Chase Davis

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PHY 577

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HW5

I chose to reevaluate the 6 minute interval water level records for January 2023, in California and Oregon. These are the same records I previously analyzed in HW4. The skill score of the fit using t-tide prediction was 99.3%. The number of constituents that were significant varied each time I ran the t-tide function, ranging from 21-23 out of the 35 constituents being significant. The skill score of the least-squares fit was 46.4%.

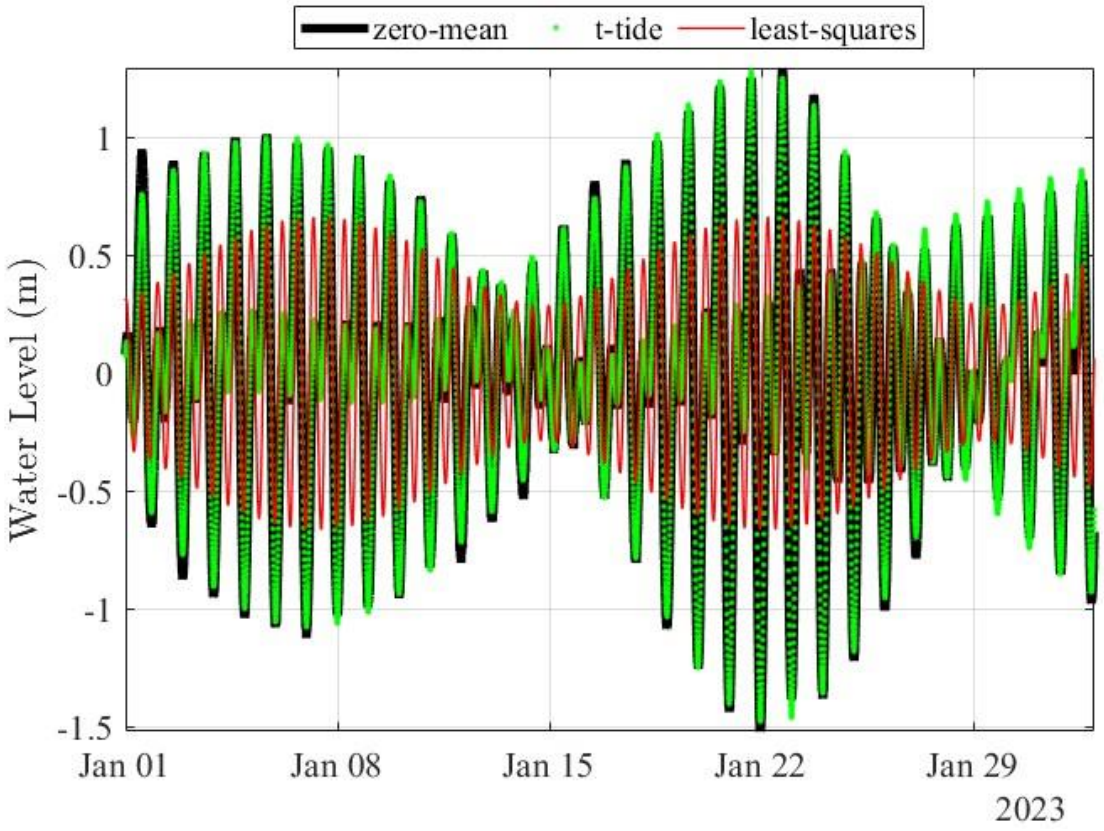

Figure 1: Zero-mean signal, t-tide fit, and least-squares fit of the water level record recorded during January 2023 in La Jolla, California.

The accuracy of the t-tide fit compared to the least-squares fit is illustrated in Figure 1 and supported by their respective skill scores, which were 99.3% and 46.4%. The t-tide function did a phenomenal job predicting the water level timing, shape, and magnitude. At times it slightly under or overpredicted the magnitude but by a very small margin. The least-squares fit does not

do a great job predicting the water level, it appears to be an incomplete prediction. It follows a semi-diurnal structure and captures the larger weekly trends but fails to capture the timing, shape, and magnitude of the daily tidal cycle.

The amplitude and phase of the M2 fit is 0.2265 and -0.0312. The amplitude and phase of the S2 fit is 0.0355 and 2.6662. The fraction of the total variance explained by M2 is 3.1%. The fraction of the total variance explained by S2 is 0.5%. The percent difference in amplitude between the least-squares fit and t-tide is 148.5%.

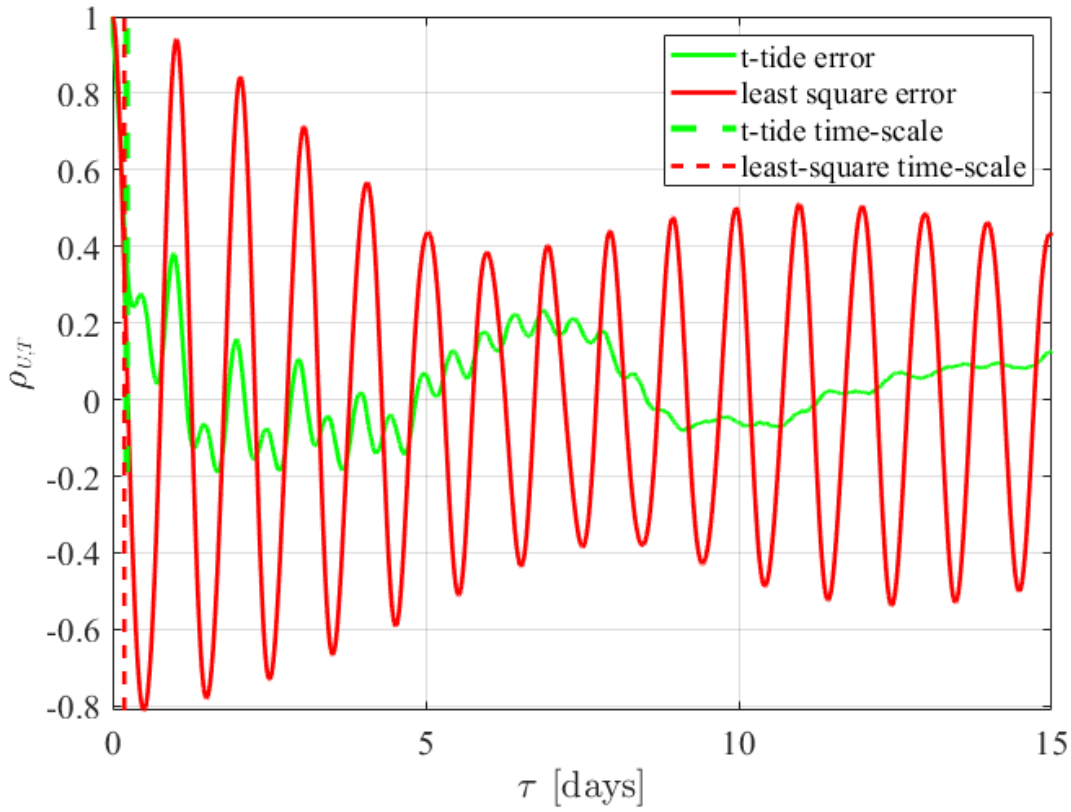

Figure 2: Lagged auto-correlation for t-tide and least-squares error, along with their respective integral time-scale.

The N_d and N_{eff} values for the t-tide error were 54 and 142.22. The N_d and N_{eff} values for the least-squares error were 45 and 170.67.

The lower and upper bound confidence intervals for the least-squares method were 20.7% and 24.6% respectively. The confidence intervals using t-tide are within 95%. These means the upper bound confidence interval using t-tide is 5x more accurate and the lower bound confidence interval using t-tide is 4x more accurate.

The time lag between the sites for the M2 constituent was 2.8 hours. The time lag for the S2 constituent was -8.2 hours. In HW4, the maximum cross-correlation occurred at -2.8 hours.