

## Problem Set 3: SIO 221B, Data Analysis

due Friday, November 1, 2002

1. (Problem 2 from the notes.) Suppose particle motion evolves according to

$$X(n) = X(n-1) + \Delta V(n) \quad (1)$$

$$V(n) = (1 - \alpha)V(n-1) + R(n) \quad (2)$$

where  $R$  is independent of  $V(n)$ , has stationary statistics and is serially uncorrelated. Find the general solution for  $V(n)$ . Use it to find the diffusivity of  $\kappa^\infty = \lim_{t \rightarrow \infty} \frac{1}{2} \frac{d}{dt} \langle X^2(t) \rangle$  in terms of  $\alpha$  and  $\langle R^2 \rangle$ . Will the concentration of  $X$ -particles obey a diffusion equation? Why?

2. The wind fields that we used in the midterm show evidence for a clear annual cycle. Use a least squares fitting procedure to estimate the mean wind, a linear trend, and the size of the annual cycle. Explain your method and show your results for both the zonal and the meridional component of the wind.

You can refine your estimate by assuming that the uncertainty in the wind fields depends on the number of measurements averaged to produce each wind estimate (column 6 of the data). Explain how you would do this?