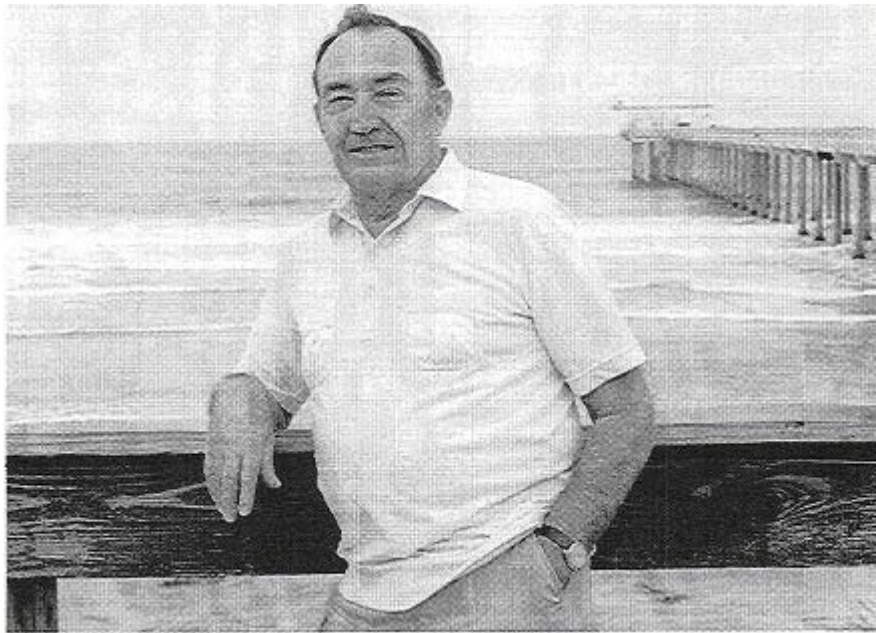


W. G. Van Dorn Principal Published Works

Research Oceanographer
Scripps Institution of Oceanography
1947-1987



Wm. G. Van Dorn, 1993.

CURRICULUM VITAE

Born in Chicago, Illinois, in 1920, Dr. Van Dorn obtained his B.S. in mechanical engineering from Stanford University (1946) and his M.S. and Ph.D. degrees in physical oceanography from the University of California (1953).

Before coming to Scripps in 1947, Dr. Van Dorn worked at Northrup, Solar, and Consolidated-Vultee Aircraft Corporations, and Aerojet Engineering Corporation. His industrial experience included stress analysis, research, design, and testing of airframes and rockets.

Dr. Van Dorn's background in oceanography includes participation in most of the Pacific nuclear tests. He served as chief of the Island Observatory Program during the International Geophysical Year (1957). His fields of interest include air-sea interaction, dynamics of wave breaking, waves produced by explosions and undersea earthquakes (tsunamis), and control of sedimentation in estuaries. He has developed a number of special devices and instruments for the measurement of oceanographic phenomena, and has acted as consultant and advisor to many federal, state, and corporate agencies.

Dr. Van Dorn served as Chairman of Scripps' Ocean Research Division in 1978-79, and was awarded the position of Research Oceanographer Emeritus upon retirement in December, 1979. He was recalled to active duty with Scripps in 1981, and continues to pursue and publish his scientific research.

PRINCIPAL PUBLISHED WORKS

I Papers in Physical Oceanography (1992)

Published under contract and distributed to 72 universities and federal agencies.

Foreword

If it seems presumptuous to assemble a collection of one's scientific efforts, I can only say that there seems no better way of ensuring their perpetuity. Would that more of my colleagues had done the same, for only in this way can a reader appreciate the purpose, direction, and variety of a life spent in pursuit of scientific discovery.

Among these pages the reader may note at least four such discoveries. Paper No. 1 shows that rain significantly, increases the stress that wind exerts on water. Papers 13 and 14 predict the existence of a high-density rigid layer 55 km beneath the moon's present surface, a prediction later verified by seismometry after man had landed on the moon. In paper no. 23, I derived the average dissipation coefficient for tsunami energy for the world's oceans, and showed that it also suffices to explain about half the dissipation of tidal energy. Lastly (paper 25), I found that the greatest rate of expenditure of mechanical energy of which humans are capable is about 12 watts/kg, multiplied by an exponential endurance factor.

1

Wind Stress on an Artificial Pond

Journal of Marine Research, v.12, no.3, December 31, 1953, pp. 249-276.

A condensation of my PhD dissertation, this paper shows that the stress of wind on a free water surface is the resultant of three effects: that due to tangential friction, that due to form drag caused by waves, and additional stress contributed by rainfall, which always has a tangential component in the wind direction.

2

A Portable Tsunami. Recorder

Transactions, American Geophysical Union, v.37, no. 1, February 1956, pp.105-108.

Although doubling as a tsunami recorder, this portable instrument was specifically designed to measure long waves from Pacific nuclear explosions in the Marshall Islands. Packaged in a small suitcase, it could be attached to any rigid post high enough to keep the recorder out of reach of local tides and wind wave. But, in fact, this instrument provided the two best small-island tsunami records ever obtained (11/4/52 and 3/9/57).

3

Large-Volume Water Samplers

Transactions, American Geophysical Union, v.37, no.6, December, 1956, pp.682-684.

This sampler resulted from a 15-min. sketch, as a last-minute attempt to collect chemically-uncontaminated, radioactive water samples from an underwater atomic test. The samplers were air dropped by parachute from navy fighter planes, and retrieved by helicopters. Later, cable-lowered versions were manufactured in large numbers, from which I received my only invention royalties.

4

Origin of the Lunar Craters and Maria

Nature, v.183, Series III, no. 64, March 14, 1959, pp.737-738.

An interesting speculation and response, triggered by some exposure to atomic explosion cratering, a subject more-fully explored in papers 13 and 14, below.

5

A New Long-Period Wave Recorder

Transactions, American Geophysical Union, v.65, no.3, March, 1960, pp. 1007-1012.

This improved tsunami recorder, and the band-pass microbarograph described in the next paper, were installed at Wake, Johnston, and Canton Islands during the summer of 1960, and were kept running intermittently until late 1964. Altogether, I was fortunate during twelve years of effort to obtain records from the four of the five large Pacific tsunamis of this century. Twenty-eight years have now past since the Alaskan tsunami without another major event.

6

A Low-Frequency Microbarograph

Transactions, American Geophysical Union, v.65, no.11, November, 1960, pp. 3693-3698.

Aside from the coupled air-sea squall line interaction described herein, the twin (sea-level and microbarograph) installation at Canton Island recorded a coupled gravity-wave pulse from the great (60 megaton) Russian nuclear test over Novaya Zemlya (9/1/61) traveling three times around the world in both directions. The forced water wave system thus traveled at the minimum shock speed in the atmosphere (322 m/s), which is substantially greater than that for long gravity waves in the Pacific (250 m/s).

7

Some Characteristics of Surface Gravity Waves in the Sea Produced by Nuclear Explosions.

Journal of Geophysical Research, v.66, no.II, November, 1961, pp.3845-3862.

By the time this paper was published, I had completed ten years of small-island wave observations in the Pacific as part of the hazard-evaluation effort associated with the U.S. nuclear testing program. That these observations greatly advanced our understanding of natural tsunamis is shown in later paper herein.

8

The Source Motion of the Tsunami of March 9, 1957, as Deduce from Wave Measurements at Wake Island.

Proceedings of the tsunami meetings, Tenth Pacific Science. Congress, IUGG monograph # 24, Paris, 1963, pp.39-48.

Probably the earliest attempt to apply centered wave theory to tsunami origin, this paper gave the first convincing estimate of tsunami energy. Subsequent seismic evidence has suggested that the actual earthquake source was more elongate--and its vertical displacement much smaller--than the circular source assumed herein; however, the energy estimate is still valid (paper 22).

Explosion-generated Waves in Water of Variable Depth

Journal of Marine Research, v.22, no.1, May, 1964, pp.123-141.

The assumption of conservation of energy flux within a centered wave system propagating over variable topography is shown to agree with wave characteristics observed during high-explosive tests near San Clemente Island.

This result led me to develop a generalized computer model for predicting coastal effects from nuclear explosion, and, in turn, to the realization that large explosions in deep water might produce breaking waves over the entire continental shelf, thus rendering it un-navigable for many hours.

The (so-called) Van Dorn Effect inspired substantial military research, and ultimately led to a decision against concealing MX missiles in mini-sub patrolling the continental margins.

The Source Mechanism for the Tsunami of March 28, 1964, in Alaska

Proceedings of the Ninth Conference on Coastal Engineering, ASCE, 1964, pp. 166-190.

Recognizing from early reports that the Alaskan tsunami source lay partly on land, I boarded the first available flight, and spent ten days surveying all sites reachable by plane or helicopter. This paper, which provided, for the first time, a convincing geophysical tsunami source mechanism, was presented in Lisbon only ten weeks later.

11

Boundary Dissipation of Oscillatory Waves

Journal of Fluid Mechanics, v.24, part 4, 1966, pp. 769-779.

Finding that dissipation of dispersive wave trains over gentle slopes in a 100-ft laboratory channel greatly exceeded that predicted by boundary theory, I separately investigated the energy dissipation by surface films, which fully accounted for the missing fraction.

12

Tsunamis

Contemporary Physics. v.9. no.2. 1968, pp. 145-164

This paper is a substantial abridgement of an article in *Advances in Hydroscience*. v.2. 1965, Academic Press, NY. It reviews the current status of tsunami knowledge. In retrospect, not much is changed today, except for the realization that the coastal manifestation of a tsunami is just its normal mode response to a singular tsunami pulse (See paper 23).

13

Tsunamis on the Moon

Nature, v.220, no.5172, December 14, 1968, pp 1102-1107.\

Seeing the Orbiter photographs of the giant lunar Mare Oriental, sparked this application of linear wave theory to geophysics. It was found that the spacing of five mountains rings perfectly fitted the dispersive theory for free gravity waves in a liquid layer fifty kilometers deep, if "frozen" 78 minutes after and asteroid impact. First scoffed at by lunar geologists, the concept of "instant Rockies" is now generally accepted as Van Dorn Rings. That I first predicted the Moon's Mohorovicic discontinuity from indirect evidence seems not so well known.

14

Lunar Maria: Structure and Evolution

Science, v.165, 15 August, 1965, pp.693-695.

Sixteen multi-ringed lunar maria are shown to fit the same gravity-wave dispersion pattern as Mare Orientale, suggesting that the 50-km rigid sublayer is a general feature of the lunar interior. This view was later supported by lunar seismometry after man landed on the moon.

15

Tsunami. Response at Wake Island: a Model Study

Journal of Marine Research, v.28, no.3, September, 1970, pp.336-344.

In order to better interpret tsunami signals observed at Wake Island, a three-dimensional model was exposed to periodic wave: of different frequencies and directions. The experiment was performed by flooding the plastic-lined floor of a large building at the Del Mar Fair grounds, into which the wave generator and the island model were inserted.

16

A Model Experiment on the Generation of the Tsunami Of March 28 1964. In Alaska

Tsunamis in the Pacific Ocean, East-West Center Press, Honolulu 1970, 3-45.

Because of the unusual, non-dispersive character of the record from the Alaskan tsunami at Wake Island, a one-dimensional model of the shelf-uplift was constructed, and shown to produce waveform quantitatively similar to that observed at Wake.

17

Ocean Character, Propagation, and Coastal Modification of the Alaskan Tsunami

The Great Alaskan Earthquake of 1964, Oceanography and Coastal Engineering, National Academy of Sciences, Washington, DC, 1972. pp. 147-157.
(with Doak C. Cox, Hawaii Institute of Geophysics).

Knowing something tectonically about the source of the tsunami, this paper seeks to correlate its initial signature with those observed at tide stations along the west coast of the Americas.

18

Run up Recipe for Periodic Waves on Uniformly Sloping Beaches

Proceedings Tenth Conference on Coastal Engineering, ASCR, v.I, 1966, pp. 349-363.

Federal support for tsunami research having dwindled, I undertook the study of wave interactions with the shoreline. This paper describes the results of a laboratory study aimed at improving a rather poorly-defined area of wave dynamics. The results are interesting, but rather too-complicated for general engineering application.

19

Deep Water Wave Breaking

Condensed from SIO Report No. 75-21, A Laboratory Study of Wave Breaking.
(with S.E. Pazan)

Probably the most careful study of breaking-wave dynamics in deep water. Breaking was accomplished by lateral squeezing of periodic waves in a tapered channel, on a scale large enough to avoid the complications of depth, boundary dissipation, and surface tension.

20

Set-up and Run-up in Shoaling Breakers

Proceedings, Fifteenth Conference on Coastal Engineering, ASCE, v.I, 1976, pp.738-751.

This paper describes a laboratory investigation of surf-zone dynamics, including wave set-up, set-down, and both steady and transient run-up. The precision was, I believe, much better than that of any other similar study at that time.

21

Breaking Invariants in Shoaling Water

Journal of Geophysical Research, v83, no.C6, June 20, 1978. pp.2981-2988.

An attempt at a more-formulistic approach to shoreline breaker dynamics. Although not generally accepted, this laboratory study provides a more accurate parametric description of the internal velocity fields within breakers than any other current treatment.

22

Some Tsunami Characteristics Deducible from Tide Records

Journal of Physical Oceanography, v.14, no.2, February 1984, pp.353-363.

An in-depth analysis of tsunami spectral decay at 28 Pacific tide stations provides a comparative estimate of total tsunami energy among five events that is well correlated with seismic energy.

A significant finding is that the ocean becomes isotropic in tsunami energy after about 40 hours, and energy thereafter decays at the same exponential rate at all stations.

23

Coastal Response to Tsunamis

Proceedings, International Tsunami Symposium. IUGG. Institute of Ocean Sciences, Sydney, B.C., Canada, August, 1985, pp. 1-10. (with W.B.Thompson, Physics Dept., UCSD).

The hypothesis that tsunami response at tide stations is dominated by pumping-mode shelf resonances is examined theoretically, and found to be in good agreement with spectra computed at moderately high resolution.

24

Tide Gage Response to Tsunamis. Part II: Other Oceans and Smaller Seas.

Journal of Physical Oceanography, v.17, no.9, September, 1987, pp. 1507-1516.

The tsunami energy decay moduli for the Pacific and three smaller seas are found to be proportional to the ratio of shelf area to ocean area, assuming a constant decay coefficient of 0.38/hour. The same coefficient, applied to the world's oceans reasonably accounts for the dissipation of tidal energy, as manifested by slowing of the earth's speed of rotation.

25

Formulae for Maximal Human Performance

Journal of Biomechanical Engineering. October, 2000.
Vol.122, pp.545-547.

A single racing equation with variable coefficients is shown to predict maximum aerobic performance vs endurance in cycling, swimming, and running. Interestingly, although the racing equation is intended to apply only aerobic performance, the maximum endurance coefficient (1 joule /kg/sec) applies well to championship weightlifting; e.g., snatching and pressing one's weight in one second.

Thermodynamic Model for Cold Water Survival

Journal of Biomechanical Engineering, October 2000, Vol. 122, pp. 541-544.

Using commonly-accepted values for fat, muscle, and external insulation, the differential cooling equation is solved to determine human survival time in water of different temperatures.

A by-product of this study is the ability to predict the external insulation required for a diver of known body fat thickness to work for a specified time at a given water temperature.

II Oceanography and Seamanship

1st ed. (1974) Dodd Mead & Co., New York, NY. 2d ed. (1993) Cornell Maritime Press, Centrevill, MD.

This book about boats, ships, and the sea attempts to explain in practical terms what the ocean is really like, why boats behave as they do, and what the average skipper can do to make any voyage safer and more comfortable.

III Ivy-Mike the First Hydrogen Bomb (2008)

Xlibris Corp., Philadelphia, PA

A narrative description of the concept, design, construction and testing of the first hydrogen bomb at Eniwetak Atoll, Marshall Islands, on Nov. 1, 1952. Involvement of the Scripps Institution of Oceanography was sought when late calculations indicated that the device might prove sufficiently energetic to blow the atoll apart and generate a dangerous tsunami.