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CECIL H. AND IDA M. GREEN
INSTITUTE OF GEOPHYSICS AND PLANETARY PHYSICS
SCRIPPS INSTITUTION OF OCEANOGRAPHY (0225)

LA JOLLA, CALIFORNIA 92093-0225

03 September 2013

RADM Matthew Klunder
Chief of Naval Research
875 North Randolph Street
Arlington, Virginia 22203

Dear Admiral Klunder,

I wish to report on my activities from 1 October 2012 to 30 September 2013 as Secretary of the Navy Chair of Oceanography. This is in continuation of the Secretary of the Navy Chair in Oceanography 1985-90, and follows the same informal letter format designated by Admiral Brad Mooney and continued under Admirals Wilson, Miller, Palaez, Gaffney, Cohen, Landay, and Carr.

My 2012-13 efforts have been divided between acoustics and physical oceanography.

Farrell and I have completed our analysis of three years of excellent hydrophone and geophone recordings transmitted from an abandoned ATT able at 5 ½ km depth (beneath conjugate depth) in the mid-Pacific, midway between Hawaii and California (JASA in press). This comes at a time of renewed interest in the ambient noise structure of the deep sea. About a third of the record shows clear evidence of ship traffic and whale noises. Between 1 and 6 Hz, the bottom data are interpreted as acoustic radiation from surface gravity waves, an extension of classical microseism theory. The spectrum is saturated (wind independent) and consistent with the Phillips k^-4 wavenumber dependence. There is a sharp transition to higher frequencies with exponential local wind dependence (so vital for maritime satellite wind reports). We have not come up with a theory for the generation of the "ultra-gravity" waves and the capillaries.

I have continued my work on sea surface roughness as related to wind drag. Here the short and low ultragravities are important because of their lead contribution to slope variance. Given that so much of ocean dynamics is the result of a the variable wind drag, understanding the ultragravity (ug) waves is a first order problem in many ocean processes. I am preparing a report on wind drag with some speculations on the sensitivity to ocean warming.

Sincerely yours

Walter Munk

Walter Munk

CC: DR ROBERT H. HEADRICK

Symposium and Reception at Tokyo University
"A Discussion with Walter Munk" (November 7, 2012)

Birch Aquarium at Scripps, University of California, San Diego (La Jolla, CA)
Distinguished Speakers Series: *"Where the Swell Begins"* (October 8, 2012)

Kyoto Prize Presentation at the Atheneum (La Jolla, CA)
"Reflections of a Past Laureate on the 2012 Kyoto Prize Ceremony" (November 28, 2012)

Keck Theory Seminar at Scripps Institution of Oceanography, UCSD (La Jolla, CA)
"Where the Swell Begins" (March 30, 2013

Penn State University (State College, PA)
"Where the Swell Begins" (February 5, 2013)

~~Groundswell Society~~ Annual Meeting (La Jolla, CA)
"Where the Swell Begins" (February 16, 2013)

RELATED PROJECTS

Meetings and Invited Talks

- Attended: Southern Ocean Observing Systems (SOOS) Workshop and gave talk *Acoustic probing of ocean wedge under an ice sheet*; Hobart, Australia 22-25 October 2012
- Presented Symposium at University of Tokyo; 7 November 2012
- Invited Talk: *Where the Swell Begins*, Seminar in Dept. of Acoustics at Pennsylvania State University, 5 February 2013
- Attended: Meeting with CNR RADM Kluder at Office of Naval Research, Arlington, VA, 7 February 2013
- Attended: MEDEA Meeting at National Academy of Sciences, Washington, DC, 8 February 2013
- APS Richard A. F. Penrose Lecture, Corrigendum: *Where the Swell Begins*, 26 April 2013
- Attended: JASON Spring Meeting; Arlington, VA; 27-28 April 2013
- Attended: The National Academy of Sciences Annual Meeting; Washington, DC; 28-29 April 2013

REFERENCES and PUBLICATIONS

Farrell, W. and W. Munk (2013) Surface gravity waves and their acoustic signatures, 1-30 Hz, on the mid-Pacific sea floor, JASA Special Issue, in press.

Young, W.R., C.L. Wolfe, and W.H. Munk (2013) Generation of gravity-capillary waves by instability of shear flow, J. Fluid Mech., submitted.

Munk, W. (2013) The perfect storm. Proceedings of the American Philosophical Society, in press.