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Book Review

GNSS Remote Sensing: Theory, Methods and Applications by Shuanggen Jin, Estel Cardellach and Feiqin Xie, Remote Sensing and Digital Image Processing, Vol. 19, Springer, 2014;
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This book is the first attempt to look as widely as possible at the Global Navigation Satellite System (GNSS) remote sensing technique. Previous books have already shown the possibilities of GNSS remote sensing. The authors of this book were the first to show such a wide range of GNSS capabilities in this area.

The GNSS was created for navigation and positioning. Research on the GNSS signal to improve the accuracy of positioning allowed us to isolate and detail knowledge of the errors affecting the GNSS signal propagation in the atmosphere. Understanding the impact of the ionosphere, troposphere and multipath marked the beginning of GNSS applications in remote sensing. In Part I, the authors discuss the very accessible essence of the errors of GNSS signal propagation in the atmosphere. This is not necessary for an understanding of the usefulness of the GNSS in remote sensing applications.

Part II is dedicated to GNSS applications in remote sensing, which have been well known for many years. Chapters 3 and 4 describe the ground GNSS sensing techniques for a neutral atmosphere (troposphere) and ionosphere. The book describes in detail how to create 2D images of the state of the neutral atmosphere (water vapor). It is a pity that the authors devote so little space to the most developing technique of GNSS tomography, which gives 3D images of the neutral atmosphere. Much better, the authors describe the modeling of the state of the ionosphere in both 2D and 3D images.

The next chapters, 5 and 6, are devoted to the new GNSS Radio Occultation (RO) technology, which allows creating full 3D images of the atmosphere directly from observations. The theoretical introduction presented in Chapter 5, supported by studies of recent scientific publications in this field, is very valuable.

The most interesting section of the bood is Part III, which explores a new and dynamic drop-down application—GNSS reflectometry. The multipath effect in the GNSS signal was turned into a remote sensing technique for sea and ice surface monitoring. In this part of the book, the authors meticulously describe the theoretical basis of GNSS reflectometry and its potential application for earth-observing systems. This part shows the enormous possibilities of integrating GNSS ground and space observations.

As the authors note in the summary chapter, GNSS remote sensing is currently using signals from the GPS (USA) and GLONASS (Russia) systems, using what is available everywhere on earth, the signals from about 20 GNSS satellites. In the near future, signals from the Galileo satellite system (Europe), Beidou/COMPASS (China), QZSS (Japan) and IRNSS (India) will be available, which will greatly expand the resolution of models of the atmosphere, sea and ice surfaces.

The book shows the possibility of using GNSS technology for multidisciplinary research, which is addressed here to a wide audience, representing the community of GNSS, meteorologists, hydrologists and others, from the area of earth sciences. I highly

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recommend this book to students and researchers who wish to learn about how to think about new possibilities of using GNSS technology in monitoring of the earth.