Mathematics of Planet Earth (MPE) as a field of study was started and continues to be consolidated as a collaboration of mathematical science organisations around the world. These organisations work together towards tackling global environmental, social and economic problems using mathematics. This textbook introduces the fundamental topics of MPE to advanced undergraduate and graduate students in mathematics, physics and engineering while explaining the modern usages and operational connections amongst these topics. In particular, it discusses the links between partial differential equations, data assimilation, dynamical systems, mathematical modelling and numerical simulations and applies them to real-life, illustrated examples.

The text also complements advanced courses in geophysical fluid dynamics (GFD) for meteorology, atmospheric science and oceanography. It links the fundamental scientific topics of GFD with their potential usage in a career of applications dealing with climate change and weather variability. The immediacy of examples also provides an excellent introduction for experienced researchers interested in learning the current scope and primary concepts in the field of MPE. Written by experienced researchers and educators in mathematics, this textbook is the first of its kind to link together the disparate fundamental topics necessary in educating and training the future leaders in this new and exciting field.

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