Pop Quiz

Nov. 29

- The tsunami occurred in Indian Ocean on Dec. 26, 2004 killed approximately 230,000 people. The right photos show the satellite photos of Banda Ache, a famous resort city in Indonesia, before and after the tsunami. The tsunami killed people over an area ranging from the immediate vicinity of the quake in Indonesia, Thailand and the north-western coast of Malaysia to thousands of kilometres away in Bangladesh, India, Sri Lanka, the Maldives, and even as far as Somalia, Kenya and Tanzania in eastern Africa.
 - (1) Tsunami is a typical eample of shallow waves. The average depth in the Indian Ocean is 3,900m. Estimate the velocity of Tsunami waves in the Indian Ocean.



- (2) Sketch briefly the velocity vectors and particle orbits in one or two wavelengths.
- (3) When the Tsunami waves approach coastal region, describe how the velocity changes (i.e. speeding up or down), how the wave amplitude changes (i.e. up or down), and what other physical parameter(s) can significantly change the wave motion.
- 2. In 1998, Chevron's Genesis Spar was installed at the location with 790m depth, as indicated the below figure. It carries a full sized drilling rig (7620m depth capacity) in addition to production facilities for 55,000 barrels of oil and 2 million cubic meter of gas per day. The Genesis has a hull of 37.2m hull diameter and 214.9m length. The draft of the hull is 198.1m and a topside deck has the freeboard of 16.8-m. This platform was under the influence of the hurricane Katrina.



(1) Hurricane Katrina hit the offshore production facilities in the Gulf of Mexico (GOM) during 28-29, 2005. Let's assume

that, in one day during Katrina's passing, the ocean waves observed at the Genesis could be

represented by ISSC spectrum with the modal wave period of 21sec and the significant wave height 15m. Then, obtain the followings:

- (i) Mean upcrossing wave period, mean wave height, averaged 1/10th wave height, 1/3rd wave height
- (ii) Find the wave amplitude of 1% and 0.1% probability.



- (iii) The probability that the wave crest hits the deck of topside.
- (2) At this location, if the mean period of waves is 12sec and the significant wave height is 3m through one year, predict the wave heights of 100-year return period.
- 3. When a fully-developed wave spectrum takes the below graph, answer the following questions:



- (1) Write the ocean waves into 4 components.
- (2) What is the mean energy density in this region?
- (3) Describe briefly what the spectrum will look like when the waves becomes smoother a few days later.