

## Problems Week 6<sup>1</sup>

*Due Wednesday, November 13, 2019*

This problem set is to be completed independently, without collaborating with your classmates. At the top of your problem set, please write and sign the following statement: “I certify that this represents my own work and that I have not worked with classmates or other individuals to complete this assignment.” If you have questions, you may e-mail me.

1. **Testing degrees of freedom for windowed spectra.** Using the same red and white data records that you used last week, evaluate how many degrees of freedom you have if you apply a *Hamming* window and use records that overlap by 75% rather than 50%. To do this, repeat the Monte Carlo-based analysis that you carried out in part 3 of last week’s problem set. Are the total degrees of freedom consistent with results inferred with a Hanning window or a boxcar window?
2. **Aliasing.** The ERS and Envisat satellites (and their successors) are flown on a 35 day repeat. (The orbit is “sun-synchronous”, so the time period is exactly 35 days.). How are the following tidal frequencies aliased by the satellite orbit? How long does the series of satellites need to sample to provide multiple realizations of the tidal amplitude?

Symbol	Name	period (hours)
$S_1$	Solar diurnal	24.00
$2N_2$	Second-order elliptical lunar	12.9054
$N_2$	Larger elliptical lunar	12.6583
$M_2$	Principal lunar	12.4206
$S_2$	Principal solar semidiurnal	12.00
$K_2$	Declinational solar	11.9672

3. **Bonus: Degrees of freedom.** For a boxcar window with 75% overlap, show that the empirical solution from a Monte Carlo approach is consistent with the analytical solution obtained from Lecture 10, equation 6 in the 2019 course notes.

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<sup>1</sup>Last week’s problem set was erroneously numbered Week 6—this is the real week 6.