Effects of Antenna Pattern Smoothing on SeaSonde Radial Data

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Abstract – Codar Ocean Sensor's application CrossLoopPatterner provides many options for processing antenna pattern measurements (APMs). Antenna patterns were smoothed with this application at 10 degree increments and data reprocessed to radials. These radials were then compared with in situ drifter data covering a broad range of bearings from a SeaSonde site. Results indicate slightly improved comparisons with antenna patterns smoothed 10-20 degrees in azimuth.

Methods – Drifter data was binned in space and time to estimate HF radar-like radial velocity components. The R-squared and RMS difference was calculated to quantify the effects of antenna pattern smoothing on correlation between Drifter and Codar velocities. Coverage maps were made to examine the effects of antenna pattern smoothing on the radial coverage.

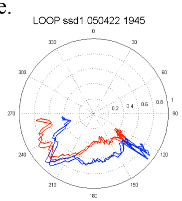


Figure 1 (right): Pattern Amplitudes from the Summerland Sanitary District HF radar site.

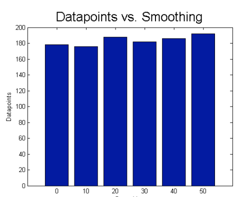


Figure 2 (left): Number of Codar and Drifter data points from the same space and time for different levels of APM smoothing.

Results

Degrees of Smoothing	R-squared (r^2)	RMS
0	0.237	18.19
10	0.257	17.66
20	0.267	17.96
30	0.262	17.89
40	0.264	17.77
50	0.189	18.71

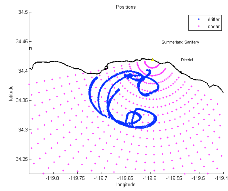


Figure 3 (above) : Drifter and Codar bin locations prior to spatial and temporal binning.

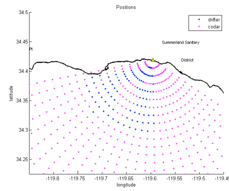
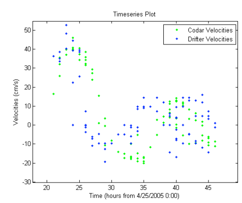
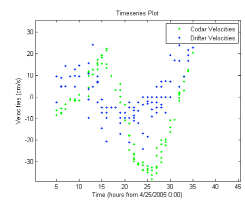


Figure 4 (above): Drifter and Codar locations after binning.

Figures 5 & 6 (above): Timeseries plots of Codar and Drifter velocities for 0 degrees of smoothing on different days. We attribute the relatively low r^2 to antenna pattern distortion .

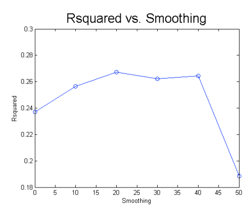


Figure 7: Correlation coefficient (r^2) vs. level of APM smoothing.

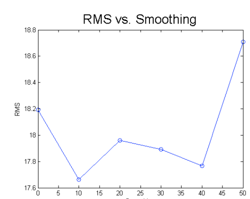


Figure 8: RMS difference vs. level of APM smoothing.

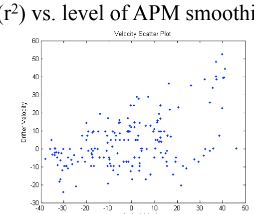


Figure 9 (above): Scatterplot of corresponding Codar and Drifter velocities for 0 degrees of smoothing.

Coverage Maps

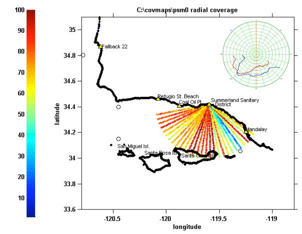


Figure 10: 0° smoothing

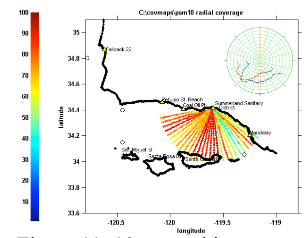


Figure 11: 10° smoothing

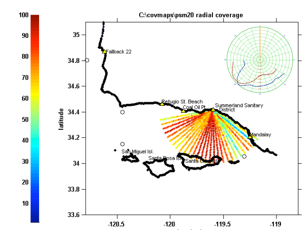


Figure 12: 20° smoothing

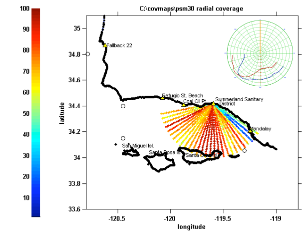


Figure 13: 30° smoothing

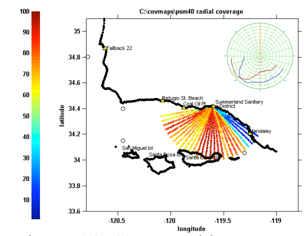


Figure 14: 40° smoothing

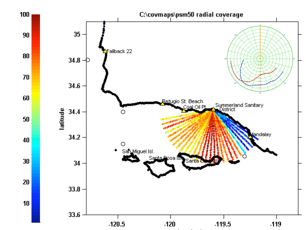


Figure 15: 50° smoothing

Conclusions

•At 20 degrees of smoothing, r^2 between Codar and Drifter radial velocities is 12.7% higher than with no smoothing. The greatest improvements to RMS difference occurred at 10 degrees of smoothing, but were minimal overall.

•Affects of APM smoothing on coverage were negligible for smoothing less than 50 degrees, where coverage was adversely affected.

•Correlation between Drifter and Codar data may be improved through APM smoothing.