Working with CLIMCAPS trapezoids

How to calculate coarse-layer AKs on fine-layer RTA grid

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Acronyms

- **fn** = file name
- **AK** = averaging kernel
- **nL** = number of retrieval (fine) layers above surface pressure at target scene
- **nj** = number of trapezoidal (coarse) layers above surface pressure at target scene
- **ifoot** = index of retrieval footprint along scanline. Each CLIMCAPS granule has 30 footprints in each scanline
- **iscan** = index of footprint across scanline. Each CLIMCAPS granule has 45 footprints across the scanlines
- ***func*** = trapezoidal basis function

STEP 1: Read file and extract relevant fields then plot arrays using **calc_trapezoids_fmatrix.pro**

- Sample files
  - **fn1**='~/data/SNDR.J1.CRIMSS.20201230T2248.m06.g229.L2_CLIMCAPS_RET.std.v02_28.G.210203073025.nc'
  - **fn2**='~/data/SNDR.J1.CRIMSS.20190901T0336.m06.g037.L2_CLIMCAPS_RET.std.v02_28.G.200214174949.nc'
- Ifoot=4, iscan=32 (target field-of-regard)
- Read these fields for ozone:
  - Co2_func_htop = 0
  - Co2_func_hbot = 0
  - Co2_func_indxs = [1, 22, 44, 55, 63, 69, 75, 85, 100] = 9 values depicting boundaries of coarse pressure layers for trapezoid basis functions
  - Co2_ave_kern(*,*,ifoot,iscan) = [8 x 8]
  - Prior_surf_pres/100. –> **fn1** = 1019.00 hPa, **fn2** = 840.207 hPa

STEP 2: Adjust vertical grids according to surface pressure at target scene [ifoot,iscan]

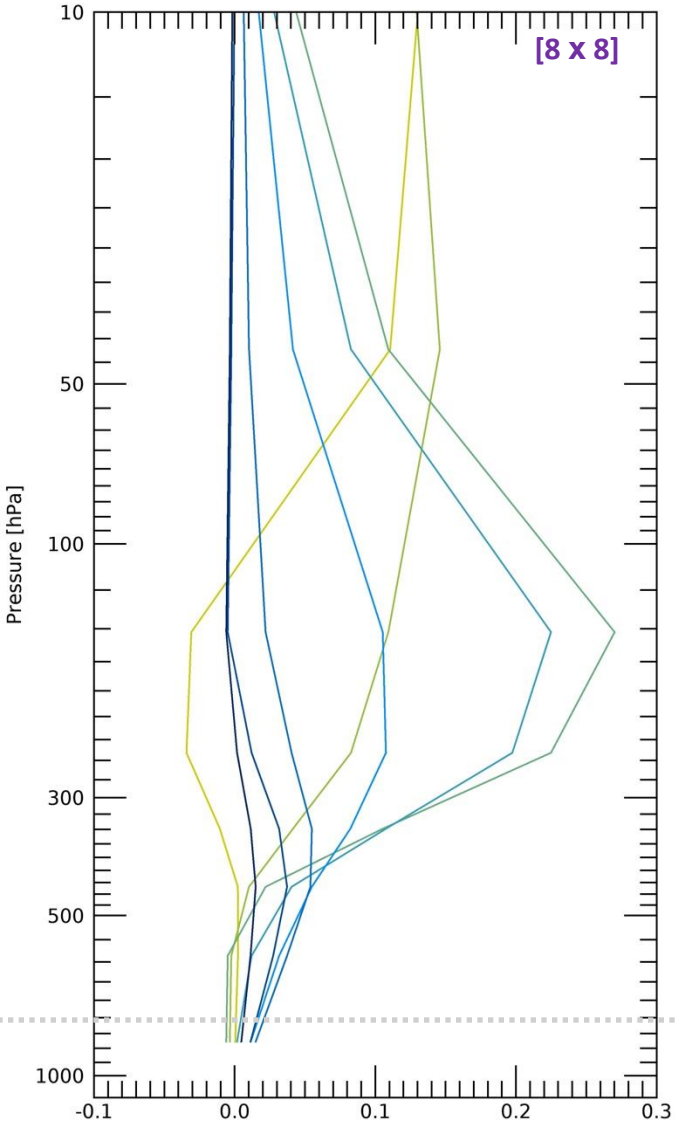
- ak_nlev_scene = 9
- co2_func_indxs after surface adjustment
  - fn1 = [1 22 44 55 63 69 75 85 98]
  - fn2 = [1 22 44 55 63 69 75 85 91]

STEP 3: Calculate transformation matrix (f_matrix) and its pseudo inverse

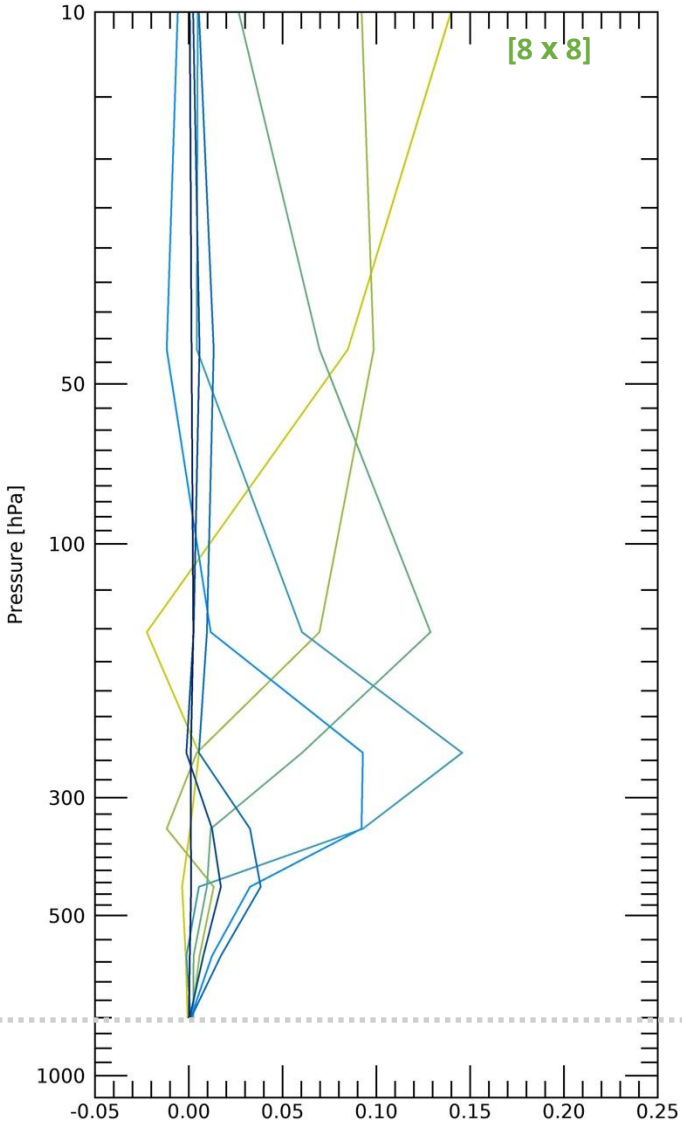
- **calc_trapezoids_fmatrix.pro** calls **calc_finv_mp.pro**, which depends on **slb2fin.pro**

Averaging Kernels (AKs) on coarse grid

co2_ave_kern from **fn1, psurf = 1019 hPa**

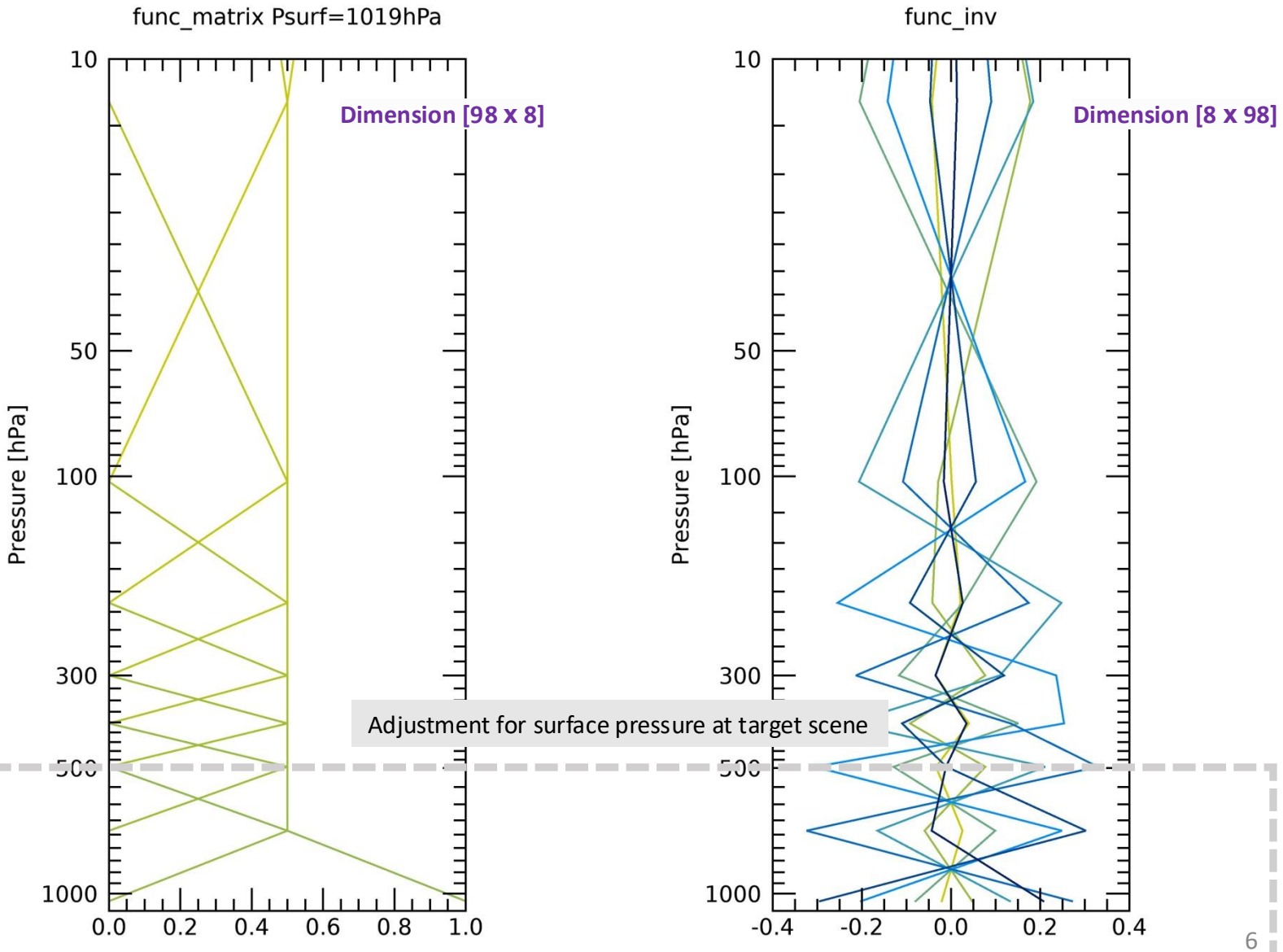


co2_ave_kern **fn2, psurf = 840 hPa**



Func_matrix and its inverse for fn1

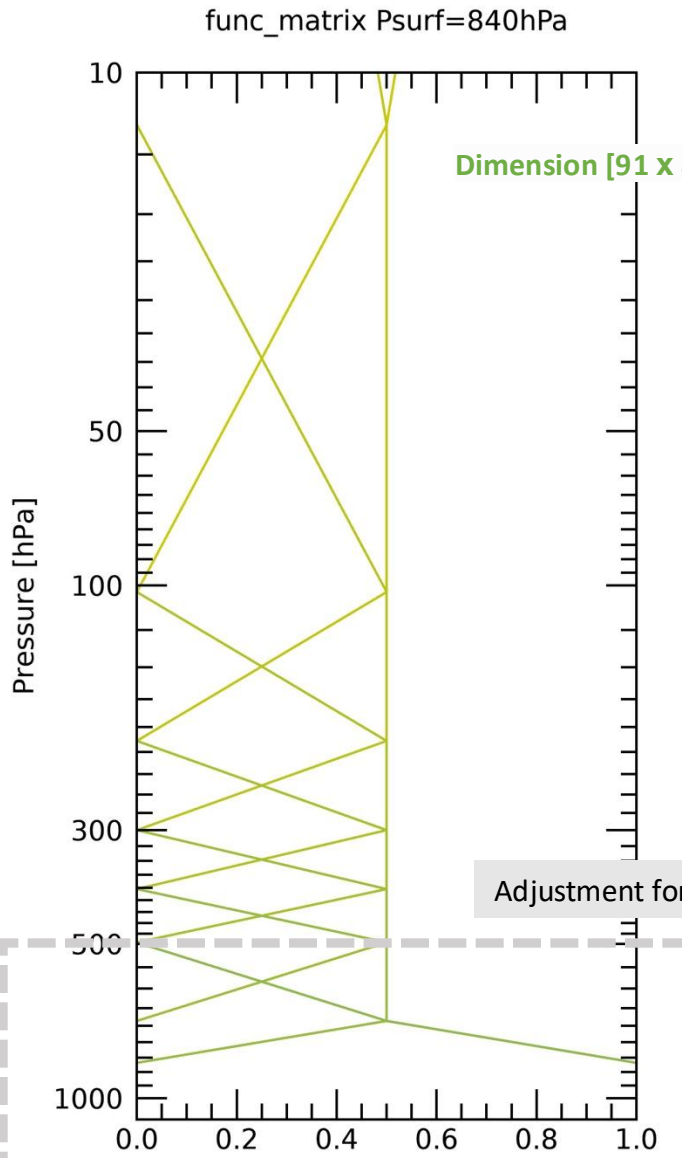
Eq. 11 Maddy & Barnet 2008



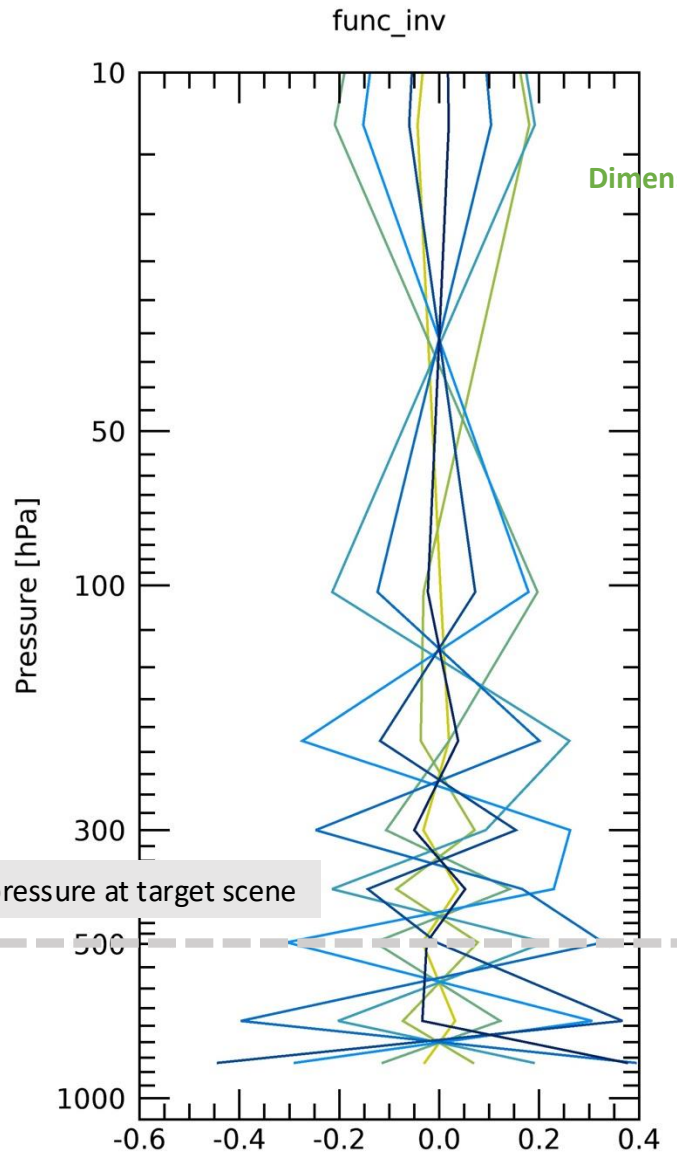
Adjustment for surface pressure at target scene

Func_matrix and its inverse for fn2

Eq. 11 Maddy & Barnet 2008



Dimension [91 x 8]

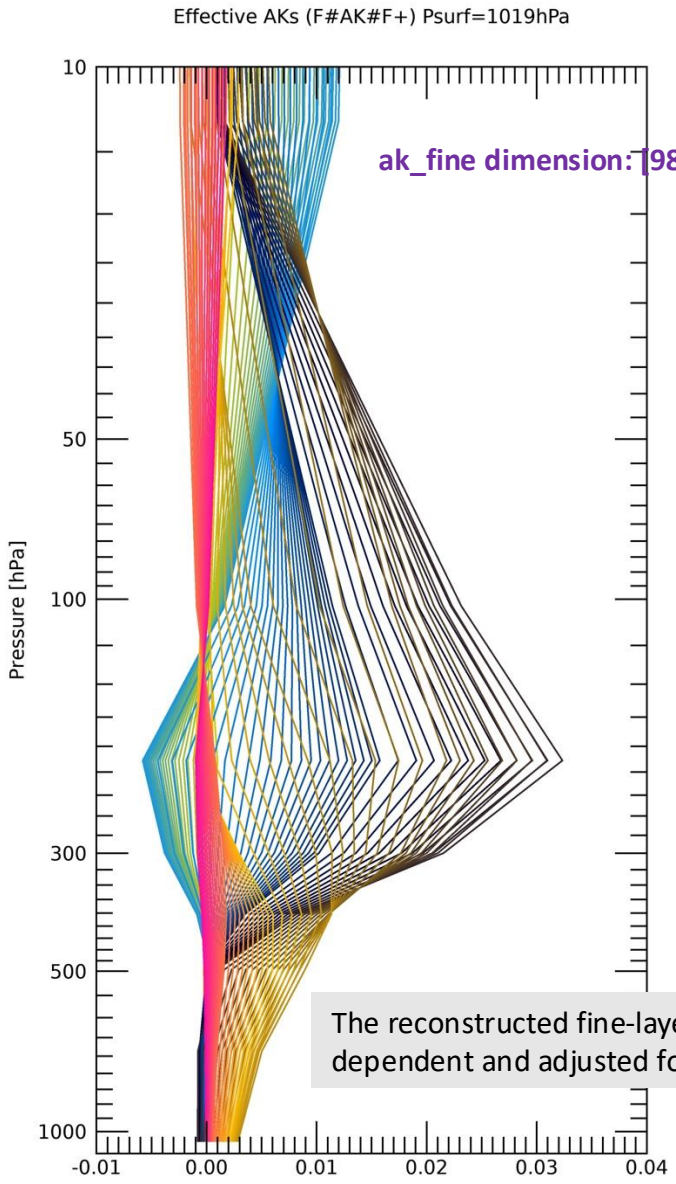


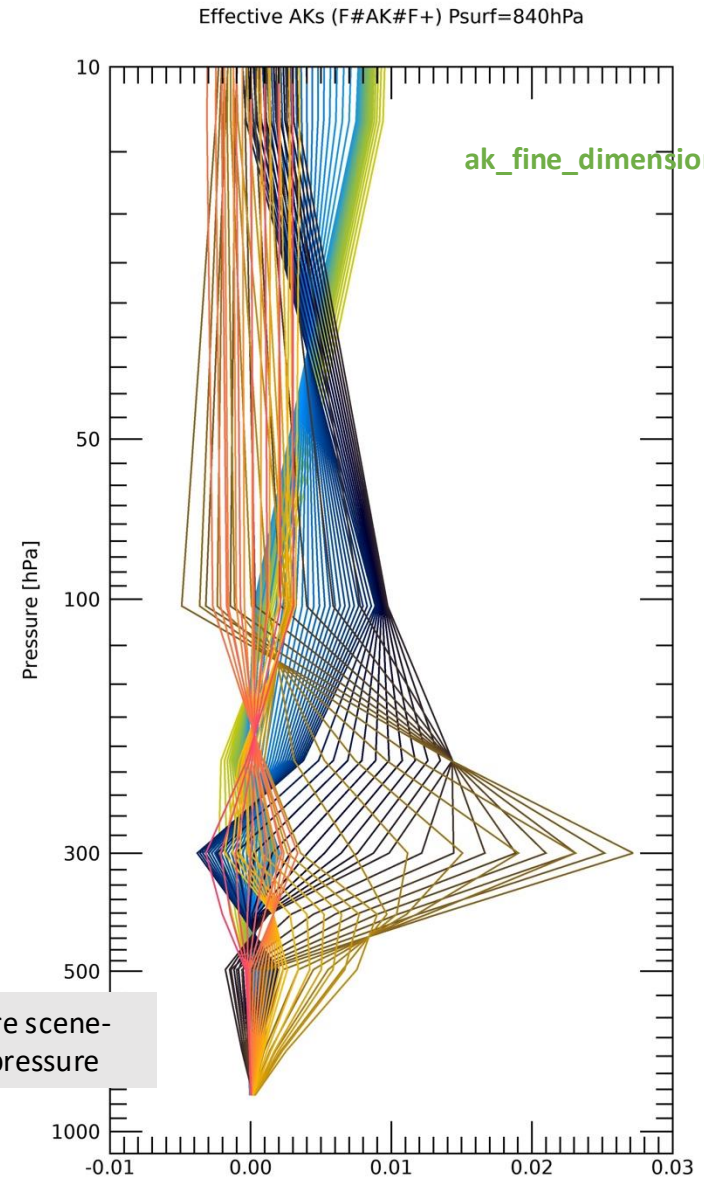
Dimension [8 x 91]

Adjustment for surface pressure at target scene

Effective Averaging Kernels (fine levels)

Similar to left panels in Figure 4 of Maddy & Barnet 2008 – Effective Averaging Kernels = func_matrix # (coarse AKs) # func_inv





The reconstructed fine-layered AKs are scene-dependent and adjusted for surface pressure

Smoothing Kernels (fine layers)

Similar to right panels in Figure 4 of Maddy & Barnet 2008 – Smoothing Kernels = func_matrix # func_inv