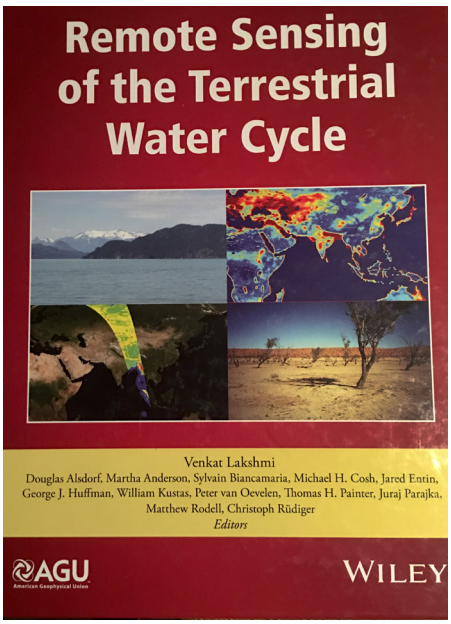

Remote Sensing of the Terrestrial Water Cycle

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This collection from the American Geophysical Union (AGU) brings together research and researchers from across disciplines and the world to examine the how satellite data is used to expand our knowledge about the terrestrial water cycle and quantify its spatial and temporal variations. This particular text comes directly from the AGU Chapman Conference on Remote Sensing of the Terrestrial Water Cycle held in February 2012.

This book is one Monograph (206) in the Geophysical Monograph Series published by Wiley in cooperation with the AGU. In particular, the book is divided into seven sections all of which relate directly to the terrestrial water cycle. Each individual chapter within each section is independent research contributed by different researchers that are grouped together by topic that do not necessarily and generally do not build upon each more comparable in the world of fiction to short stories than a novel and should be read as such.

Section 1 addresses the remote sensing of precipitation with two literature reviews, the first on Rain / no rain classification (RNC) algorithms based on passive microwave sensors and the second review is on the Climate Prediction Center Morphing (CMORPH) techniques including the development and future directions. An application chapter considers work to improve the measure of precipitation in mountainous regions through research using Global Satellite Mapping (GSMap) algorithm and Tropical Rainfall Measuring Mission (TRMM) microwave imager (TMI). Finally, there is a discussion of quantitative precipitation estimates (QPEs) for error characterization and quantification in terms of the TRMM and Global Precipitation Measurement Mission (GPM).

Section 2 addresses the remote sensing of evapotranspiration (ET) with two case-studies. The first case-study uses the 3Temp. model to ET based on Moderate Resolution Imaging Spectroradiometer (MODIS) data. It tests this method regionally, also looking for spatial and temporal trends within the Jinghe River Basin in the southern part of the Loess Plateau in China. The second case-study centered in the Lower-Colorado River Basin in a region of interest in southern California looked at ET using a Remotely Sensed Energy Balance (RSEB) model to investigate effects on the invasive Tamarisk species.

Section 3 addresses surface water remote sensing. The first chapter is a case study looking at the Central Congo Basin's Terrestrial Water Storage (TWS) changes using multiple satellite measures including, among others, the Gravity Recovery And Climate Change Experiment (GRACE) mission data. Chapter 10, Downstream Hydraulic Geometry (DHG) estimates are derived for the entire Yukon River Basin using software designed to measure river widths through algorithms applied to imagery data in conjunction with Digital Elevation Model (DEM) discharge estimates. The final chapter in this section is a report from the Jet Propulsion Lab on ongoing Surface Water Ocean Topography (SWOT) research. This particular study repurposed of the Terminal Descent Sensor (TDS) from the Mars Science Laboratory, which is a 35.75 GHz Dopplar Radar. This repurposed Ka- band radar was deployed in bridge based river observations and preceded KaSPAR airborne radar.

Section 4 addresses remote sensing of snow and the sensors best suited for its detection. The first chapter is a literature review of snow cover depletion in hydrologic applications and the change in remotely sensed data, its uses, and how it has changed the understanding of, especially snow extent measures. Next, a chapter discussing snow cover observations using the Visible /

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Infrared Imager Radiation Suite (VIIRS) summarizes the platform and observation issues including some instrumentation problems. Followed by a chapter case-study based in the Oregon Cascades, McKenzie River and Middle Fork Williamette Basins to study fractional snow cover area (fSCA) [i.e., here estimates of snow under the forested canopy] comparing an adjust fSCA to a standard fSAC. The fourth chapter in this section was a study that provided evidence from again the Yukon River Basin for the utility of Diurnal Amplitude Variations (DAV) in terrestrial hydrological systems via passive microwave remote sensing systems specifically from Special Sensor Microwave Imager (SSM/I) and Advanced Microwave Scanning Radiometer – Earth Observation System (AMRS-E) and MODIS. The final chapter in this section is a temporal study of the Canadian Prairies (CP) from 1979-2004's snow pack change where snow water equivalent (SWE) is measured monthly using Scanning Multichannel Microwave Radiometer (SMMR) and SSM/I data.

Sections 5 addresses remote sensing of soil moisture. The first chapter discusses the JPL Soil Moisture Active Passive (SMAP) sensor that at the time of this monograph's publication had not yet been launched but in 2014 was launched and has subsequently stopped transmitting data due to sensor failure. The authors gives some details about the instrument and issues addressed in its calibration and validation. The second chapter considers three Artificial Intelligence (AI) algorithms to retrieve soil moisture estimates and examines their sensitivity to backscatter and the usefulness of ancillary data, the case study is based in Alberta, Canada. Next, a case study in the Little Washita River Watershed micronet in Oklahoma with the aim of the study to disaggregate the North American Land data Assimilation System (NLDAS) derived soil temperatures and to derive the soil evaporation efficiency variables. The fourth chapter in this section is a case-study in the Yanco region of New South Whales, Austraila that utilizes AMRS-E derived soil moistures data for the top soil measurement and Community Atmosphere Bioshpere Land Exchange (CABLE) data for deeper soil moisture predictions. The next case-study is found in the Green Bayou Basin in east Texas, USA. Here the surface and root zone satellite soil moisture retrievals from both passive and active microwave sensors were separately assimilated to the Sacramento Soil Moisture Accounting Model (SAC-SMA) and their contribution to river discharge improvement was evaluated. The final chapter in this section gives the ins and outs of the NASA Giovanni tool for visualization, analyzation, and intercomparison of soil moisture data.

Section 6 addresses groundwater remote sensing. In the first chapter a case study focusing on Nubian Sandstone Aquifer System (NSAS) in north east Saharan Africa and the Arabian Pennisula Aquifer System (APAS) in the Arabian Pennisula where temporal and spatial variation in groundwater is examined using GRACE, TRMM, soil moisture derived from t he ESA-ECV project and other ancillary data is used to monitor changes since 1987. The next case-study is from the Nile Basin and examines ground water change from 2003-2013. The fourth chapter in this section details the creation of a ground water potential map in the Northern Highland Lake Region (NHLR) of Vilas County Wisconsin using field work collection, an AirSAR data collect and Shuttle Radar Topography Mission (STMR) DEM used in the map compilation. The final chapter in this section from JPL is a study on land subsidence using InSAR to monitor ground water dynamics.

And finally, section 7 considers different aspects remote sensing analyses involved in terrestrial water cycle modeling and consists of nine chapters of widely varying mostly application and case study work related to hydrological remote sensing, including topics such as extreme events, unmanned areal systems collections, a case study from Iran and prediction in ungagged basins through spaceborne microwave signals.

Missing from this text is a list of the many acronyms used throughout the book, but the editors were diligent about acronyms being defined within the text and the index included at the end of the book is both sufficient and useful. This compilation of important research is welcomed for any interested in remote sensing of the terrestrial water cycle.