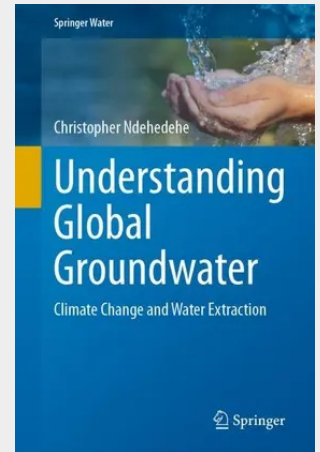


Understanding Global Groundwater

Climate Change and Water Extraction

This book advances our understanding of global groundwater status, emphasizing the growing threats from unsustainable extraction and climate change. It highlights the central dilemma: groundwater is essential for socio-economic development, yet overuse leads to severe environmental and ecological consequences. With many aquifers rapidly declining, the book stresses the urgent need for advanced monitoring to better understand hydrological processes such as recharge, to inform stronger management policies. A major focus is the role of modern satellite hydrology missions in improving groundwater assessment. By integrating radar, Gravity Recovery and Climate Experiment (GRACE), and GNSS data with outputs from hydrological models, these technologies offer the capability to enhance our assessment of groundwater status, provide deeper insights into groundwater processes, and support sustainable decision-making. The book examines groundwater drought, articulating its principles and presenting methods for monitoring this phenomenon underpinned by machine learning techniques. Case studies illustrate how GRACE, combined with climate data, can clarify the links between climate variability and groundwater resources. Emerging techniques for assessing groundwater availability and drought impacts are also discussed. Another key contribution is the discussion on co-management of freshwater resources using satellite-based assessments. The book outlines pathways toward long-term groundwater sustainability through the integration of multi-satellite data with in-situ observations. It underscores the need for an operational service application to monitor groundwater drought and identify vulnerable regions. By bridging traditional groundwater science with advanced satellite Earth observation, this book provides essential insights into groundwater behavior in an era of climate change and population growth. It serves as a valuable resource for understanding the risks and actions needed to protect groundwater systems for future generations.

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