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NASA Outlines Changes in Earth's Freshwater Distribution

U.S.-German mission gives new picture of Earth's most precious natural resource

Recent space observations of freshwater storage by NASA's Gravity Recovery and Climate Experiment (GRACE) are providing a new picture of how Earth's most precious natural resource is distributed globally and how it is changing.

According to a December 12 NASA press release, researchers are using the mission's nearly five-year data record to estimate seasonal water-storage variations in more than 50 river basins that cover most of Earth's land area.

The variations reflect changes in water stored in rivers, lakes and reservoirs; on floodplains as snow and ice; and underground in soils and aquifers.

"GRACE is providing a first-ever look at the distribution of freshwater storage on the continents," said Jay Famiglietti, professor of earth system science at the University of California-Irvine.

"With longer time series," he added, "we can distinguish long-term trends from natural seasonal variations and track how water availability responds to natural climate variations and climate change."

GRACE is a partnership between NASA and the German Aerospace Center.

Global Water Storage

Several African basins, such as the Congo, Zambezi and Nile, show significant drying over the past five years. In the United States, the Mississippi and Colorado River basins show water-storage increases during that time. Such information is vital for managing water resources in vulnerable parts of Africa and Southeast Asia because increasing populations and standards of living put demands on often unsustainable water resources. The GRACE data can be used to support more informed regional water-management decisions.

The twin GRACE satellites monitor tiny month-to-month changes in Earth's

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gravity field that are caused mainly by the movement of water in Earth's land, ocean, ice and atmosphere reservoirs. Scientists are analyzing GRACE data to identify possible trends in precipitation changes, groundwater depletion and snow and glacier melt rates, and to understand their underlying causes.

Matt Rodell, at NASA's Goddard Space Flight Center in Maryland, said the data correspond well with ground observations. As a result, researchers now can apply GRACE data in ways that will affect regional water management.

"GRACE data improve our understanding of the water cycle and simulations of soil moisture, snow and groundwater in computer models," he said. "This is a key step toward better weather, stream flow, flood, drought and water resource forecasts worldwide."

Grace and The Water Cycle

Michael Watkins, GRACE project scientist at NASA's Jet Propulsion Laboratory in California, said GRACE is the only element in NASA's broad water-cycle research program that measures changes in all types of water storage. The mission's abilities to detect water are particularly vital for the emerging field of remote sensing of groundwater.

"It's been speculated that many of Earth's key aquifers are being depleted due to over-exploitation, but a lack of data has hampered efforts to quantify how aquifer levels are changing and take the steps necessary to avoid depleting them," Famiglietti said.

GRACE also lets scientists estimate another key component of the water cycle for the first time - water discharged by freshwater streams from Earth's continents. Stream flow measurements often are not shared for economic, political or national defense reasons.

GRACE measurements of total water discharged by continental streams are important for monitoring the availability of freshwater and understanding how surface water runoff from continents contributes to rises in global sea level.

More information about GRACE is available at the University of Texas Web site. Additional information about water and energy-cycle research is available at the NASA Goddard Space Flight Center Web site.

For more information about U.S. policies, see [Environment](#) and [Science and Technology](#).

Source: U.S. Department of State

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