METR 5303 Computer Problem #3

Successive Corrections and Barnes Objective Analysis

Assigned October 15, 2019, Due Tuesday, October 29, 2019

1. Perform a 3-pass Cressman analysis with $R = 4\bar{d}$, $R = 2.5\bar{d}$ and $R = 1.5\bar{d}$, using the mean station separation value you calculated earlier. Use height data only. The first pass will have no first guess field, but interpolation of observation increments will be used on the second and third passes. Contour the three analyses and the difference fields between them. Compute root mean square difference between both analyses and observations and between the different analyses. Please comment on your results.

2. We will now use the Barnes weight function and follow the Koch et al (1983) procedure. Use the same data and grid as before. Let $\Delta n_r = \Delta n =$ the average station separation you computed in Homework Problem # 1 (using $\bar{d}$ = 346 km). Compute k_0 and plot the response function D_0 as a function of λ / L, L=2Δn (i.e., - reproduce the curve labeled "1" on Fig. 1 in Koch et al).

   Also plot on this same diagram:

   (a) D_1 * *for* $\gamma = 1.0$
   (b) D_1 * *for* $\gamma = 0.4$
   (c) D_1 * *for* $\gamma = 0.2$
   (d) D_2 * *for* $\gamma = 1.0$ (3 passes of regular Barnes scheme)

   NOTE: Compute response for D_2 * from

$$D_2^* = D_0 \sum_{n=0}^{2} (1 - D_0)^n$$

   Please interpret your results.

3. Perform a Barnes 2-pass analysis of your height data with

   (a) $\gamma = 1.0$
   (b) $\gamma = 0.4$
   (c) $\gamma = 0.2$
   (d) $\gamma = 1.0$ but using 3 passes

   Let your cutoff radius $R_c = (15k_0)^{1/2}$. (What is R_c in terms of Δx?). Compare these analyses with each other and with the 1-pass Cressman scheme with $R = 1.87\bar{d}$. Use RMS difference fields to make judgments about which analysis is "best".