

## Class Exercise 2

### Introduction to Data Assimilation

**Given:**

Observation of room temperature at grid 1 and its error characteristics,

$$T_{o,1} = T_{t,1} + e_{o,1} \text{ where } E(e_{o,1}) = 0, E(e_{o,1}^2) = \sigma_{o,1}^2$$

as well as, a first guess of the room temperature at grid 0 and 1 and their error characteristics,

$$T_{b,0} = T_{t,0} + e_{b,0} \text{ where } E(e_{b,0}) = 0, E(e_{b,0}^2) = \sigma_{b,0}^2$$

$$T_{b,1} = T_{t,1} + e_{b,1} \text{ where } E(e_{b,1}) = 0, E(e_{b,1}^2) = \sigma_{b,1}^2$$

where

$$\sigma_{b,0}^2 = \sigma_{b,1}^2 \text{ and } E(e_{b,0}, e_{b,1}) = \rho_{0,1} \sigma_b^2$$

Assume that the error in observation is uncorrelated with the errors in our first guess, i.e.,

$$E(e_{o,1}, e_{b,0}) = \sigma_{\{o,1\}\{b,0\}} = 0$$

$$E(e_{o,1}, e_{b,1}) = \sigma_{\{o,1\}\{b,1\}} = 0$$

**Question:** Find an analysis estimate (and its error) of the temperature at grid 0 given observation in grid 1.