Objective Analysis Laboratory Assignment, OC4331 S96
Due Thursday, 18 April 1996

General notes

- This assignment requires the use of Matlab v4.1. The program may be run from any computer but access to the OC/MR SGI network is required to obtain the command file.
- You will need to copy the command file to your directory (it is not large) by typing:
  `cp ~paduan/OC4331/oa.m ./oa.m` ↵ (both upper and lower case)
- You may execute the command file from within Matlab by typing: `oa` ↵
- The command file presents a figure of a Gaussian hill constructed from the equation: $f(x,y) = \exp\,[\,-(x^2 + y^2)\,/\,20]$. We'll take this to be the "true" property value, e.g. temperature, in the experiment domain.
- The command file makes a total of 4 plots in separate plot windows. You may need to move the windows around your screen to see them and the instructions in the command window.
- You will select locations at which to sample the true field using the Left and Right mouse buttons. You will then be asked to select shape and length scale parameters of the covariance function used to objectively map the sampled points over the entire domain.
- The instructions below ask you to run several trials and to comment on the impact of the mapping parameters and the data locations. The program reports the rms difference between the true and mapped fields as one relative measure of error.

Specific Instructions

1) Run the oa program and select 10–15 fairly evenly distributed observation points.
2) Try both Exponential and Gaussian covariance functions with length scales in the range L=0.5 to L=20
3) Run the oa program and select poorly distributed observations points (i.e. in clumps).
4) Repeat 2) above.
5) Write up answers to the following questions:

   What is the effect of the shape of the covariance function (Exp versus Gaussian)? Which covariance function is likely to be closer to the appropriate one for the true field?

   What is the effect of the length scale, L?

   What is the effect of data distributions relative to the true field?

   What combination of covariance function and L (approximately) gives the best answer?

6) Support your conclusions with 3 or 4 plots of your mapped fields. (You should be able to do most of your work from the computer screen. Print out only representative plots to save trees and toner!)