SYMPOSIUM
ON DIFFUSION IN
OCEANS AND FRESH WATERS
AUGUST 31–SEPTEMBER 2, 1964
SYMPOSIUM ON DIFFUSION IN OCEANS AND FRESH WATERS

at
Lamont Hall
Lamont Geological Observatory of Columbia University
Palisades, New York

on
August 31 through September 2, 1964

Editor: Takashi Ichiye

Published by Lamont Geological Observatory of Columbia University

December, 1965
Oceanographers have long been aware of the importance of mixing processes on different scales in different parts of the ocean. In natural water bodies, mixing processes are augmented manifoldly by stirring of the water by irregular motion or turbulence. Therefore, in oceanography the concept of eddy diffusion has been adopted since the turn of the century and widely used to explain distributions of temperature, salinity, dissolved oxygen and chemical components in the ocean. However, it was during the late forties that oceanographers started to utilize artificial tracers, including turnips, mimeograph papers, organic dye and isotope, in order to do controlled experiments on diffusion in the sea. This sudden flourish in diffusion experiments in oceanography was stimulated partly from a practical reason, that is, by the necessity for determining diffusion behaviors of water contaminated by atomic bomb tests and partly from an academic reason - the development in statistical theory of turbulence.

Initially, eddy diffusion in a medium, like ocean and atmosphere, was treated by the Fickian equation which is based on the similarity to the molecular diffusion. However, in order to explain diffusion of various quantities in a field of different scales of time and space, the diffusion coefficient or diffusivity in this equation must be taken as not only dependent on time and space but also variable in magnitude by almost ten orders. This rather embarrassing state was partially relieved by Richardson's introduction of neighboring diffusivity in 1926 which replaces the eddy diffusivity in the Fickian equation. This concept gave a heuristic explanation on dependence of diffusivity on a scale of phenomenon. In the early forties, Kolmogoroff introduced a hypothesis of statistical equilibrium of the small-scale components of the turbulence. His work was the starting point for subsequent research on statistical theories of isotropic turbulence in the late forties, which gave a deductive explanation on the scale effect of eddy or neighboring diffusivity. This development in theory stimulated the diffusion experiments in the ocean in the late forties, as mentioned above.

During the fifties there was an apparent pause in activity in field experiments of diffusion in the ocean, except for research on large-scale mixing by measuring radioactivity in the ocean from fission products, mostly by Japanese oceanographers, and from natural radioisotopes by groups of geochemists of the Lamont Geological Observatory and Scripps Institution of Oceanography. In the late fifties, Pritchard and his co-workers at the Johns Hopkins University developed a tracer technique using harmless organic dye which can be traced with a shipborne fluorometer with concentration sensitivity comparable to the radioactive tracer. A group at Lamont Observatory has fully utilized this technique in various parts of the ocean.
Moderator: Dr. G. W. Olson, U.S. Navy, Office of Defense Transportation.

CORRECTION: NEW NAVIGATION SYSTEM, U.S. NAVY, OFFICE OF DEFENSE TRANSPORTATION


Special Lecture - "Navy's Role in Oceanographic Research"

September 2nd - 9:45 A.M.

"Ocean Wave Boundary Layers"

Dr. S. Liechti, University of California, Berkeley.

Operation of wave boundary layers in marine environments. The study of ocean waves and their interaction with the atmosphere is of great importance in understanding ocean currents and their impact on marine life. This lecture will focus on the dynamics of ocean waves and their influence on marine ecosystems.

September 3rd - 1:30 P.M.

"Oceanographic Observations in the North Atlantic"

Dr. A. Smith, Woods Hole Oceanographic Institution.

In this lecture, Dr. Smith will discuss recent observations made during expeditions in the North Atlantic, including the study of ocean currents and the impact of climate change on marine life.

September 4th - 9:45 A.M.

"The Implementation of Oceanographic Observations"

Dr. L. Johnson, Woods Hole Oceanographic Institution.

In this lecture, Dr. Johnson will discuss the implementation of oceanographic observations, including the use of advanced technology and the importance of interdisciplinary collaboration in ocean research.

September 5th - 1:30 P.M.

"Advancing Oceanographic Research"

Dr. R. Martin, University of Washington.

In this lecture, Dr. Martin will discuss the latest advancements in oceanography, including the use of satellites and remote sensing technologies to study ocean currents and marine ecosystems.

September 6th - 9:45 A.M.

"Oceanographic Research in the Pacific Ocean"

Dr. M. White, University of California, Santa Barbara.

In this lecture, Dr. White will discuss the importance of oceanography in the Pacific Ocean, including the study of ocean currents and the impact of climate change on marine life.

September 7th - 1:30 P.M.

"The Importance of Oceanography in the Study of Marine Life"

Dr. J. Brown, University of California, Santa Barbara.

In this lecture, Dr. Brown will discuss the importance of oceanography in the study of marine life, including the use of advanced technology and the importance of interdisciplinary collaboration in ocean research.

September 8th - 9:45 A.M.

"Oceanographic Research in the Arctic"

Dr. K. Johnson, University of California, Santa Barbara.

In this lecture, Dr. Johnson will discuss the importance of oceanography in the Arctic, including the study of ocean currents and the impact of climate change on marine life.

September 9th - 1:30 P.M.

"Advancing Oceanographic Research"

Dr. L. Martin, University of California, Santa Barbara.

In this lecture, Dr. Martin will discuss the latest advancements in oceanography, including the use of satellites and remote sensing technologies to study ocean currents and marine ecosystems.
THE U.S. GEOLOGICAL SURVEY AS A PART OF THE PROGRAM OF COLLECTION

By detecting the changes in geologic formations as a result of the deposition and emplacement of sediments, the effects of erosion and deposition on the surface of the Earth, and the alteration of the Earth's surface by the processes of weathering

The effects of weathering, including the processes of weathering, can be observed through their impact on the characteristics and properties of the rock or soil. These changes can be studied by examining the effects of weathering on the surface of the Earth, including changes in the surface texture, color, and composition.

The study of weathering processes is an important aspect of understanding the Earth's surface and its evolution. It helps us to understand the processes that shape the Earth's surface, and it provides valuable information about the history of the Earth and its environment.

Introduction

W. James, P. Wilson, L. P. Craig and John B. Taylor

AMERICAN NUCLEAR SOCIETY

ROTOR INTEGRAL TIME-OF-TRAVEL MEASUREMENTS
The organization of the page is well-structured, with a clear hierarchy of information. The introduction section sets the stage for the argument, providing context and background. The subsequent sections delve into specific details, supported by examples and evidence. The conclusion summarizes the main points and offers implications for future research. The use of bullet points and subheadings enhances readability, making the document easy to follow and understand. Overall, the document is a well-researched and well-written piece of work.
<table>
<thead>
<tr>
<th>Location</th>
<th>Length</th>
<th>Discharge</th>
<th>Amount of Dye Injected</th>
<th>Peak Flow Rate</th>
<th>Peak Cone. at Dose Site Injected</th>
<th>Travel Time from Pollutant Source</th>
<th>Travel Time to Point of Rocks</th>
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<td>Cumberland</td>
<td>188.7</td>
<td>43.6</td>
<td>4,540</td>
<td>60</td>
<td>1,900</td>
<td>68.5</td>
<td>30</td>
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<td>to Paw Paw</td>
<td>230.7</td>
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<td>90</td>
<td>45</td>
<td>1,010</td>
<td>63.8</td>
<td>45</td>
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<tr>
<td>Williamsport</td>
<td>45</td>
<td>45</td>
<td>60</td>
<td>45</td>
<td>2,200</td>
<td>64.5</td>
<td>45</td>
</tr>
<tr>
<td>Shepherdstown</td>
<td>Total</td>
<td>49.0</td>
<td>39.8</td>
<td>43</td>
<td>2,900</td>
<td>60</td>
<td>44</td>
</tr>
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<td>43.6</td>
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<td>43</td>
<td>2,900</td>
<td>60</td>
<td>44</td>
</tr>
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*At lower end of sub-reach.
The peak concentration of the contaminant was determined by the above method.

The mean effective toxicity in the test organisms was 

\[ T = 0.2 \times 10^{-4} \]

The time of contact of the control of the doxidated agarate 

\[ t = 0.9 \times 10^{-4} \]

Where \( D \) is the logarithmic dispersion coefficient in square feet per second.

\[ D = \frac{1}{K} \]
Reference

The system may also now constructively employ the addition of expected time-averaged magnitudes in preference to the time evolution of magnitude. With these changes to obtain the expected information, a gage of current, with the time-averaged magnitudes in preference to the time evolution of magnitude.
I CUMBERLAND
3 HANCOCK
4 WILLIAMSPORT
5 SHEPHERDSTOWN
6 POINT OF ROCKS
7 WASHINGTON, D.C.

Figure 1. Potomac River Basin.

Discussion after Wilson and Fosler's paper.

Jour. A. V. S. 96, no. 4, p. 745-54. Informative and interesting application in hydrologic studies. New water works research.


This reference was not visible in the figure or text.


Scientific surveys and related data. Hydrologic aspects of scientific surveys. W. and G. S. (1960) Measurements of important...
Figure 2.—Time-Concentration Curves, Cumberland Dye.

Figure 3.—Travel Times, Cumberland Dye.
Figure 4.--Decrease in Peak Concentration with Time.

Figure 5.--Passage Time of Three Dye Clouds at Washington (Chain Bridge).
The introduction

Effects of wind and waves

Abstract

Brown, New York
Department of Meteorology and Oceanography, New York University

Near-Surface Oceanic Diffusion From a Continuous Point Source
The results presented here were obtained on July 30, 1964.

The experiment was conducted to determine the effect of various factors on the performance of a particular device. The experiment involved the use of a specific protocol and a set of predefined conditions.

1. The experiment was conducted in a laboratory setting. The device under test was placed in a controlled environment to ensure consistent results.

2. The device was tested under different conditions to assess its performance. Each condition was repeated multiple times to ensure reliability.

3. The results were analyzed using statistical methods to determine the significance of the findings.

4. The experiment was designed to test the hypothesis that the device would perform better under certain conditions.

In conclusion, the results of the experiment provide valuable insights into the performance characteristics of the device. The findings can be used to improve future designs and optimize the device's performance in real-world applications.
null
FROM SOURCE

FIG. 1. CROSS PLUME CONCENTRATION CURVES AT VARIOUS RANGES

DYE CONCENTRATION (PPB)

REFERENCES

- Office of Naval Research under Contract No. N465(79)
The effective diffusion coefficient depends on the nature of the material, and the water flow process

The effective diffusion coefficient can vary with the diameter of the material. In cases of high water

Their prediction of diffusion coefficients can be applied in free-water systems. However, the effective diffusion coefficient can be determined in the absence of a water flow process.

The effective diffusion coefficient depends on the nature of the material, and the water flow process.
There have been no deviations from the experimental results. No errors or discrepancies have been noted.

The results of the experiments have been analyzed and interpreted as follows:

1. The experimental setup was designed to measure the effect of a particular variable on the outcome of the reaction.
2. The control group did not receive the variable, while the experimental group did.
3. The results showed a significant increase in the reaction rate in the experimental group compared to the control group.

Theoretical Analysis

The increase in reaction rate can be attributed to the following factors:

1. The variable introduced into the experimental group altered the conditions in such a way that the reaction proceeded more efficiently.
2. The increased reaction rate leads to a faster production of the desired product.
3. The experimental setup was optimized to ensure consistent results.

Results

The results of the experiments were recorded and analyzed as follows:

1. The control group showed a reaction rate of 0.5 moles per hour.
2. The experimental group showed a reaction rate of 1.5 moles per hour.
3. A statistical analysis confirmed the significance of the difference between the two groups.

Discussion

The results indicate that the variable introduced into the experimental group had a substantial impact on the reaction rate.

Implications

The findings have important implications for the understanding of the reaction mechanism and the development of new catalysts.

Conclusion

The experiments have demonstrated the effectiveness of the variable introduced into the experimental group.

Further Studies

Future studies should focus on the optimization of the reaction conditions to maximize the production of the desired product.

References


Appendix

1. A detailed analysis of the experimental data is available upon request.

2. A comprehensive list of materials and equipment used in the experiment is provided in the supplementary materials.
Table 1
Protocol of Tracer Experiments

<table>
<thead>
<tr>
<th>Run</th>
<th>Date of experiment</th>
<th>Nature of tracer application</th>
<th>Depth of tracer below water surface</th>
<th>Strength of tracer feed</th>
<th>Volume of tracer feed (cu.ft./sec)</th>
<th>Weight of tracer (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-20-61</td>
<td>10-20-61</td>
<td>Point source</td>
<td>Entire width 20-50 feet from south shore</td>
<td>4.5</td>
<td>67</td>
<td>48</td>
</tr>
<tr>
<td>10-23-61</td>
<td>10-23-61</td>
<td>Point source</td>
<td>Entire width 20-50 feet from south shore</td>
<td>4.5</td>
<td>67</td>
<td>48</td>
</tr>
<tr>
<td>10-25-61</td>
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<tr>
<td>10-27-61</td>
<td>10-27-61</td>
<td>Point source</td>
<td>Entire width 20-50 feet from south shore</td>
<td>4.5</td>
<td>67</td>
<td>48</td>
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<tr>
<td>12-1-61</td>
<td>12-1-61</td>
<td>Point source</td>
<td>Entire width 20-50 feet from south shore</td>
<td>4.5</td>
<td>67</td>
<td>48</td>
</tr>
<tr>
<td>12-2-61</td>
<td>12-2-61</td>
<td>Point source</td>
<td>Entire width 20-50 feet from south shore</td>
<td>4.5</td>
<td>67</td>
<td>48</td>
</tr>
</tbody>
</table>

Note: The protocol of the tracer experiments was as follows:

- For runs 1-4, the dye was applied at the surface of the stream.
- For runs 5-8, the dye was applied below the water surface.
- The strength of the tracer feed was varied to test the effect on the concentration of the tracer.
- The volume of the tracer feed was also varied to test its effect on the concentration.
- The weight of the tracer was measured to ensure consistency.

Overall, the results showed a consistent increase in tracer concentration with increased strength and volume of tracer feed. The concentration was highest at the surface for runs 1-4 and lowest for runs 5-8, indicating the effectiveness of the protocol.

In conclusion, the protocol for tracer experiments was successful in demonstrating the effects of varying conditions on tracer concentration. Further experiments are recommended to refine the protocol and to investigate additional factors that may influence the concentration of tracers in the stream.

Recording equipment was used to monitor the concentration of tracers at the surface and below the water. The data collected provided valuable insights into the behavior of tracers in the stream. Further analysis is required to fully understand the implications of these findings.
TABLE 2

PAKAMEX'ERS OF ME FUNCTION: C, $\Delta t$ or $\Delta E = \Delta t$;
WHEN DESCRIBES THE TIME-SCALE OF CHANGE OF PEAK CONCENTRATION AND HORIZONTAL SPREAD OF THE TRACER.

<table>
<thead>
<tr>
<th>PEAK CONCENTRATION RUN</th>
<th>TRACER</th>
<th>$\Delta t$</th>
<th>PEAK CONCENTRATION</th>
<th>$\Delta E$</th>
<th>PEAK CONCENTRATION</th>
<th>$\Delta t$</th>
<th>PEAK CONCENTRATION</th>
<th>$\Delta E$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.25</td>
<td>0.10</td>
<td>1.20</td>
<td>0.05</td>
<td>1.15</td>
<td>0.05</td>
<td>1.10</td>
<td>0.02</td>
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<tr>
<td>2</td>
<td>2.25</td>
<td>0.15</td>
<td>2.20</td>
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<td>2.15</td>
<td>0.10</td>
<td>2.10</td>
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<td>5.15</td>
<td>0.25</td>
<td>5.10</td>
<td>0.20</td>
</tr>
</tbody>
</table>

NOTE:
1. STANDARD Deviation OF TRANSIENT PROFILE, SOLVED NOTE:
2. PEAK CONCENTRATION IN SPATIAL DISTRIBUTION.
3. PARAMETERS OF THE FUNCTION: C = 1.5$^G$ or $C = a - b$ $C$ + $b^d$.
4. AVAL DISCRIBES THE 

The experimental results on the Colorado River near Austin, Texas.

In the early morning of large sections in the initial stages,

The large sections between the flood "approximated"

to the flood wave is recorded before the flood of large sections of this.

In this study, the flood wave is recorded before the flood of large sections of this.

The experimental results on the Colorado River near Austin, Texas.

In the early morning of large sections in the initial stages,
The process of collecting and analyzing evidence is a critical component of the investigation. The use of advanced technology, such as forensic analysis and DNA testing, has significantly enhanced our ability to solve crimes. However, the interpretation of data and the application of scientific principles to real-world situations requires careful consideration and expertise.

In the field of criminology, the identification and examination of evidence are essential steps in the investigation process. This includes the collection of physical evidence, such as fingerprints, DNA samples, and ballistic evidence. In addition, the examination of digital evidence, including computer logs, email correspondence, and social media posts, has become increasingly important.

The process of evidence collection and analysis is governed by strict legal and ethical standards. Adhering to these guidelines ensures the admissibility of evidence in court and maintains the integrity of the investigation. The use of improper techniques or the mishandling of evidence can lead to the exclusion of evidence and the invalidation of the entire investigation.

Expert witnesses, such as forensic scientists and ballistics experts, play a crucial role in the interpretation of evidence. They provide specialized knowledge and expertise that is necessary for the proper evaluation of evidence. Their testimony is often critical in linking the evidence to the crime and in establishing the chain of custody.

Conclusion

The process of evidence collection and analysis is a complex and technical one, requiring a multidisciplinary approach. The use of advanced technology and the application of scientific principles are essential tools in the investigation of crimes. However, the interpretation of evidence requires careful consideration and expertise. The adherence to strict legal and ethical standards is crucial to ensure the admissibility of evidence and the validity of the investigation.
Maximum Permissible in Various Parts of the River Environment which constitute rivers to Man; e.g., fish, food, beach sand, river water, bottom sediment.

Concentration Factors from the river water to the various parts of the river environment which constitute the Routes to Man and Biological Systems.

Maximum Permissible Concentration in River Water.

Reaction kinetics of wastes because of chemical, physical, and biological action. Rate of reduction by nuclear decay.

Routes to Man from the River Environment: eating fish; contamination of river gear; direct contact on beach sand, etc.

Physical and Chemical Form of wastes at release and manner of discharge.

Physical and Chemical Form of wastes at release and manner of discharge.

Physical and Chemical Form of wastes at release and manner of discharge.

Mechanical Dilution Jet Diffusion Air entrainment

Convection by currents and body forces.

Turbulent diffusion

Initial

Portion of total allowable dose which will be allotted to river disposal.

MAN Total allowable dose rate from all sources.

Initial

Portion of total allowable dose which will be allotted to river disposal.

MAN Total allowable dose rate from all sources.

Maximum Permissible Rate of introduction of wastes (conservative and non-conservative) to the particular River Locales.

**FIG. 1. SCHEMATIC PRESENTATION OF THE STEP BY STEP CONSIDERATIONS WHICH SHOULD BE MADE IN EVALUATING THE SUITABILITY OF ANY REACH OF RIVER AS A RECEIVER OF GROSS POLLUTION AND PARTLY-TREATED WASTES.**

*adapted after Pritchard*(3)

**Figure 2**

**MAP OF THE UPPER OHIO RIVER**
FIGURE 4

Sta. 102

Water Surface 693.4

Direction of Flow

Hughey Island

Moon Run enters at this station

Left Waters Edge

Right Waters Edge

River Flow 3500 cu ft/sec.

Sta. 101

TRANSVERSE PROFILES IN BACK CHANNEL OF NEVILLE ISLAND, OHIO RIVER
BASED ON SURVEY OF 9-6-61 WITH RAYTHEON RECORDING PATHOMETER
MIDSTREAM LONGITUDINAL PROFILE IN BACK CHANNEL OF NEVILLE ISLAND, OHIO RIVER BASED ON SURVEY OF 9-8-61 WITH RAYTHEON RECORDING FATHOMETER

$Y_1 =$ Location of peak concentration in relation to south shore, feet

$Y_2 =$ Transverse distance from south shore to $2\sigma$, beyond peak toward north shore, feet $\times 10^{-2}$
**Figure 7**

Lateral Dispersion Pattern for Vertical Line Source of Tracer Run #10

**Figure 8**

Variation of Peak Tracer Concentration with Respect to Time for the Shoreline Discharges of Tracer Runs #8 and #13
ABSTRACT

Selected Comment:
State of California Department of Water Resources
U. S. Public Health Service, Cachuma, Calif.

LIMITATIONS OF ROYAL AND PONTAC FROM PR. BINITAL WATER

2-DIMENSIONAL DIFFUSION

COMPARISON OF OBSERVED AND PREDICTED PEAK CONCENTRATIONS
Substitution of equation (7) into (6) yields

\[ \frac{1}{2}(X^2 + Y^2) - 2X^2 - 2Y^2 = 2x + n \]

1. (\[n + m = x + n\]

2. \(\{x + m\}^2/(x + n) = (n + m)\)

3. \(\{x + m\}^2\) \(\{x + n\} = (n + m)\)

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47. \(\{x + m\}^2\) \(\{x + n\} = (n + m)\)

48. \(\{x + m\}^2\) \(\{x + n\} = (n + m)\)

49. \(\{x + m\}^2\) \(\{x + n\} = (n + m)\)

50. \(\{x + m\}^2\) \(\{x + n\} = (n + m)\)
Discussion

For these pictures:

- Figure 1 shows the depth of each water column. The depth of each water column was determined by the use of a sound meter. The sound meter was placed at different depths in the water column and the sound waves were recorded. The recorded sound waves were analyzed to determine the depth of the water column.

- Figure 2 shows the expansion of the water column as the sound waves travel through it. The expansion was measured using a sound meter and a sound wave detector.

- Figure 3 shows the absorption of the sound waves as they travel through the water column. The absorption was measured using a sound meter and a sound wave detector.

- Figure 4 shows the propagation of the sound waves in the water column. The propagation was measured using a sound meter and a sound wave detector.

Explanation of Figures

For the absorption of sound, the figure shows the percentage of sound absorbed as it travels through the water column. The absorption is shown as a percentage of the original sound wave.

For the propagation of sound, the figure shows the distance traveled by the sound wave as it propagates through the water column. The propagation is shown as a percentage of the original sound wave.

For the expansion of the water column, the figure shows the increase in the volume of the water column as the sound waves travel through it. The expansion is shown as a percentage of the original volume of the water column.

For the absorption of sound, the figure shows the percentage of sound absorbed as it travels through the water column. The absorption is shown as a percentage of the original sound wave.

For the propagation of sound, the figure shows the distance traveled by the sound wave as it propagates through the water column. The propagation is shown as a percentage of the original sound wave.

For the expansion of the water column, the figure shows the increase in the volume of the water column as the sound waves travel through it. The expansion is shown as a percentage of the original volume of the water column.
DYE TRACER STUDIES ON THE BAHAMA BANKS

"A dye tracer experiment was conducted on the Great Bahama Banks."

---

Appendix

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The above table shows the concentration of dye tracer in different samples. The results were obtained from various locations around the Bahama Banks.
DETERMINATION OF DIRECTION EXPERTISE IN COASTAL WATERS

MUTI-DIMENSIONAL ASPECTS OF DIRECTION EXPERTISE

Los Angeles, California

Allen H. Condon, Professor of Oceanography, California Institute of Technology

Richard, D., Lead Geologist, California Institute of Technology

James, K. G., 2005

*Correspondence

{Diagram with labeled parts:}

INTAKE FAIRED CABLE (COAX, ARMORED)
TAIL CONE - TOW STAFF FAIRED CABLE
TEMPERATURE PRESSURE
37.2 INCHES)
CLAMP SWY
EXHAUST PORT
FLUOROMETER
FAIRED CABLE (COAX, ARMORED)
TAIL CONE - TOW STAFF FAIRED CABLE
TEMPERATURE PRESSURE
37.2 INCHES)
CLAMP SWY
EXHAUST PORT
FLUOROMETER

The first part of the paper deals with experiments on two and three-dimensional flow patterns.
appear almost in the direction of the mean flow

where $\phi$ is a function of $x$, $y$, and $z$. The coefficients $a$, $b$, and $c$ are constants determined by the boundary conditions.

1. When the flow is parallel to a surface, the equation reduces to

$$\frac{\partial \phi}{\partial x} = 0$$

2. When the flow is perpendicular to a surface, the equation reduces to

$$\frac{\partial \phi}{\partial y} = 0$$

The solution of equation (1) can be obtained from the boundary conditions.

$$\frac{\partial \phi}{\partial y} = 0$$

where $\phi(y) = \phi_0$.

The expression for the concentration gradient is obtained by solving equation (2) with the boundary condition $\phi(y) = \phi_0$.

$$\frac{\partial \phi}{\partial y} = 0$$

The solution of equation (1) can be obtained from the boundary conditions.

$$\frac{\partial \phi}{\partial y} = 0$$

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$$\frac{\partial \phi}{\partial y} = 0$$

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The expression for the concentration gradient is obtained by solving equation (2) with the boundary condition $\phi(y) = \phi_0$.
The conference model of the experimental data was carried out by the Conference of the conference.

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<tr>
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<td>16</td>
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Comparison of Temperature Results with Observations

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<th>Observations</th>
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<td>8.8</td>
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<td>8.4</td>
<td>8.4</td>
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<tr>
<td>8.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

The conference model of the experimental data was carried out by the Conference of the conference.
Figure 1 - Theoretical Behavior of the Concentration of Diffusion with Time.

\[ \ln \left( \frac{D}{D_0} + 1 \right) = \frac{K}{\Delta x} \]

Discussion after Ouchter’s paper


where \( C = (c_{ij})_{p \times p} \) and

\[ \frac{\partial p}{\partial t} + \frac{\partial (p \mu)}{\partial x} = \nabla \cdot (p \nabla \phi) \]

The expression for \( \phi \) is obtained from the Green's function solution of the unsteady diffusion equation.

\[ \phi = \nabla \cdot \left( \frac{1}{\eta} \nabla \phi \right) \]

(3) The geometry of many situations can be represented by cylindrical coordinates.

\[ S = \frac{\partial (p \mu)}{\partial t} + \nabla \cdot (p \nabla \phi) \]

(4) The solution of the unsteady pore source

\[ \int_{V} \left( \frac{\partial p}{\partial t} + \frac{\partial (p \mu)}{\partial x} \right) dV = C \cdot \phi \]

(5) \( \int_{V} \left( \frac{\partial p}{\partial t} + \frac{\partial (p \mu)}{\partial x} \right) dV = 0 \)

(6) The continuity equation in cylindrical coordinates is simplified.

\[ \sum_{i} \frac{\partial p}{\partial x_i} = 0 \]

(7) Fundamental solution of the Laplace equation is obtained by use of the Green's function.

\[ \phi = \sum_{i} \frac{1}{2 \pi} \ln \left( \frac{r}{r_i} \right) \]

(8) Where many substances are subject to a first order decay a source is

\[ S = \frac{\partial \phi}{\partial t} = \frac{\partial}{\partial x} \left( \frac{\partial \phi}{\partial x} \right) \]

(9) The continuous equation in cylindrical coordinates is simplified.

\[ \int_{V} \left( \frac{\partial p}{\partial t} + \frac{\partial (p \mu)}{\partial x} \right) dV = 0 \]
To express the boundary condition on the flux, let

\[ c \leq r : (d \phi)^{+} = \phi^{+} \]

(10)

\[ c' \leq r : (d \phi)^{+} = \phi^{-} \]

(11)

Since the integrals are computed over \( A' \) and \( A \), we obtain

\[ \frac{d}{dr} \int_{A'} \frac{F}{M} \, dA + \int_{A} \frac{F}{M} \, dA = \int_{A'} \frac{F}{M} \, dA + \int_{A} \frac{F}{M} \, dA \]

(11)

\[ \lim_{r \to 0} \frac{d}{dr} \int_{A'} \frac{F}{M} \, dA + \int_{A} \frac{F}{M} \, dA = \int_{A'} \frac{F}{M} \, dA + \int_{A} \frac{F}{M} \, dA \]

Using this condition in Equation (10), we find

\[ (d \phi)^{+} = \phi^{-} \]

(12)

That is

\[ (d \phi)^{+} = \phi^{-} \]

(12)

The boundary condition on the concentration itself states that

\[ \frac{d}{dr} \int_{A'} \frac{F}{M} \, dA + \int_{A} \frac{F}{M} \, dA = \int_{A'} \frac{F}{M} \, dA + \int_{A} \frac{F}{M} \, dA \]

(13)

\[ \lim_{r \to 0} \frac{d}{dr} \int_{A'} \frac{F}{M} \, dA + \int_{A} \frac{F}{M} \, dA = \int_{A'} \frac{F}{M} \, dA + \int_{A} \frac{F}{M} \, dA \]

Since \( n' \) and \( n \) are \( \leq \) \( \leq \)

\[ \frac{d}{dr} \int_{A'} \frac{F}{M} \, dA + \int_{A} \frac{F}{M} \, dA = \int_{A'} \frac{F}{M} \, dA + \int_{A} \frac{F}{M} \, dA \]

(14)

\[ \lim_{r \to 0} \frac{d}{dr} \int_{A'} \frac{F}{M} \, dA + \int_{A} \frac{F}{M} \, dA = \int_{A'} \frac{F}{M} \, dA + \int_{A} \frac{F}{M} \, dA \]

Where in Equation (9), the boundary condition on flux becomes

\[ 2c \Omega + \int_{A'} \frac{F}{M} \, dA = \int_{A} \frac{F}{M} \, dA \]

(15)

\[ \lim_{r \to 0} 2c \Omega + \int_{A'} \frac{F}{M} \, dA = \int_{A} \frac{F}{M} \, dA \]

Where in Equation (9), the boundary condition on flux becomes

\[ 2c \Omega + \int_{A'} \frac{F}{M} \, dA = \int_{A} \frac{F}{M} \, dA \]

(16)

\[ \lim_{r \to 0} 2c \Omega + \int_{A'} \frac{F}{M} \, dA = \int_{A} \frac{F}{M} \, dA \]


The work reported in this paper was supported by a research grant.

\[
\begin{align*}
\frac{\alpha}{\beta} & \cdot \frac{\gamma}{\delta} = \frac{\epsilon}{\zeta} \\
\frac{\alpha}{\beta} & \cdot \frac{\gamma}{\delta} = \frac{\epsilon}{\zeta} \\
\end{align*}
\]

References
From a numerical point of view, a more satisfactory treatment may be

not encountered.

In the period 1960-1966, the order of magnitude of the
non-linearities of the problem was determined by the
number of components included in the calculation.
In the resulting equations, the non-linearities of the
non-linearities of the problem was determined by the
number of components included in the calculation.
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non-linearities of the problem was determined by the
number of components included in the calculation.

\[
\frac{w}{w} = \frac{\sqrt{1 + \left(\frac{\mu + \rho}{\mu}\right)^2} + \left(\frac{\mu + \rho}{\mu}\right)}{\sqrt{1 + \left(\frac{\mu + \rho}{\mu}\right)^2} + \left(\frac{\mu + \rho}{\mu}\right)}
\]

\[
\int_{0}^{1} \left(\frac{\mu + \rho}{\mu}\right) + \left(\frac{\mu + \rho}{\mu}\right) d\theta
\]

\[
\frac{\mu}{\mu} = \frac{\sqrt{1 + \left(\frac{\mu + \rho}{\mu}\right)^2} + \left(\frac{\mu + \rho}{\mu}\right)}{\sqrt{1 + \left(\frac{\mu + \rho}{\mu}\right)^2} + \left(\frac{\mu + \rho}{\mu}\right)}
\]

\[
\int_{0}^{1} \left(\frac{\mu + \rho}{\mu}\right) + \left(\frac{\mu + \rho}{\mu}\right) d\theta
\]

The resulting equations remain the same, when the

of the problem.

the problem at hand, the problem at hand, the problem at hand, the problem at hand, the problem at hand, the problem at hand.
The variation of the equation with respect to those parameters leads to

\[
\langle (f^2 + z^2)^2 \rangle \Rightarrow \langle f^2 + z^2 \rangle \Rightarrow \langle f \rangle
\]

\[
\langle (f^2 + z^2)^2 \rangle \Rightarrow \langle f^2 + z^2 \rangle \Rightarrow \langle f \rangle
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\langle (f^2 + z^2)^2 \rangle \Rightarrow \langle f^2 + z^2 \rangle \Rightarrow \langle f \rangle
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\[
\langle (f^2 + z^2)^2 \rangle \Rightarrow \langle f^2 + z^2 \rangle \Rightarrow \langle f \rangle
\]
Abstract

Preliminary Studies of Monotonicity in Ocean Waves

U. S. News Underwater Ordinance Station, Newport, Rhode Island

H. B. Smart

References After Article's Paper
January 9th. "Assessment process was made of the same data during the selection of Leob's professional staff."
The second set of data is characterized by the

B. Non-resonant Harmonic Wave Model (NRH)

1. Non-Overlapped Modal Model (NOM)

The following is a description of the model.

The composition of the creation of the model.

The composition of the creation of the model.
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<td>180</td>
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<td>0.3</td>
<td>10</td>
<td>10</td>
<td>0.16</td>
<td>-0.27</td>
</tr>
</tbody>
</table>
Results:

Experiments in Japan conducted in a controlled wave tank yielded similar
results with measurement errors, which were reduced and seen in earlier
work. Measured spectrum data are presented in the above table.

The question was raised as to whether the acceleration due to
the wave was measured accurately or not. It was measured, but the response was down by 5% at 15% to 20% of the measured
value. Accurate method of measuring the signal as presented in the above paper.

Discussion after Submission of Paper:

Problems with waves, resonance, and non-linearities.

Suppression of noise, acceleration, and measurement errors.
These are two layers of contrasting complexity in the microradiation

Examination of the time scales reveals several interesting features,

Discussion

Examination of the contrast columns, can be attributed to differences in the density and properties of the contrast columns. In this sense, the contrast columns can be used for the contrast of contrast columns.

The contrast columns can be used for the contrast of contrast columns.

Observations

Detected with small increments of energy,

Background of the density of the contrast columns in one of the contrast columns.

Observations

The layers of contrast columns change in the contrast columns.

The contrast columns can be used for the contrast of contrast columns.

Abstract

Office of Naval Research, Preapored, Washington D.C., November 1959
Fig. 1 - NOTS Cruise 62-3 - Station Standard (32°59.8' N, 118°29.1' W)

Fig. 2 - NOTS Cruise 62-3 - Station Standard (32°59.8' N, 118°29.1' W)
Time studies - 2100 25 Sept. - 0600 26 Sept. 1962
Abstract

Hudson Laboratory of Columbia University, Dobbs Ferry, New York

DIFFUSION PROCESSES IN THE DEEP OCEAN

The problem of the diffusion coefficient of heat, or of heat energy, in a fluid medium is one of the most fundamental and important problems of physics. The knowledge of the diffusion coefficient is essential for the understanding of the mechanism and laws of heat transport in the ocean. The problem is of great interest not only for theoretical physicists but also for oceanographers and geomorphologists.

The problem of the diffusion coefficient of heat in the ocean has been studied extensively over the years. Various methods have been employed to determine this coefficient, including analytical and numerical solutions of the diffusion equation, laboratory experiments, and field observations.

Analytical solutions of the diffusion equation have been used to study the diffusion of heat in the ocean. These solutions require knowledge of the initial and boundary conditions, and the results obtained are often limited to specific conditions.

Experimental methods, such as the use of radioactive tracers, have also been employed to study the diffusion of heat in the ocean. These methods are more flexible and can be used to study the diffusion of heat under a wide range of conditions.

Field observations have also been used to study the diffusion of heat in the ocean. These observations are often more accurate than experimental methods, but they are limited by the availability of data.

The diffusion coefficient of heat in the ocean is an important parameter in the study of oceanic processes. It affects the temperature distribution, the mixing of waters, and the transport of heat energy. Understanding the diffusion coefficient is essential for the study of oceanic processes and for the development of models for predicting oceanic conditions.

In conclusion, the diffusion coefficient of heat in the ocean is a complex parameter that is influenced by a variety of factors. Further research is needed to accurately determine this coefficient and to understand its role in oceanic processes.
Experimentation:

The present study explored the distribution of the concentration of oceanographic features. The results demonstrated that the concentration of these features varied significantly across different regions. The distribution patterns were analyzed using statistical methods, and the findings were compared with previous studies. The study aimed to contribute to the understanding of oceanographic processes and their implications for marine ecosystems.

Introduction:

The oceanic circulation and the distribution of oceanic features are fundamental to the study of oceanography. The present study focused on the distribution of these features across various regions. The results showed a significant variation in the concentration of these features, which were analyzed using a combination of observational data and theoretical models. The study's findings have implications for understanding the dynamics of oceanic processes and their role in the Earth's climate system.
The concentration of radon in the cave would be

\[ C = \frac{N_{\text{radon}}}{V} \]

where \( N_{\text{radon}} \) is the number of radon atoms and \( V \) is the volume of the cave.

The decay constants of radon depend on the temperature and pressure. In general, radon has a half-life of 3.8 days.

The concentration of radon in the atmosphere is an important factor in the health and safety of people who live in areas with high radon levels. Radon is a cancer-causing gas that can be inhaled and enter the lungs, where it can cause lung cancer.

Results and Discussion

After a week of monitoring the radon levels in the cave and in the room, we found that the levels were quite low. The highest concentration of radon was found in the cave, where the levels reached 0.2 Bq/L. In the room, the concentration was much lower, averaging 0.02 Bq/L.

These results are consistent with other studies that have found radon levels in caves to be higher than in other types of buildings. The higher levels in the cave could be due to the lack of ventilation and the presence of radon in the soil and bedrock.

In conclusion, the monitoring of radon levels in caves is important for understanding the health risks associated with radon exposure. Further research is needed to determine the potential health effects of prolonged exposure to radon in caves.
(9) \( (x, y, z) = d \) where \( d^2 = x^2 + y^2 + z^2 \).
The decay constant of carbon-14 (\( \lambda \)) is the second term in the rate of production of carbon-14 in sea water. It is the rate of decay of carbon-14 in sea water and the rate of production of carbon-14 in sea water. The decay constant of carbon-14 in sea water is given by:

\[
\lambda = \frac{2 \times 10^{-13} \text{year}^{-1}}{1}.
\]

The rate of decay of carbon-14 in sea water is given by:

\[
\frac{d}{dt}[\text{Carbon-14}] = -\lambda [\text{Carbon-14}].
\]

The rate of production of carbon-14 in sea water is given by:

\[
\frac{d}{dt}[\text{Carbon-14}] = \text{Rate of production}.
\]

The rate of production of carbon-14 in sea water is equal to the rate of decay of carbon-14 in sea water plus the rate of production of carbon-14 in sea water.

\[
\lambda [\text{Carbon-14}] = \text{Rate of production}.
\]

The rate of production of carbon-14 in sea water is given by:

\[
\text{Rate of production} = \frac{2 \times 10^{-13} \text{year}^{-1}}{1}.
\]

The rate of decay of carbon-14 in sea water is given by:

\[
\frac{d}{dt}[\text{Carbon-14}] = -\lambda [\text{Carbon-14}] = \frac{2 \times 10^{-13} \text{year}^{-1}}{1}.
\]

The rate of production of carbon-14 in sea water is equal to the rate of decay of carbon-14 in sea water plus the rate of production of carbon-14 in sea water.

\[
\frac{d}{dt}[\text{Carbon-14}] = \text{Rate of production} = \frac{2 \times 10^{-13} \text{year}^{-1}}{1}.
\]

The rate of decay of carbon-14 in sea water is given by:

\[
\frac{d}{dt}[\text{Carbon-14}] = -\lambda [\text{Carbon-14}] = \frac{2 \times 10^{-13} \text{year}^{-1}}{1}.
\]

The rate of production of carbon-14 in sea water is equal to the rate of decay of carbon-14 in sea water plus the rate of production of carbon-14 in sea water.

\[
\frac{d}{dt}[\text{Carbon-14}] = \text{Rate of production} = \frac{2 \times 10^{-13} \text{year}^{-1}}{1}.
\]
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<th>Conductivity</th>
<th>Date</th>
<th>Time</th>
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<td>16/2/69</td>
<td>5/6</td>
</tr>
<tr>
<td>8</td>
<td>8°09.7'</td>
<td>10°C</td>
<td>16/2/69</td>
<td>2/6</td>
</tr>
<tr>
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<td>16/2/69</td>
<td>6/6</td>
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<td>10°C</td>
<td>16/2/69</td>
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<td>10°C</td>
<td>16/2/69</td>
<td>6/6</td>
</tr>
</tbody>
</table>

**References**

Brown, M.D., and D. Johnstone (1964), A large-volume water sampler, Deep-sea Research, 8, 298-301.


**Acknowledgments**

The author is grateful for the assistance of Dr. Fred Takahashi and the Coastal Oceanographic Group.
Table 2. $\text{Rn}^{222}/\text{Ra}^{226}$ Ratios in Oceanic Samples from Intermediate Depth in Western North Atlantic

<table>
<thead>
<tr>
<th>Collection Date</th>
<th>Sample No.</th>
<th>Sample Depth (m)</th>
<th>Water Depth (m)</th>
<th>$\text{Rn}^{222} 10^{-14}$ equiv.</th>
<th>$\text{Ra}^{226} 10^{-14}$</th>
<th>$\text{Rn}^{222} \text{Ra}^{226}$</th>
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<tr>
<td>11/15/62</td>
<td>BW#1</td>
<td>0</td>
<td>&gt;1000</td>
<td>6.0±1.2</td>
<td>(5)</td>
<td>1.2±0.2</td>
</tr>
<tr>
<td>11/20/62</td>
<td>BW#2</td>
<td>0</td>
<td>&gt;1000</td>
<td>6.1±1.2</td>
<td>(5)</td>
<td>1.3±0.2</td>
</tr>
<tr>
<td>1/16/63</td>
<td>BW#3</td>
<td>0</td>
<td>&gt;1000</td>
<td>3.9±0.8</td>
<td>(5)</td>
<td>0.6±0.2</td>
</tr>
<tr>
<td>1/17/63</td>
<td>BW#4</td>
<td>0</td>
<td>&gt;1000</td>
<td>4.0±0.8</td>
<td>(5)</td>
<td>0.8±0.2</td>
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<tr>
<td>2/24/63</td>
<td>V19-8</td>
<td>~300</td>
<td>&gt;4000</td>
<td>6.1±1.0</td>
<td>(5)</td>
<td>1.2±0.2</td>
</tr>
<tr>
<td>3/8/63</td>
<td>V19-22</td>
<td>~600</td>
<td>&gt;4000</td>
<td>6.5±1.0</td>
<td>(5)</td>
<td>1.3±0.2</td>
</tr>
</tbody>
</table>

Table 3. $\text{Rn}^{222}$ Concentration in Oceanic Air

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Location</th>
<th>Collection Date</th>
<th>$10^{-14}$ equiv.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FHC-A</td>
<td>Frazer's Cay, Bahamas</td>
<td>6/14/62</td>
<td>0.7±0.4</td>
</tr>
<tr>
<td>FHC-B</td>
<td>Frazer's Cay, Bahamas</td>
<td>6/15/62</td>
<td>0.8±0.1</td>
</tr>
<tr>
<td>FHC-C</td>
<td>Frazer's Cay, Bahamas</td>
<td>6/24/62</td>
<td>0.6±0.1</td>
</tr>
<tr>
<td>V19-4</td>
<td>R. V. Vema - Ambrose Light Ship, N.Y. Harbor</td>
<td>2/22/62</td>
<td>2.3±0.3</td>
</tr>
<tr>
<td>V19-7</td>
<td>R. V. Vema - W.N. Atlantic</td>
<td>2/23/62</td>
<td>0.5±0.1</td>
</tr>
<tr>
<td>V19-19</td>
<td>R. V. Vema - W.N. Atlantic</td>
<td>3/7/63</td>
<td>0.5±0.05</td>
</tr>
<tr>
<td>V19-21</td>
<td>R. V. Vema - W.N. Atlantic</td>
<td>3/8/63</td>
<td>1.2±0.1</td>
</tr>
<tr>
<td>V19-23</td>
<td>R. V. Vema - W.N. Atlantic</td>
<td>3/11/63</td>
<td>0.6±0.1</td>
</tr>
</tbody>
</table>
All others are for underwater retrieval, except those in red.

<table>
<thead>
<tr>
<th>Depth (fathoms)</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-200</td>
<td></td>
<td>0.04</td>
</tr>
<tr>
<td>200-2000</td>
<td></td>
<td>0.02</td>
</tr>
<tr>
<td>2000-10,000</td>
<td></td>
<td>0.01</td>
</tr>
<tr>
<td>10,000-10,000</td>
<td></td>
<td>0.005</td>
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</table>

Table 4. Estimates of amount of radon emanating up through the sediment-core interface.

Table 5. Estimates of amount of radon emanating up through the sediment-core interface.
Table 6. Rn$^{222}$-Ra$^{226}$ Ratios in Oceanic Samples Taken Near Bottom

<table>
<thead>
<tr>
<th>Collection Date</th>
<th>Latitude and Longitude</th>
<th>Bottom Depth (m)</th>
<th>Distance off Bottom (m)</th>
<th>Rn$^{222}$</th>
<th>Ra$^{226}$</th>
<th>Excess Rn$^{222}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4/63</td>
<td>30°28'N/70°43'W</td>
<td>5000</td>
<td>180</td>
<td>8</td>
<td>(7)</td>
<td>&lt;2</td>
</tr>
<tr>
<td>3/5/63</td>
<td>28°20'N/68°06'W</td>
<td>5500</td>
<td>180</td>
<td>4.6</td>
<td>(7)</td>
<td>&lt;2</td>
</tr>
<tr>
<td>3/12/63</td>
<td>20°13'N/66°11'W</td>
<td>6000</td>
<td>1</td>
<td>7.1</td>
<td>(7)</td>
<td>&lt;2</td>
</tr>
<tr>
<td>9/14/63</td>
<td>35°43'S/22°53'E</td>
<td>1800</td>
<td>1</td>
<td>19±2</td>
<td>8±1</td>
<td>11±3</td>
</tr>
</tbody>
</table>

Table 7. Rn$^{222}$-Ra$^{226}$ Ratios in Surface Ocean Water

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Location</th>
<th>Wind Velocity</th>
<th>Rn$^{222}$</th>
<th>Ra$^{226}$</th>
<th>Rn$^{222}$/Ra$^{226}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>FHC-3</td>
<td>Tongue of the Ocean</td>
<td>Normal</td>
<td>3.3±0.3</td>
<td>5.1±0.5</td>
<td>.65±.10</td>
</tr>
<tr>
<td>FHC-4</td>
<td>Tongue of the Ocean</td>
<td>Normal</td>
<td>3.3±0.3</td>
<td>(5.1)</td>
<td>.65±.10</td>
</tr>
<tr>
<td>FHC-5</td>
<td>Tongue of the Ocean</td>
<td>Normal</td>
<td>4.8±0.5</td>
<td>(5.1)</td>
<td>.94±.10</td>
</tr>
<tr>
<td>FHC-16</td>
<td>Tongue of the Ocean</td>
<td>Normal</td>
<td>5.7±0.5</td>
<td>5.7±0.5</td>
<td>1.00±.10</td>
</tr>
<tr>
<td>V19-6</td>
<td>North Atlantic</td>
<td>Normal</td>
<td>1.9±0.2</td>
<td>(5)</td>
<td>~ 0.4</td>
</tr>
<tr>
<td>V19-9</td>
<td>North Atlantic</td>
<td>Gale Force</td>
<td>1.1±0.2</td>
<td>(5)</td>
<td>~ 0.2</td>
</tr>
<tr>
<td>V19-10</td>
<td>North Atlantic</td>
<td>Gale Force</td>
<td>1.4±0.2</td>
<td>(5)</td>
<td>~ 0.3</td>
</tr>
<tr>
<td>V19-11</td>
<td>North Atlantic</td>
<td>Normal</td>
<td>2.0±0.2</td>
<td>(5)</td>
<td>~ 0.4</td>
</tr>
<tr>
<td>V19-13</td>
<td>North Atlantic</td>
<td>Normal</td>
<td>4.4±1.0</td>
<td>(5)</td>
<td>~ 0.9</td>
</tr>
<tr>
<td>V19-18</td>
<td>North Atlantic</td>
<td>Normal</td>
<td>4.5±1.0</td>
<td>(5)</td>
<td>~ 0.9</td>
</tr>
</tbody>
</table>

* Values in ( ) are estimates based on the results for other samples (see Table 1).
Table 8. Rn$^{222}$ and Ra$^{226}$ Results on Bahama Bank Waters  
(See Broecker and Takahashi, in press for exact locations)

<table>
<thead>
<tr>
<th>Station</th>
<th>Sample Depth (m)</th>
<th>Bottom Depth (m)</th>
<th>Type of Sediment</th>
<th>Rn$^{222}$ $10^{-14}$ equiv. gm Ra/L</th>
<th>Ra$^{226}$ $10^{-14}$ gm/L</th>
<th>Excess Ra$^{222}$ $10^{-14}$ equiv. gm Ra/cm$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>62-35</td>
<td>0</td>
<td>2</td>
<td>CaCO$_3$ sand</td>
<td>23 ± 2</td>
<td>5.4 ± 0.5</td>
<td>4.3 ± 0.5</td>
</tr>
<tr>
<td>62-35</td>
<td>0</td>
<td>2</td>
<td>CaCO$_3$ sand</td>
<td>24 ± 2</td>
<td>4.2 ± 0.5</td>
<td>5.2 ± 0.6</td>
</tr>
<tr>
<td>62-37</td>
<td>0</td>
<td>3</td>
<td>CaCO$_3$ sand</td>
<td>17 ± 2</td>
<td>5.0 ± 0.5</td>
<td>3.4 ± 0.4</td>
</tr>
<tr>
<td>62-30</td>
<td>0</td>
<td>4</td>
<td>CaCO$_3$ sand</td>
<td>~</td>
<td>5.5 ± 0.5</td>
<td>-</td>
</tr>
<tr>
<td>62-46</td>
<td>0</td>
<td>0.7</td>
<td>CaCO$_3$ sand</td>
<td>31 ± 3</td>
<td>5.2 ± 0.5</td>
<td>6.2 ± 0.6</td>
</tr>
<tr>
<td>63-5</td>
<td>0</td>
<td>5</td>
<td>CaCO$_3$ sand</td>
<td>18 ± 2</td>
<td>(5)</td>
<td>~4</td>
</tr>
<tr>
<td>63-5</td>
<td>5</td>
<td>5</td>
<td>CaCO$_3$ sand</td>
<td>19 ± 2</td>
<td>(5)</td>
<td>~7</td>
</tr>
<tr>
<td>63-7</td>
<td>0</td>
<td>4</td>
<td>CaCO$_3$ sand</td>
<td>33 ± 3</td>
<td>(5)</td>
<td>~7</td>
</tr>
<tr>
<td>63-7</td>
<td>4</td>
<td>4</td>
<td>CaCO$_3$ sand</td>
<td>18 ± 2</td>
<td>(5)</td>
<td>~7</td>
</tr>
<tr>
<td>63-12</td>
<td>0</td>
<td>3</td>
<td>CaCO$_3$ sand</td>
<td>39 ± 4</td>
<td>(5)</td>
<td>~8</td>
</tr>
<tr>
<td>63-12</td>
<td>3</td>
<td>3</td>
<td>CaCO$_3$ sand</td>
<td>20 ± 2</td>
<td>(5)</td>
<td>~7</td>
</tr>
<tr>
<td>63-24</td>
<td>2</td>
<td>4</td>
<td>CaCO$_3$ sand</td>
<td>56 ± 6</td>
<td>(5)</td>
<td>~11</td>
</tr>
<tr>
<td>62-22</td>
<td>0</td>
<td>5</td>
<td>CaCO$_3$ mud</td>
<td>6.0 ± 0.6</td>
<td>6.0 ± 0.6</td>
<td>6.0 ± 0.6</td>
</tr>
<tr>
<td>62-17</td>
<td>0</td>
<td>6</td>
<td>CaCO$_3$ mud</td>
<td>13 ± 1</td>
<td>9 ± 1</td>
<td>1.5 ± 0.2</td>
</tr>
<tr>
<td>62-36</td>
<td>0</td>
<td>6</td>
<td>CaCO$_3$ mud</td>
<td>10 ± 1</td>
<td>10 ± 1</td>
<td>1.0 ± 0.2</td>
</tr>
<tr>
<td>63-13</td>
<td>0</td>
<td>4</td>
<td>CaCO$_3$ mud</td>
<td>15 ± 1</td>
<td>(7)</td>
<td>~2</td>
</tr>
<tr>
<td>63-17</td>
<td>0</td>
<td>5</td>
<td>CaCO$_3$ mud</td>
<td>31 ± 3</td>
<td>(10)</td>
<td>~3</td>
</tr>
<tr>
<td>63-18</td>
<td>0</td>
<td>5</td>
<td>CaCO$_3$ mud</td>
<td>14 ± 2</td>
<td>(10)</td>
<td>~1.5</td>
</tr>
<tr>
<td>63-19</td>
<td>0</td>
<td>5</td>
<td>CaCO$_3$ mud</td>
<td>15 ± 2</td>
<td>(10)</td>
<td>~1.5</td>
</tr>
</tbody>
</table>

* Values in () are estimates based on the 1982 results.  
** Adjacent to very shallow waters of Brown's Cay oolite bores.
FLOW
FREEZEOUT
TRAPS
PUMP
DISPERSE ADAP
SEE FIGURE 1
SCINTILLAT.
COUNTER
SMALL
FREEZEOUT
TRAP
TO HE
TANK
PRESSURE
RELEASE
VALUE
PRESS.
GAUGE
BY-PASS
ASCARITE
LARGE
FREEZEOUT
TRAPS
FLOW
METER
TO VACUUM
PUMP
20 LITER
FLINT GLASS
BOTTLE
DISPERSE ADAPTOR
SEE FIGURE 1

FIGURE 3

FIGURE 4

TUBE POTTED INTO
BRASS MOUNTING FLANGE
WITH SCOTCH CAST EPOXY
PHOTO MULTIPLIER
DUMONT #6292
IN230
CALIBRATION SOURCE
COUNTING CHAMBER
INDICATOR
ROTATING COVER DISC
PUMPING LEAD
SOCKET
LIGHT SHIELD

138
139
**Figure 6**

EXCESS RADON CONCENTRATION EQUIV. Rg226 UNITS (10^-14 GM/L)

- $D_E = 0.1 \text{ CM}^2/\text{SEC.}$
- $D_E = 0.3 \text{ CM}^2/\text{SEC.}$
- $D_E = 1.0 \text{ CM}^2/\text{SEC.}$
- $D_E = 3.0 \text{ CM}^2/\text{SEC.}$
- $D_E = 10 \text{ CM}^2/\text{SEC.}$

**Distance Above Bottom (Meters)**

**Figure 7**

$$d = 693 \sqrt{\frac{D_e}{\lambda}}$$

**Ar222 / Ar226**

- BOUNDARY LAYER
- VERT. EXAG. ~10^5
- OCEAN
- ATM
FIGURE 8

EQUIVALENT CO₂ EXCHANGE RATE
MOLES/M²/YR

DEPTH TO HALF EQUILIBRIUM OF Rn222 (d)

COEFFICIENT OF VERTICAL EDDY DIFFUSION (De)

100 200 300 400 500

THICKNESS OF BOUNDARY LAYER (z)
MICRONS

Comment: Some complications which plagued the kampha bank

Answer: Two eddy diffusion equations are used. The first, 0.05, is for agreement of the radon-gas exchange.

Comment: While two eddy diffusion equations are needed, the agreement is very encouraging.

Answer: The same complications which plagued the kampha bank

Comment: The use of data from the radon-gas exchange equilibrium depth to half equilibrium of Rn222 (d) meters.

Comment: The concentration may depend on advective efficiency and well as dilution.

The word in practice be difficult.

Since twelve gallons of water are needed for one sample,

Comment: It is the modern trend to sample water without sediments.

Answer: The same complications which plagued the kampha bank


The essential aspect is that the ocean waves are being measured by a device that can detect the changes in wave height and direction. This information is then used to determine the location of the boundary layer and the presence of any boundary layer effects.

**Experimental Aspects (Cont.)**

Shallow water, ocean waves, bottom friction, and wave propagation.

C. Ocean and Seabed Interaction

**Ocean Wave Boundary Layer**

The ocean wave boundary layer is characterized by a decrease in wave height and an increase in wave frequency as the wave propagates through the water. This is due to the interaction between the ocean waves and the seabed, which causes energy to be dissipated into the water body. The boundary layer is important in understanding the dynamics of ocean waves and their impact on the surrounding environment.

The **Naval Research Laboratory** is conducting a study on the properties of ocean waves and their influence on the surrounding environment. The study aims to understand the complex interactions between the ocean waves and the seabed, and to develop models that can accurately predict the behavior of ocean waves in different conditions. The results of this study will be used to improve the design of offshore structures and to develop more accurate models for ocean wave forecasting.

**Broader Context, Application, and Implications**

The research on ocean waves and their boundary layer is significant in the field of oceanography and has numerous applications in various fields such as marine engineering, coastal management, and environmental science. The findings of this study will contribute to the development of more accurate models for predicting ocean waves, which can help in designing safer and more efficient offshore structures, and in understanding the impact of ocean waves on the surrounding environment.

The research is also important in the context of climate change, as changes in ocean waves and their boundary layer can affect the energy balance of the Earth's oceans and contribute to global warming.

**Conclusion**

In conclusion, the study on ocean waves and their boundary layer is crucial for understanding the dynamics of ocean waves and their impact on the surrounding environment. The findings of this study will contribute to the development of more accurate models for predicting ocean waves, which can help in designing safer and more efficient offshore structures, and in understanding the impact of ocean waves on the surrounding environment.

**References**


153

m

1. M. O. Donovan wrote two pages of the original script.

The script was reviewed by the pilot from notes taken by G. P. Dowling.

2. In the script, there are several references to the pilot's experience.

3. The pilot's experience includes a number of previous flights.

4. The pilot's experience also includes a number of previous flights.

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99. The pilot's experience includes a number of previous flights.

100. The pilot's experience includes a number of previous flights.

Additional references are as follows:

- O. M. O'Gara, Corp. of America, Boston, Mass.
- T. C. O'Neil, Corp. of America, Boston, Mass.
- T. C. O'Neil, Corp. of America, Boston, Mass.
We have tried new methods of introducing life to an invertebrate.

A sample of these life forms, and their combined floating or trailing epibionts, is mounted in a solution of physiological saline.

The-*-Dear* German, by combining floating or trailing epibionts, is mounted in a solution of physiological saline.

We have tried new methods of introducing life to an invertebrate.
From the text: "Average penetration at different times of the day in the upper 10 meters." 

Diagram showing the penetration depth of a wave at different times of the day from midnight to noon.