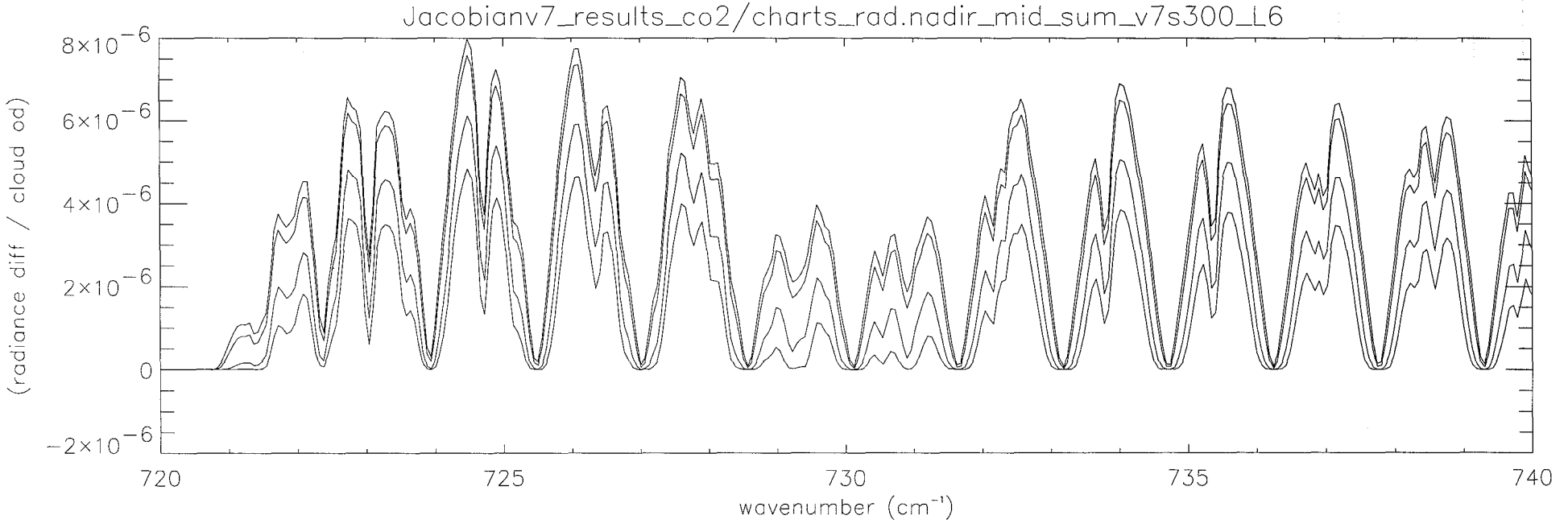


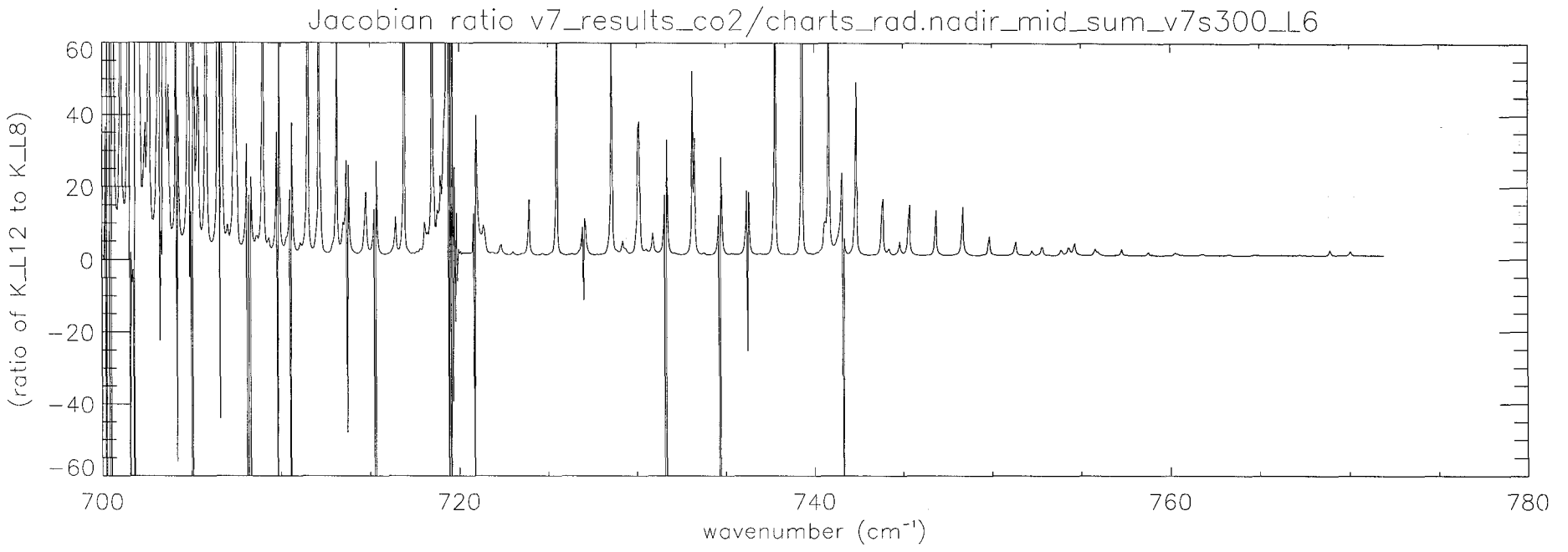
BT differences for the cold cirrus and cirrostratus models with the standard atmosphere model.

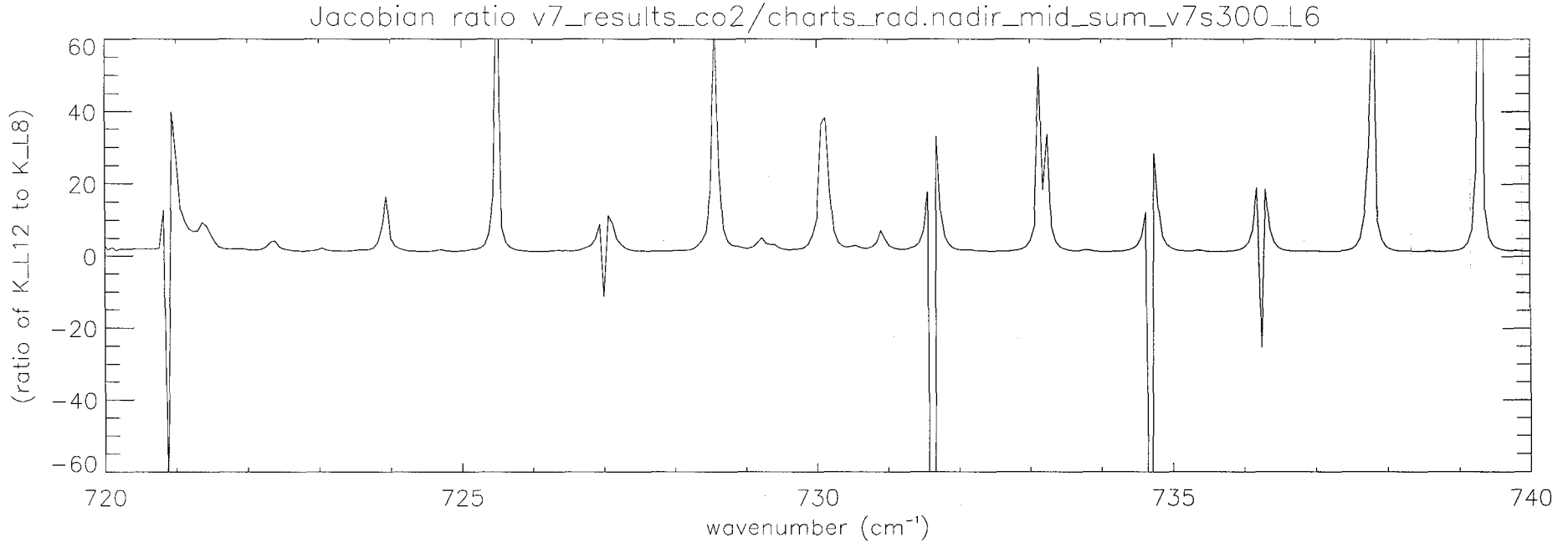


BT11-BT 12 versus BT11 for standard atmosphere cases with both cold cirrus and cirrostratus cloud models.


Jacobianv7_results_co2/charts_rad.nadir_mid_sum_v7s300_L12
1.5×10⁻⁵
1.0×10⁻⁵
5.0×10⁻⁶
0
−5.0×10⁻⁶
(radiance diff / cloud od)
700
720
740
760
780
wavenumber (cm⁻¹)


Jacobianv7_results_co2/charts_rad.nadir_mid_sum_v7s300_L6
8×10⁻⁶
6×10⁻⁶
4×10⁻⁶
2×10⁻⁶
0
−2×10⁻⁶
(radiance diff / cloud od)
720
725
730
735
740
wavenumber (cm⁻¹)


Jacobian ratio v7_results_co2/charts_rad.nadir_mid_sum_v7s300_L6
(ratio of K_L12 to K_L8)
60
40
20
0
-20
-40
-60
700
720
740
760
780
wavenumber (cm-1)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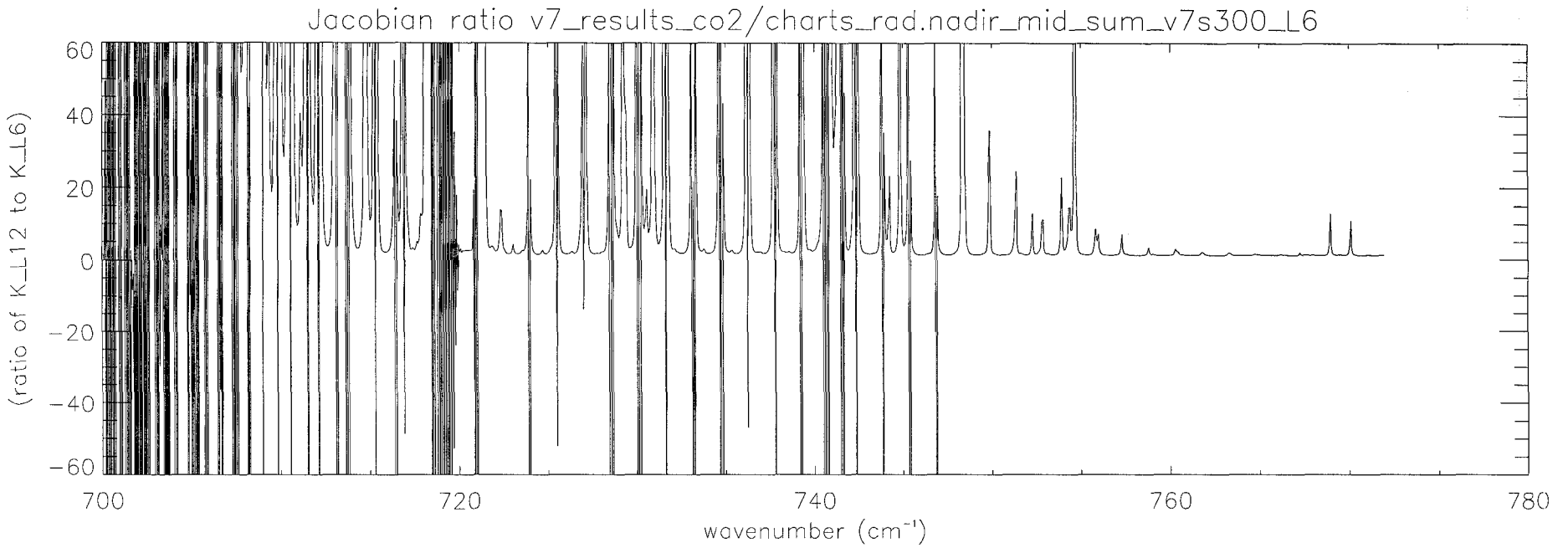
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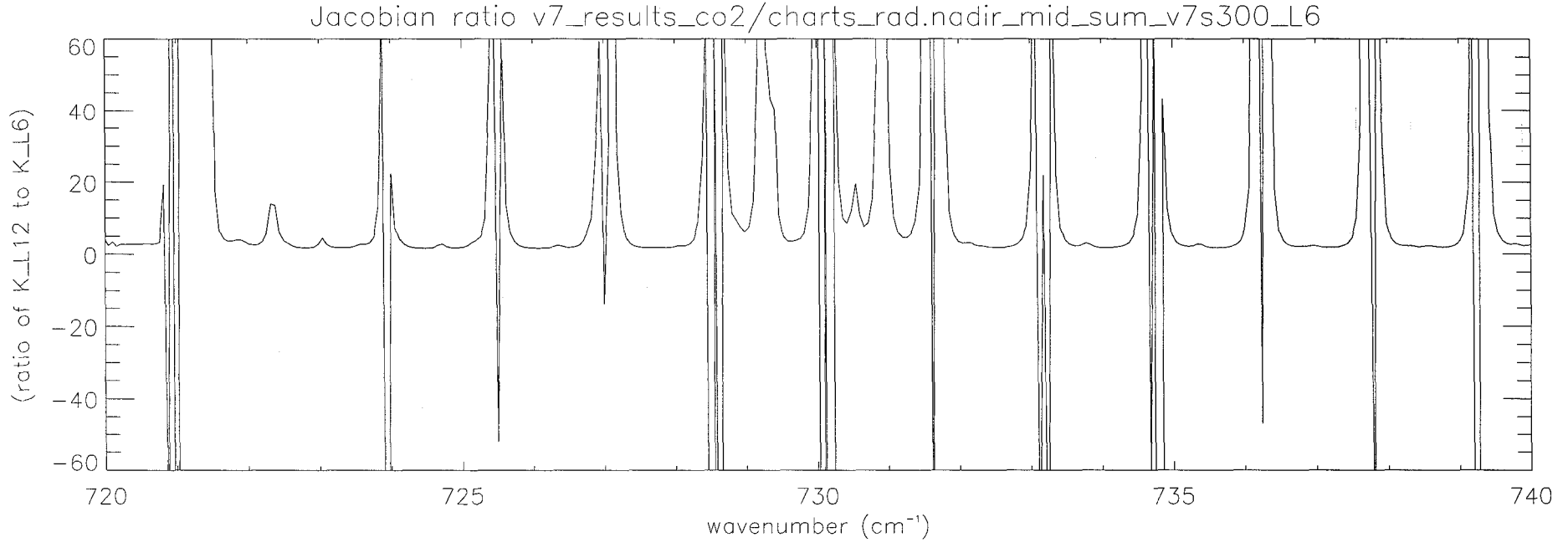
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