Complex Demodulation

A modulated inertial current may be written:

$$u(t) = A(t)e^{-ift}$$

where u is made the complex time series whose real part is the eastward velocity and imaginary part is the northward velocity, A is the low-frequency complex modulation , and f is the inertial frequency. An easy way to find A is to multiply u by e^{ift} and low-pass.

Try performing complex demodulation on the FASINEX mooring data. You might want to form the rotary spectrum of u before you start. See what you can learn about inertial current generation and focusing.

Here are some questions to answer for yourself.

1. How does one interpret the amplitude and phase of A?

2. Is this procedure any different from so-called "backrotating" where one rotates a current back to a certain time assuming that the current is purely inertial.

3. Another method of complex demodulation is to fit cosines and sines of inertial period to short chunks of data. What is the relation between the length of these chunks and the low-pass above?

4. A pure inertial oscillation rotates in the clockwise direction and is perfectly circular. There is, however, energy at the same frequency rotating counterclockwise. Demodulate at this frequency as well to see how elliptical the oscillations may be.

5. Can you see any relation between the demodulated currents, forcing, and the low-frequency currents?