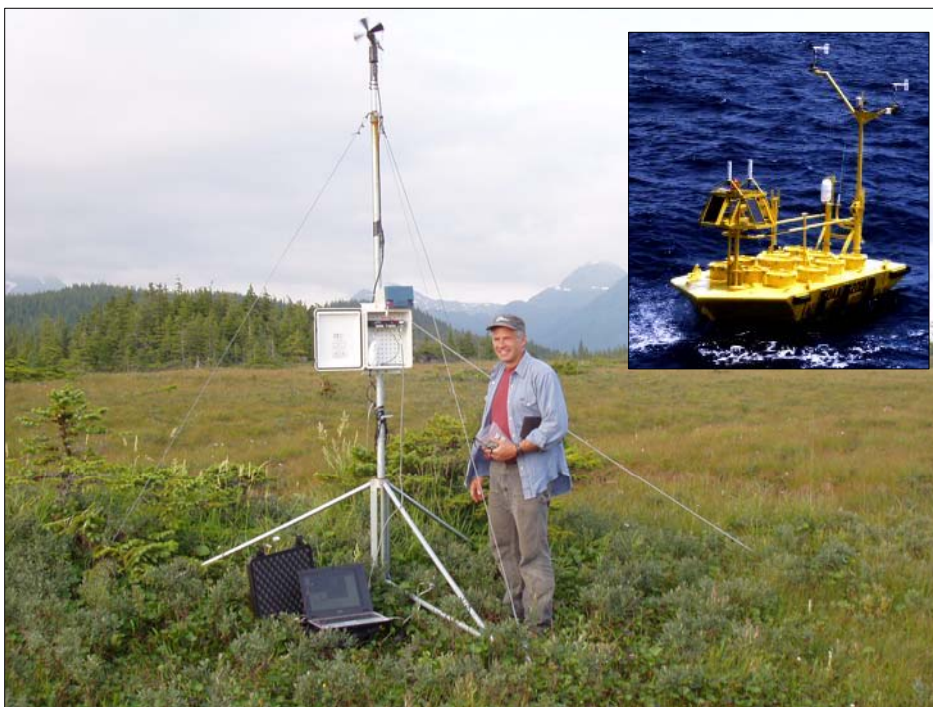


**Comparison of Wind Measurements at
Nuchek Heights, Hinchinbrook Island, and at
Seal Rocks NOAA Data Buoy in Hinchinbrook Entrance, Alaska**



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Introduction. Concurrent hourly average wind speeds and directions from data collection stations on shore at Nuchek Heights and at sea by the NOAA Seal Rocks data buoy were compared during the period from 1600 on 23 August 2004 to 1700 on 18 February 2006 Alaska Standard Time. Archived data records from both stations were retrieved and clipped to the specified time period. Data gaps or clearly anomalous recordings were set to zero so that complete time series of exactly the same length (12315 points) were available for analysis. Wind speeds were converted to statute miles per hour (mph).

Seal Rocks Wind Data. The Seal Rocks station consists of a NOAA National Data Buoy Center 6-meter NOMAD buoy (Station 46061, Figure 1) located at 60° 13.067' N latitude 146° 49.500' W longitude, which is 55 nm south of Valdez in approximately 205 m depth (Figure 2). The anemometer on the buoy is mounted 5 m above the sea. Historical data records for Seal Rocks were downloaded from the NDBC web site. The buoy web site indicates that wind samples are normally taken over an eight minute period. No sample rate is given. .



Figure 1. NOAA photo of a 6-meter NOMAD buoy.

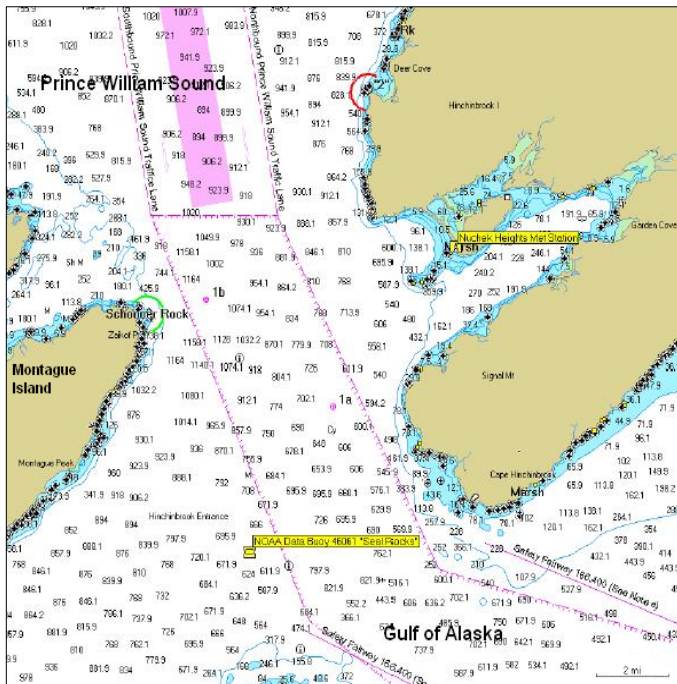


Figure 2. Vicinity of Seal Rocks buoy and Nuchek Heights meteorological station. Soundings are in feet.

Seal Rocks historical records consist mostly of thirty minute summaries. For the comparison, these thirty minutes summaries were vector-averaged to derive hourly records to coincide with the data set from Nuchek Heights.

The average wind speed during the period investigated was 15.9 mph and the maximum wind speed was 57 mph (see Figure 3). Auto-correlation analysis of the Seal Rocks wind speed data revealed no evidence of periodicity beyond

the intuitive seasonal trend of faster winds in winter (see Figure 4). A periodic pattern would show an obvious spike in the autocorrelation plot at the period (lag time) of repetition.

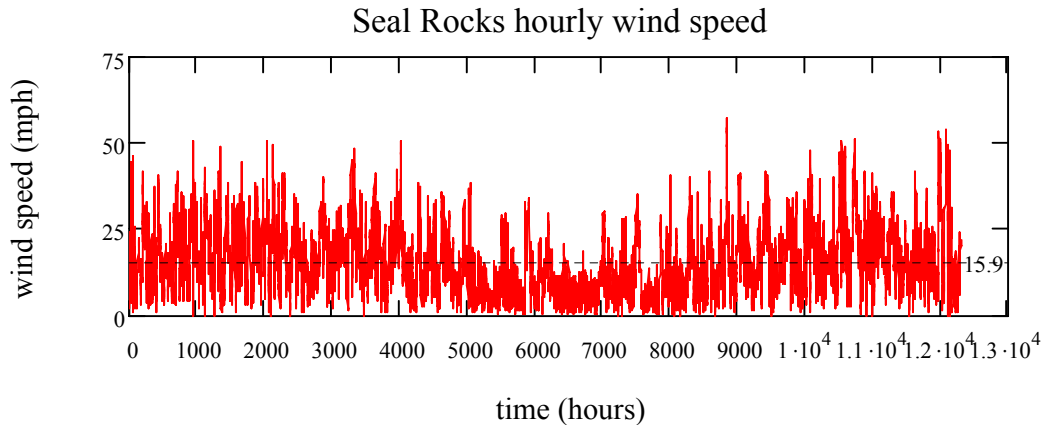


Figure 3. Seal Rocks Wind Speed Data Time Series for 23 August 2004 to 18 February 2006.

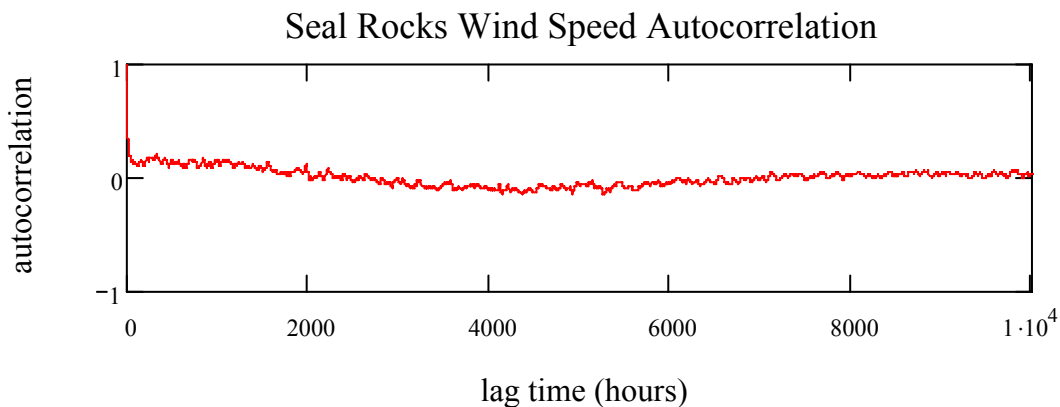


Figure 4. Seal Rocks wind speed autocorrelation plot. The pattern indicates a modest annual trend at 8,760 hours (one year), corresponding to stronger winds each winter.

The average direction from which the wind blew at Seal Rocks was 161 degrees from true north (see Figure 5). Autocorrelation of wind direction data did not indicate any periodicity (see Figure 6).

Nuchek Heights Wind Data. The Nuchek Heights weather station was temporarily located during the period of the measurements addressed herein at 60° 19.871' N latitude and 146° 39.579' W longitude on Hinchinbrook Island on the east side of the Hinchinbrook Entrance to Prince William Sound (see Figures 2 and 5). The data set gathered by the portable wind station at Nuchek Heights consists of hourly summaries produced by a Campbell Scientific CR510 data logger. The data logger had been programmed to sample its sensors every 5 seconds over the entire 60 minute report period.

The average wind speed at Nuchek Heights during the period investigated was 6.4 mph (see Figure 6). The maximum wind speed was 36.9 mph. Autocorrelation analysis of the Seal Rocks wind speed data revealed no evidence of periodicity (see Figure 7).



Figure 5. Nuchek Heights weather station on Hinchinbrook Island, Prince William Sound, Alaska.

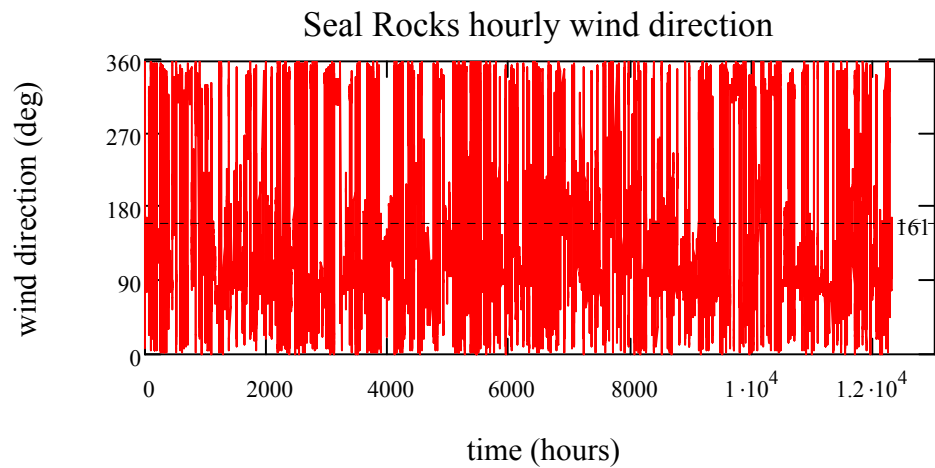


Figure 6. Seal Rocks wind direction time series.

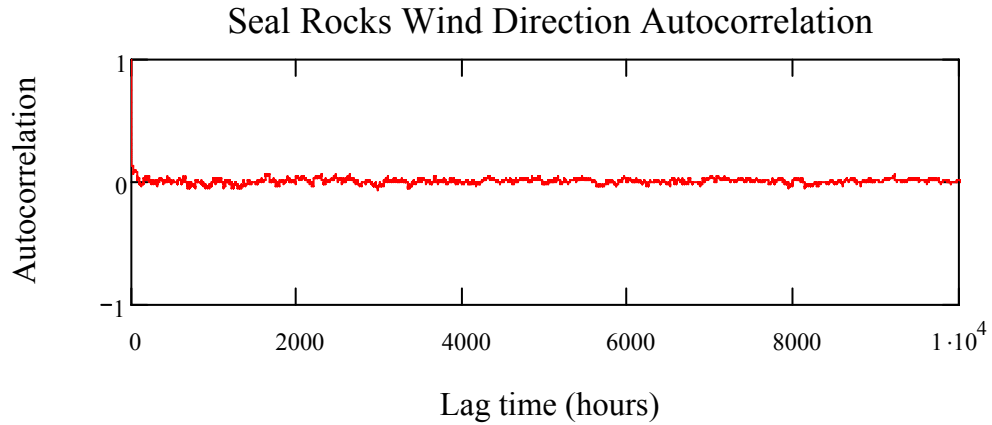


Figure 7. Seal Rocks wind direction autocorrelation.

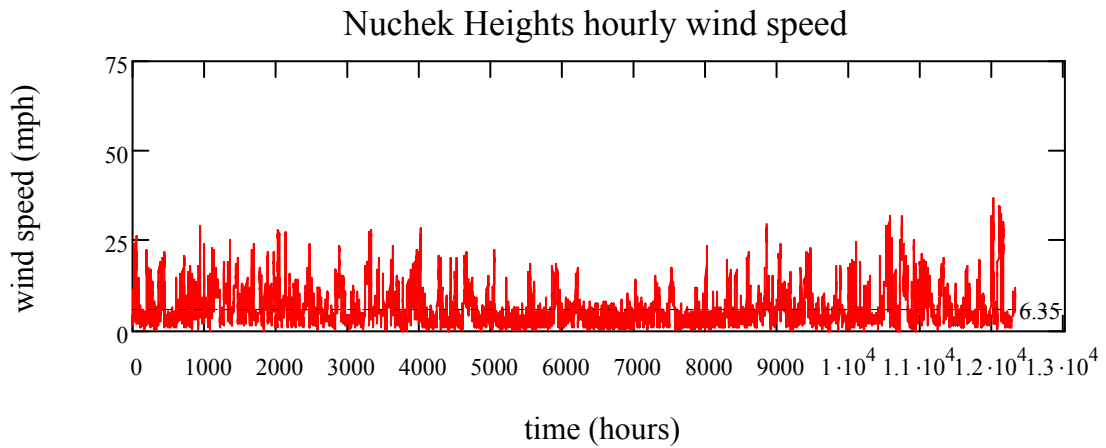


Figure 8. Nuchek Heights wind speed data time series.

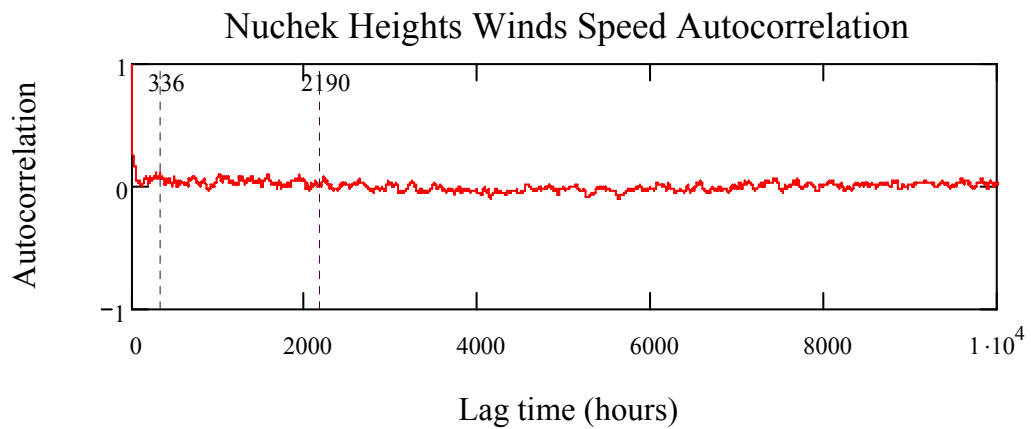


Figure 9. Nuchek Heights wind speed autocorrelation.

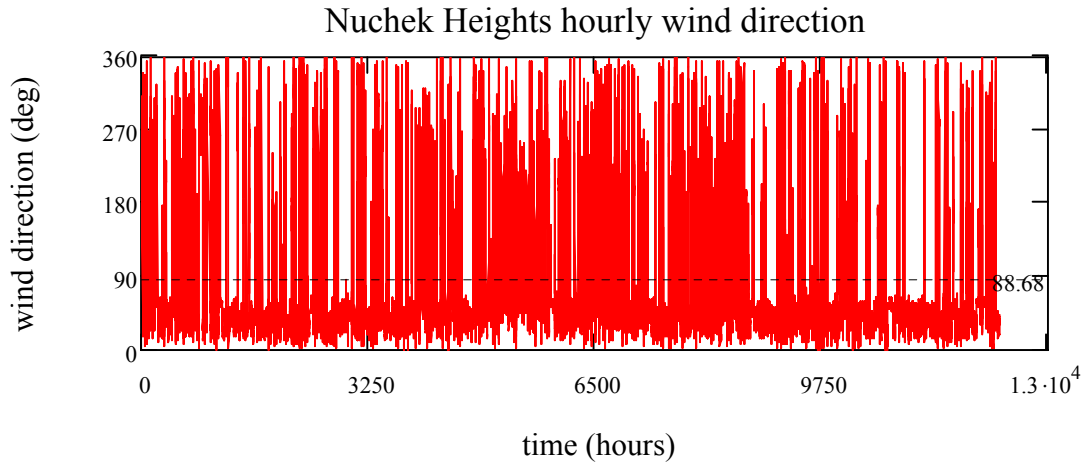


Figure 10. Nuchek Heights wind direction time series.

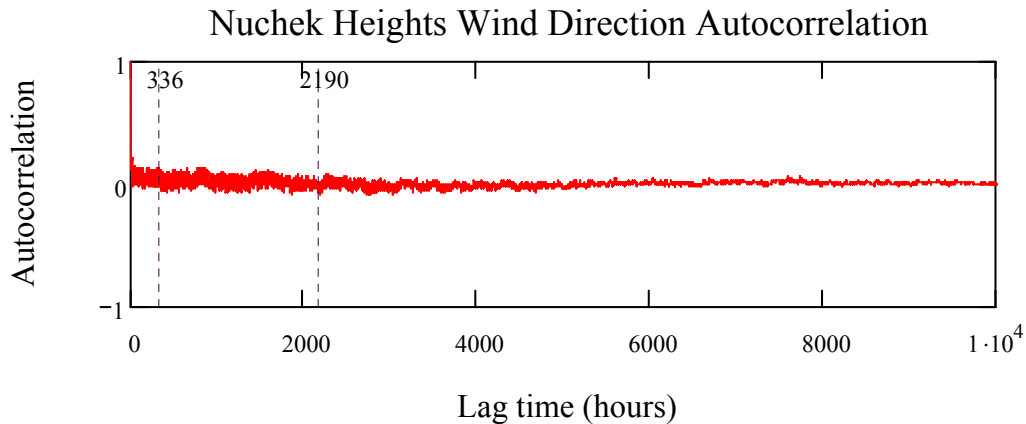


Figure 11. Nuchek Heights wind direction autocorrelation.

Comparison of wind speeds. Figure 12 is a scatter plot of concurrent wind speed data from Seal Rocks and Nuchek heights. The least squares regression correlation is 0.77, indicated by the central nature of the regression line in Figure 12. Wind speeds at Seal Rocks are routinely faster than at Nuchek Heights with a modest degree of predictability. The equation of the line predicting Seal Rocks wind speed given Nuchek Heights wind speed is:

$$\text{Seal Rocks wind speed (mph)} = [\text{Nuchek Heights wind speed (mph)} \times 1.37] + 7.2 \text{ mph.}$$

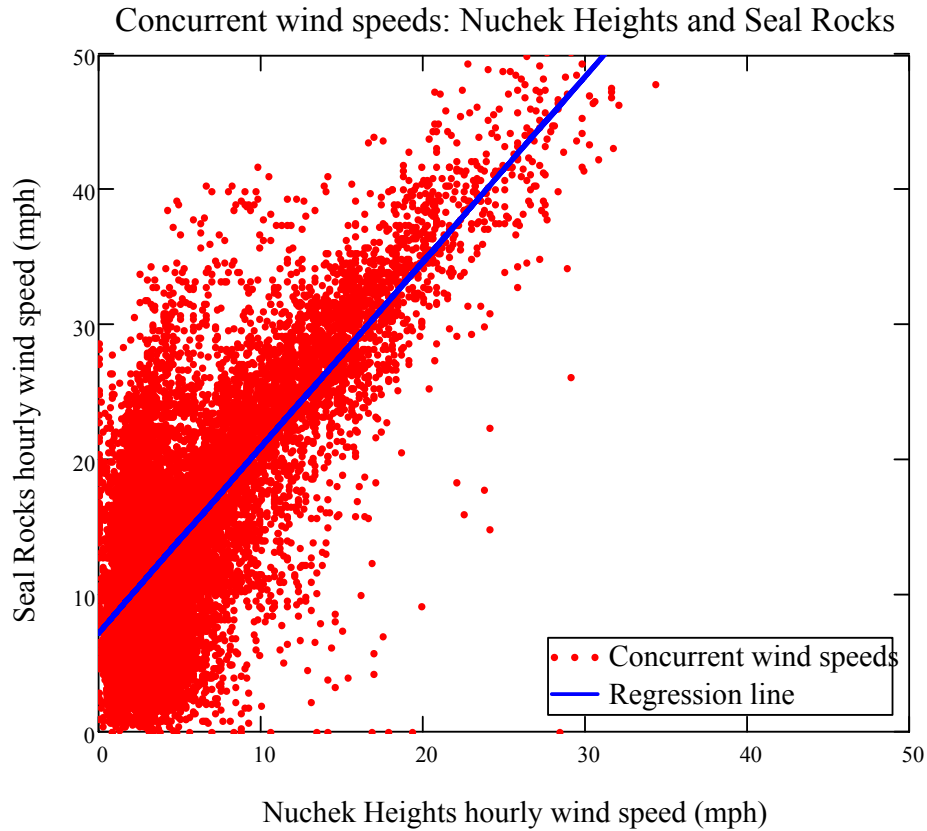


Figure 12. Scattergram of Seal Rocks and Nuchek Heights concurrent wind speeds.

Cross-correlation of the two concurrent time series does not indicate that any lag time between the two time series significantly improves their correlation, as shown in Figure 13. No pattern of a speed correlation other than that of concurrent measurements is evident, indicating the two nearby sites tend to be affected by the same weather conditions at once rather than in a predictable sequence.

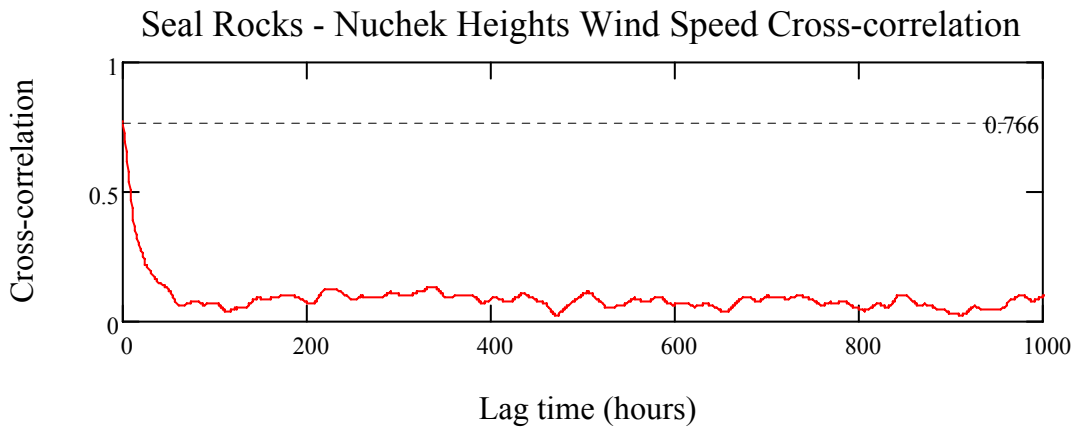


Figure 13. Cross-correlation of Seal Rocks and Nuchek Heights concurrent wind speed data.

Comparison of wind directions. Figure 14 is a scatter plot of concurrent wind speed data from Seal Rocks and Nuchek heights. The least squares regression correlation is low

(0.35), indicating wind directions at Seal Rocks cannot be reliably predicted on the basis of concurrent wind directions at Nuchek Heights, or vice-versa. The wide and random scatter of concurrent data in Figure 14 shows this.

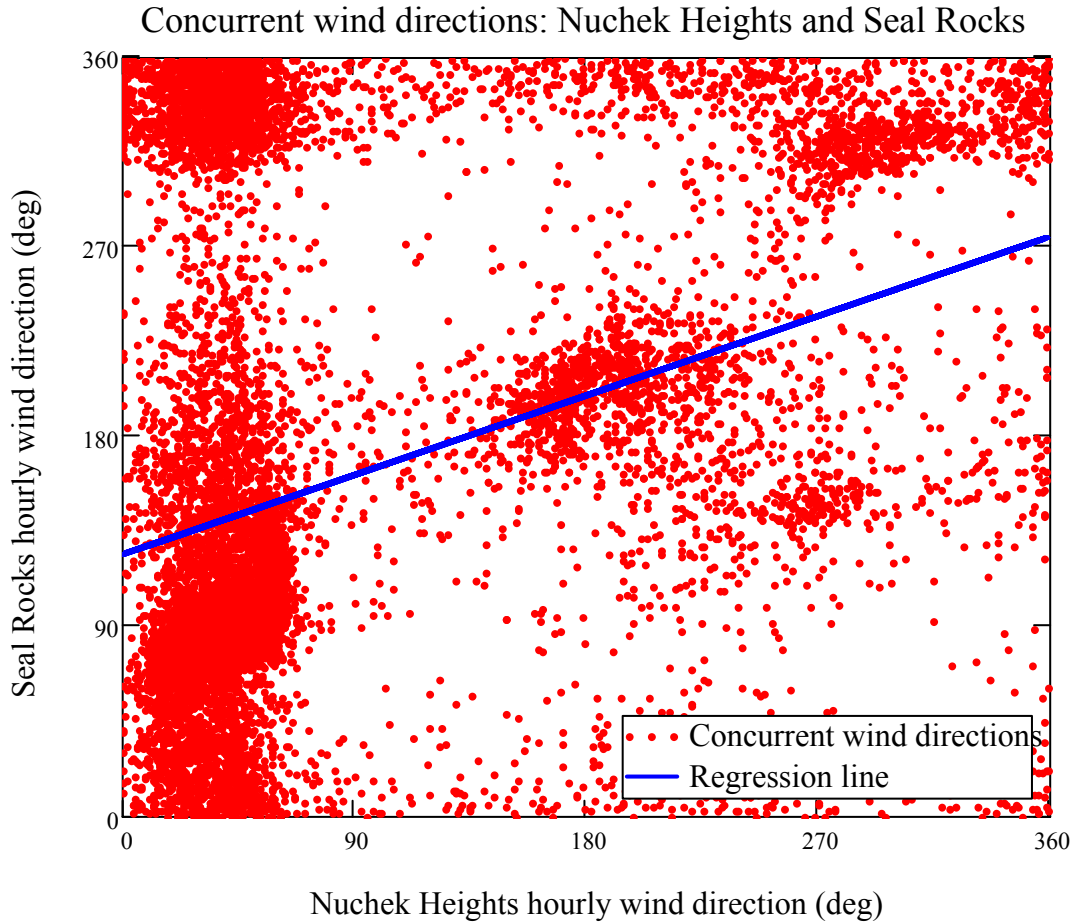


Figure 14. Scattergram of Seal Rocks and Nuchek Heights wind directions.

Cross-correlation of the two concurrent time series does not indicate that any lag time between the two wind direction time series significantly improves their correlation, as shown in Figure 15. Wind directions between the two sites are practically uncorrelated.

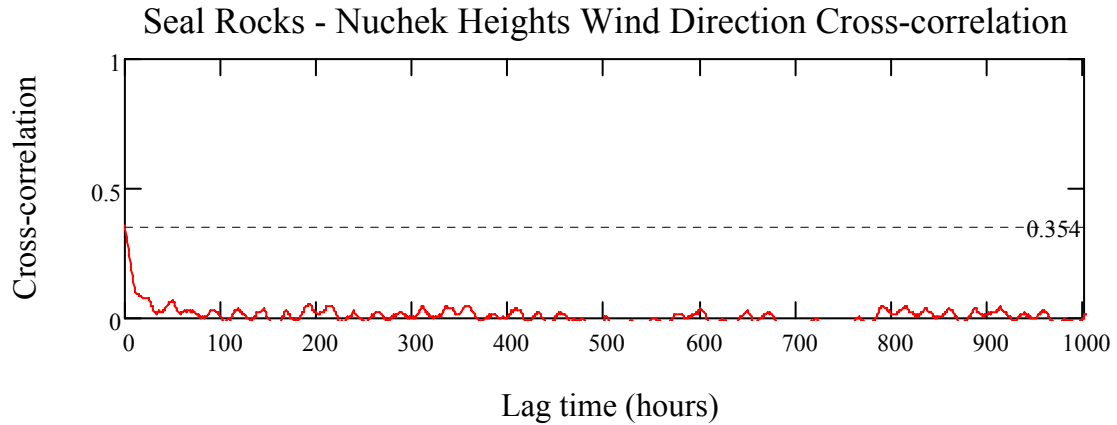


Figure 15. Cross-correlation of concurrent wind directions at Seal Rocks and Nuchek Heights.
Conclusions. Weather patterns in Hinchinbrook Entrance to Prince William Sound between Montague and Hinchinbrook Islands appear to cause stronger winds over the center of the passage than at the shore at Nuchek Heights. This is to be expected given the higher drag of land features compared to that of open water at the Seal Rocks data buoy. Wind direction at Nuchek Heights varies dramatically from that at the Seal Rocks buoy without a predictable pattern. The Nuchek Heights station location does not appear to be a good site for measurements intended to represent conditions in the navigation channel, except that wind speed has a fair correlation with open water speeds in Hinchinbrook Entrance. Buoy data give a fair indication of concurrent wind speed at Nuchek Heights, but not of wind direction.