

## Preface

There has not been a period where climate change received as much attention as it is getting now. Should the mean monthly temperature in summer or winter be around 3°C higher or lower than the average year (in general, the historical 30-year mean), talk of erratic weather floods the news. In addition, global warming, a phenomenon that happens on a different timescale, complicates matters further. Once exposed to extreme phenomenon, we tend to obsess over the deviation (anomaly) from the variation component represented by the mean. However, without understanding the factors behind the formation of the mean climate, it cannot be said that we have grasped the true state of the problem. Taking an example from the climate in Japan, if we observe closely, even the coming of the four seasons every year, which we take for granted, actually changes significantly with respect to simple seasonal variations in incident sunlight. The reason for this is the interactions and feedbacks that occur between sub-systems such as the atmosphere and oceans, snow and ice, vegetation and soil.

Speaking of monsoons, we naturally think of warm, moist southerly winds or the dry, cold north winds that blow in winter. In this book, we will not only be describing the three-dimensional structure of such wind and rain, but also devote space to explaining the systems that are responsible for such phenomena. The reason why we have attached the descriptor “global” in front of monsoon is stems from the fact that monsoons are not only distributed across the broad region between the equator and the mid-latitudes, including over the ocean, it is important to also note the interactions between regions.

The target audience for this book is undergraduate students who possess some foundational knowledge of meteorology, as well as masters students who are learning global climatology for the first time, weather forecasters and young researchers, and sets out to impart the general essence of the dynamical climatology and oceanography required for the understanding of climate systems. The main scope is designated as the broad monsoon region other than the high latitudes, with effort made to promote an understanding of the profundity of climate systems while examining real-life examples of air-sea-land interaction.

For the sake of convenience, the former half of this book is devoted to dynamical oceanography in the tropical region, while the latter half discusses monsoon climate dynamics. The reason for this is because dynamically, the fundamental equa-

tions for both dynamical oceanography and climatology are the same, and, such as in the case of the delayed oscillator theory, it is easier to recognize the various waves and air-sea interactions as actual phenomena.

While I originally intended to stop at introducing the jargon and phenomena not without using many equations, I eventually decided to include the equations in order to promote a deeper understanding of the physical mechanisms. However, to ensure that beginners do not have trouble following, much effort has been made to derive the equations in a step-by-step manner from the beginning, instead of simply including only the final relational expressions. This is based on the painful experience that I myself went through as a student, giving up in the introductory chapters of difficult textbooks.

With the existing domain of dynamical meteorology as its foundation, dynamical climatology has rapidly developed in the last quarter-century amidst social pressures regarding the understanding climate change as represented by global warming. In this book, in addition to foundational content, I will also be actively covering recently discovered phenomena and outstanding issues currently being discussed.

Writing on such a broad topic as climate systems as an individual is no mean feat, and it took substantial courage. Even though this is constrained by the scope of the understanding of the writer, who is but one individual, the reason I went ahead with this is because it was felt that the act of examining the big picture from a singular, foundational aspect is important as well in the promotion of academic specialization. It would be most fortunate if I manage to interest more people in the mysteries of climate formation and climate changes through this book.