

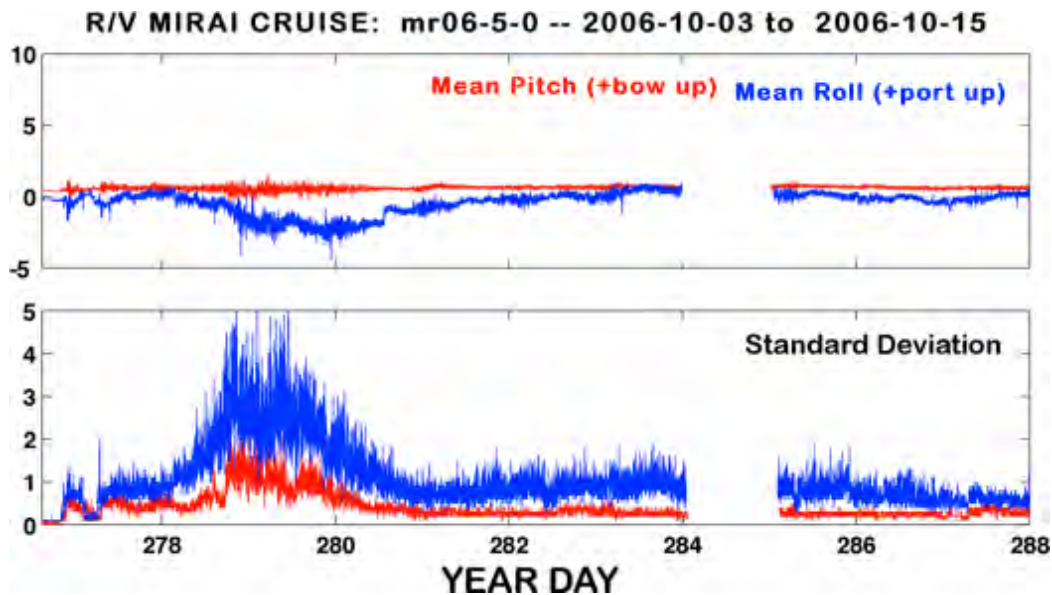
**From:** Michael Reynolds <michael@rmrco.com>  
**Subject:** Ship motion  
**Date:** 11/17/2010 10:06:37  
**To:** Warren Wiscombe <warren.j.wiscombe@nasa.gov>, Ernie Lewis <elewis@bnl.gov>  
**Cc:** Michael Reynolds <michael@rmrco.com>  
▶ 1 Attachment, 75.8 KB



Hi,

Two things.

First, I have been collecting ship motion data from a wide variety of ships for years. I use it to correct the ISAR for IR reflection angle and the PRP MFR head for hemispheric correction. This uses a crude tilt sensor with a conductive fluid in a glass capsule. The fluid is damped to remove vibrations below about 4 Hz. The output is sampled at a rate of about 2-3 sec. Tilts are averaged over several minutes to derive a mean tilt for the correction.



The example here is the pitch and roll for the R/V MIRAI, Japanese research ship, 125 m long. The mean is a two-minute vector average of 3-sec samples. These data are taken at the equator and 80E, very quite seas. Pitch (bow up) is red. The mean pitch is small but the mean roll, called 'list,' is as much as 3 deg. Listing comes from ballast, windage, or wave setup. The standard deviation of the roll, blue, give some indication of the motion of the ship in open sea. Note, a point on a floating platform is subject to accelerations from the tilt of the platform AND from horizontal and vertical accelerations. The data here does not attempt to separate these because the data of interest is mean tilt.

Second, I have located a very nice motion package at a good price, < \$1000. It

is a Microstrain model 3DM-GX2 (<http://microstrain.com/3dm-gx2.aspx>). I am making calls now for price and availability. This sensor uses accelerometers and roll rate gyros for all motions. My friends at NOAA have used this and it is the sensor used by AxyS. We can connect a PC to this and record data at 4 Hz for post-processing spectral analysis.

More later.

Michael