Predicting groundwater fluctuations in major global river basins: Case study of California and Mekong River Basins

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The increasing trend of floods and droughts over the past decade has made the study of hydrologic processes and water availability vital to our understanding of extreme hydrological events. As extreme events result in the loss of thousands of lives and billions in property damage, the causes for these extreme fluctuations vary across the world—there is not one formula to explain global hydrologic processes. Several river basins around the globe are analyzed using satellite and modeled data from NASA and NOAA to identify patterns at a regional level to begin to understand and predict extreme events based on fluctuations in ground water modeled by the GRACE satellite. This study assesses how the water cycle variables derived from GRACE Water Equivalent Thickness Anomaly, TRMM and GPM Precipitation, MODIS NDVI and ET, and GLDAS Runoff and Soil Moisture have changed over the past 15 years, focusing on climate systems represented by the 2007 Koppen Climate Classification. In addition to natural variables, anthropogenic factors such as farming and urbanization play a large role in water usage and storage. Previous studies showed that groundwater fluctuations in California and Mekong basins can be predicted using a combination of these water cycle variables in unconventional water balance formulas to produce R^2 correlations over 0.80 and 0.81, respectively, with some climate regions achieving an R^2 value of 0.87 and 0.85, respectively. This study seeks to improve that method while focusing in the anthropogenic differences in these two basins, and applying the calculation to the spatial domain to calculate how well the formulas perform across spaces, in addition to time.