Notes on Kriging. Menke 23 Nov 93. Note also Hansen, R.O., Interpretive gridding by anisotropic kriging, Geophysics 58, 1491-1497, 1993.

A. u_i are a stationary, random process with

$\langle u_i \rangle = 0$, and covariance

$$C_{ij} = \int u_i u_j P(\underline{u})\, d\underline{u}$$

B. interpolate with formula

$$u_i^{est} = \lambda_{ij} u_j$$

C. find λ_{ij} by minimizing $\langle [u_i^{est} - u_i]^2 \rangle$ at every i

$$\frac{\partial}{\partial \lambda_{iq}} \int \Big[\sum_j \lambda_{ij} u_j - u_i\Big]^2 P(\underline{u})\, d\underline{u} = 0$$

$$\int \Big[\sum_j \delta_{jq} u_j\Big]\Big[\sum_k \lambda_{ik} u_k - u_i\Big] P(\underline{u})\, d\underline{u} = 0$$

$$\int \Big[u_q \sum_k \lambda_{ik} u_k - u_q u_i\Big] P(\underline{u})\, d\underline{u} = 0$$

$$\sum_k C(q-k)\, \lambda_{ik} = C(q-i)$$

which can be solved for λ_{ik} if $C(i-j)$ is known.

D. Note that the Wiener-Khinchin relation relates $C(\Delta x)$ to $P(k_x)$; where P = power spectrum

$$C(\Delta x) = \mathcal{F}^{-1} P(k_x) \qquad \mathcal{F}^{-1} = \text{inverse Fourier transform}$$