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*detailed description of radiative transfer processes at a level accessible to advanced students. The volume gives the reader a basic understanding of global warming and enhanced levels of harmful ultraviolet radiation caused by ozone depletion. It teaches the basic*

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*physics of absorption, scattering and emission processes in turbid media, such as the atmosphere and ocean, using simple semi-classical models. The radiative transfer equation, including multiple scattering, is formulated and solved for several prototype problems,*

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*using both simple approximate and accurate numerical methods. In addition, the reader has access to a powerful, state-of-the-art computational code for simulating radiative transfer processes in coupled atmosphere-water systems including snow and ice. This*

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*computational code can be regarded as a powerful educational aid, but also as a research tool that can be applied to solve a variety of research problems in environmental sciences.*

*Fluid dynamics is fundamental to our understanding of the atmosphere and*

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*oceans. Although many of the same principles of fluid dynamics apply to both the atmosphere and oceans, textbooks tend to concentrate on the atmosphere, the ocean, or the theory of geophysical fluid dynamics (GFD). This textbook provides a comprehensive*

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*unified treatment of atmospheric and oceanic fluid dynamics. The book introduces the fundamentals of geophysical fluid dynamics, including rotation and stratification, vorticity and potential vorticity, and scaling and approximations. It*

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*discusses baroclinic and barotropic instabilities, wave-mean flow interactions and turbulence, and the general circulation of the atmosphere and ocean. Student problems and exercises are included at the end of each chapter.*

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provide an overview  
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climate research. The  
book begins with  
basic mathematics*

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*then leads on to specific applications in atmospheric and ocean dynamics, such as fluid dynamics, atmospheric dynamics, oceanic dynamics, and glaciers and sea level rise. Mathematical and Physical Fundamentals of Climate Change*

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underlying the  
large circulations  
of the coupled  
ocean-atmosphere  
system Dynamics  
of The Tropical  
Atmosphere and  
Oceans provides a  
detailed  
description of  
macroscale

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tropical circulation systems such as the monsoon, the Hadley and Walker Circulations, El Niño, and the tropical ocean warm pool. These macroscale circulations interact with a myriad of higher

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frequency  
systems, ranging  
from convective  
cloud systems to  
migrating  
equatorial waves  
that attend the low-  
frequency  
background flow.  
Towards  
understanding and  
predicting these

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circulation

systems. A

comprehensive

overview of the

dynamics and

thermodynamics of

large-scale tropical

atmosphere and

oceans is

presented using

both a

“reductionist” and

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“holistic” perspectives of the coupled tropical system. The reductionist perspective provides a detailed description of the individual elements of the ocean and atmospheric circulations. The



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physical nature of  
each component  
of the tropical  
circulation such as  
the Hadley and  
Walker  
circulations, the  
monsoon, the  
incursion of  
extratropical  
phenomena into  
the tropics,

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precipitation  
distributions,  
equatorial waves  
and disturbances  
described in detail.

The holistic  
perspective  
provides a physical  
description of how  
the collection of  
the individual  
components

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produces the  
observed tropical  
weather and  
climate. How the  
collective tropical  
processes  
determine the  
tropical circulation  
and their role in  
global weather and  
climate is provided  
in a series of

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overlapping  
theoretical and  
modelling  
constructs. The  
structure of the  
book follows a  
graduated  
framework.  
Following a  
detailed  
description of  
tropical

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phenomenology,  
the reader is  
introduced to  
dynamical and  
thermodynamical  
constraints that  
guide the  
planetary climate  
and establish a  
critical role for the  
tropics. Equatorial  
wave theory is

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developed for  
simple and  
complex  
background flows,  
including the  
critical role played  
by moist  
processes. The  
manner in which  
the tropics and the  
extratropics  
interact is then

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described,  
followed by a  
discussion of the  
physics behind the  
subtropical and  
near-equatorial  
precipitation  
including arid  
regions. The El  
Niño phenomena  
and the monsoon  
circulations are

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discussed,  
including their  
covariance and  
predictability.  
Finally, the  
changing structure  
of the tropics is  
discussed in terms  
of the extent of the  
tropical ocean  
warm pool and its  
relationship to the



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intensity of global convection and climate change. Dynamics of the Tropical Atmosphere and Oceans is aimed at advanced undergraduate and early career graduate students. It also serves as

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an excellent  
general reference  
book for scientists  
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tropical circulations  
and their  
relationship with  
the broader  
climate system.  
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undergraduate and  
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graduate students  
in atmospheric,  
oceanic, and  
climate science,  
Atmosphere,  
Ocean and  
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is an introductory  
textbook on the  
circulations of the  
atmosphere and  
ocean and their

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interaction, with an emphasis on global scales. It will give students a good grasp of what the atmosphere and oceans look like on the large-scale and why they look that way. The role of the oceans in

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climate and  
paleoclimate is  
also discussed.  
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theory and  
accompanying  
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experiments sets  
this text apart by  
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instructions on  
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problems (with  
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to help students  
learn the material.

The two chapters  
of this book  
originally appeared  
in "Air Sea



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Exchange of  
Gases and  
Particles", edited  
by P.S. Liss and  
W.G.N. Slinn. We  
wrote them as a  
general  
introduction to the  
physical processes  
in the atmosphere  
and ocean which  
govern the

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transport of gases  
and particles in  
and between the  
two media. Our  
audience was to  
be graduate  
students in  
physical chemistry  
of air and sea, and  
research workers  
wishing to get  
started in this or a

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related field. It was  
Dr. Alan

Longhurst, Director-  
General of the  
Atlantic Region,  
Canada

Department of  
Fisheries and  
Oceans, who  
pointed out that  
our introduction  
had a far wider

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audience: in fact,  
anyone with a  
scientific  
background who  
needs a basic  
under standing of  
the physics of the  
atmosphere and  
ocean. Dr. D.J.  
Larner of Reidel  
agreed, and this  
book is the result.

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Since we expended considerable effort to satisfy the demands of the physical chemists, and also discussed the explanations much with our colleagues at home, we expect

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the reader will find the two parts to be complementary and useful as a unified reference text. On the other hand, since it was designed as background material for a text on air-sea gas exchange and

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transport, the more experienced reader will be aware that the picture presented emphasizes transport and exchange processes while it ignores others. No mention is made, for example, of

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weather  
forecasting;  
neither is large-  
scale ocean  
modelling  
considered.

This book is  
unique in bringing  
together the  
diverse concepts  
and ideas of  
meteorologists,



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atmospheric  
physicists and  
oceanographers  
into a single  
coherent account  
of the fluid  
environment, with  
emphasis on their  
physical properties  
and inter-  
dependence rather  
than on the

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mathematics. It provides an up-to-date appreciation of the subject area with reference to major research programmes in Oceanography and Meteorology, and an invaluable combined perspective for

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undergraduates  
who tend to  
compartmentalise  
themselves. It also  
shows the way the  
subject is currently  
developing and  
suggests possible  
future research.

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Dynamics

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Salmon Production

50 Years of Ocean  
Discovery  
Thermodynamics  
of Atmospheres  
and Oceans  
Waves in the  
Ocean and  
Atmosphere  
***An engaging***

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***and accessible  
textbook  
focusing on  
climate  
dynamics from  
the perspective  
of the ocean,  
specifically  
interactions  
between the  
atmosphere and  
ocean. It***

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***describes the  
fundamental  
physics and  
dynamics  
governing the  
behaviour of the  
ocean, and  
provides  
numerous end-  
of-chapter  
questions and  
access to online***

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***data sets.***

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development of  
ocean sciences  
over the past 50  
years,  
highlighting the  
contributions of  
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***(NSF) to the  
field's progress.  
Many of the  
individuals who  
participated in  
the exciting  
discoveries in  
biological  
oceanography,  
chemical  
oceanography,  
physical***



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***oceanography,  
and marine  
geology and  
geophysics  
describe in the  
book how the  
discoveries were  
made possible  
by combinations  
of insightful  
individuals, new  
technology, and***

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***in some cases,  
serendipity. In  
addition to  
describing the  
advance of  
ocean science,  
the book  
examines the  
institutional  
structures and  
technology that  
made the***

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***advances  
possible and  
presents visions  
of the field's  
future. This  
book is the first-  
ever  
documentation  
of the history of  
NSF's  
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***how the  
structure of the  
division evolved  
to its present  
form, and the  
individuals who  
have been  
responsible for  
ocean sciences  
at NSF as  
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**over the past 50  
years.**

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fundamental  
theory of waves  
appropriate for  
first year  
graduate  
students in  
oceanography,  
meteorology and  
associated***

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elementary  
overview of the  
basic wave  
concept, specific  
wave  
phenomena are  
then examined,  
including:  
surface gravity  
waves, internal***

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***gravity waves,  
lee waves, waves  
in the presence  
of rotation, and  
geostrophic  
adjustment.***

***Each wave topic  
is used to  
introduce either  
a new technique  
or concept in  
general wave***

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placed on  
connectivity  
between the  
various subjects  
and on the  
physical  
interpretation of  
the  
mathematical  
results. The***



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population and  
human  
development in  
coastal areas***

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***has led to a  
greater  
importance of  
understanding a  
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interactions.  
This second  
volume on atmo  
sphere-ocean  
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***several of the  
key mechanisms  
that are  
important for  
the development  
of marine  
storms.***

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focus of this book  
is the physical  
processes in the  
World Ocean  
which regulate  
the interannual-to-  
multidecadal  
natural variability  
of the climate  
system, and  
some key  
atmospheric and  
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manifestations of this variability. It analyses a number of Atlantic and Indo-Pacific signals, and describes their regional atmospheric and marine manifestations. The role of the Ocean in the

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recent hiatus of global warming and the probability of abrupt climate change due to thermohaline catastrophe are also assessed. The book pays special attention to the change of parameters of



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synoptic  
atmospheric  
disturbances over  
the Northern  
Hemisphere and  
its sub-regions in  
different phases  
of the natural  
quasi-periodical  
climatic signals. It  
will appeal to  
oceanographers,  
climatologists,

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meteorologists,  
hydrologist,  
geographers and  
the general  
reader interested  
in the problem of  
climate change  
all over the globe,  
especially with  
regards to  
Eastern Europe  
and the Black Sea  
region.

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The goals of the  
Symposium were  
to highlight  
advances in  
modelling  
of atmosphere  
and ocean  
dynamics, to  
provide a forum  
where  
atmosphere and  
ocean scientists  
could present

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their latest  
research results  
and learn  
of progress and  
promising ideas  
in these allied  
disciplines; to  
facilitate  
interaction  
between theory  
and applications  
in atmosphere/oc  
ean dynamics.

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These goals were seen to be especially important in view of current efforts to model climate requiring models which include interaction between atmosphere, ocean and land influences.

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Participants were delighted with the diversity of the scientific programme; the opportunity to meet fellow scientists from the other discipline (either atmosphere or ocean) with whom they do not

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normally interact through their own discipline; the opportunity to meet scientists from many countries other than their own; the opportunity to hear significant presentations (50 minutes) from the keynote speakers

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on a range  
of relevant topics.  
Certainly the goal  
of creating a  
forum for  
exchange  
between  
atmosphere and  
ocean scientists  
who need to input  
to create realistic  
models for  
climate prediction



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was achieved by  
the Symposium  
and this goal will  
hopefully be  
further advanced  
by the publication  
of these  
Proceedings.

Atmosphere-  
Ocean Dynamics  
deals with a  
systematic and  
unified approach

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to the dynamics of the ocean and atmosphere. The book reviews the relationship of the ocean-atmosphere and how this system functions. The text explains this system through radiative equilibrium

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models; the book also considers the greenhouse effect, the effects of convection and of horizontal gradients, and the variability in radiative driving of the earth. Equations in the book show the properties of a

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material element,  
mass

conservation, the  
balance of scalar  
quantity (such as  
salinity), and the  
mathematical  
behavior of the  
ocean and  
atmosphere. The  
book also  
addresses how  
the ocean-

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atmosphere  
system tends to  
adjust to  
equilibrium, both  
in the absence  
and presence of  
driving forces  
such as gravity.  
The text also  
explains the  
effect of the  
earth's rotation  
on the system, as

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well as the application of forced motions such as that produced by wind or temperature changes. The book explains tropical dynamics and the effects of variation of the Coriolis parameter with

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latitude. The text  
will be

appreciated by  
meteorologists,  
environmentalists  
, students  
studying  
hydrology, and  
people working in  
general earth  
sciences.

Introduction to  
Wave Dynamics

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The Ocean's Role  
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Change  
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ocean  
Interactions  
Embracing  
Description of the  
Earth,  
Atmosphere,  
Ocean, and



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Distribution of  
Plants and  
Animals (1850)  
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**It Is Well**

**Recognised That  
Oceans Exercise A  
Profound Influence  
Upon The Climates  
Of The World And  
Upon The Larger  
And Smaller**

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**Features Of The  
Atmospheric  
Circulation Which  
Together  
Determine The  
Weather; And Also,  
That The  
Atmosphere  
Controls The  
Oceanic  
Circulation. The  
Interaction,**

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**However, Is Quite  
Complex. With A  
View To Explain  
The Intricacies  
Involved In This  
Interaction, This  
Book Deals With  
All Such Areas Of  
Physical  
Oceanography  
That Have Bearing  
Upon Problems Of**

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**The Atmosphere.  
The Heat Budget  
Of The Oceans  
And Of The Ocean  
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The Greatest  
Importance To The  
Atmosphere, Is  
Discussed In  
Detail, After  
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and ocean are  
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understanding the  
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**ocean, modeling capabilities, and numerical A-L-O simulations, some unresolved processes in the models do not adequately represent knowledge of the underlying physics. Moreover, there is**

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further progress in  
numerical  
simulations is  
being impeded by  
the slow pace of  
improvement in the  
representation of  
key physical  
processes in the  
models and the fact  
that geophysical**

**flow models are not receiving the attention needed to make these tools more useful and accurate. These models often are used to predict future events, so it is imperative that their underlying physical processes**

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**to improve the use  
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