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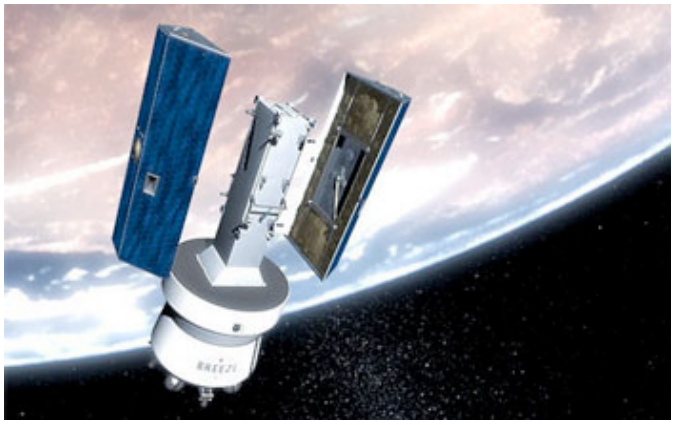
Twin Satellites Reveal Earth's Fresh Water Trends

AUSTIN, Texas, December 15, 2006 (ENS) - Recent space observations of freshwater storage by a pair of satellites are providing a new picture of how Earth's water resources are distributed globally and how water levels and distribution patterns are changing.

Researchers are using five years of data collected as part of the Gravity Recovery and Climate Experiment, GRACE 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, reservoirs; in floodplains as snow and ice; and underground in soils and aquifers.



One of the two GRACE satellites in orbit (Photo courtesy NASA)

"GRACE is providing a first ever look at the distribution of freshwater storage on the continents," said Jay Famiglietti, professor of Earth System Science, University of California, Irvine. "With longer time series, 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 the National Aeronautics and Space Administration, NASA, and the German Aerospace Center. The University of Texas Center for Space Research in Austin, Texas has overall mission responsibility.

GRACE is the only element in NASA's water cycle research program that measures changes in all types of water storage.

Hydrologists are analyzing GRACE data to identify trends in precipitation changes, groundwater depletion and snow and glacier melt rates, and to understand their underlying causes.

African river basins, such as the Congo, Zambezi and Nile, have been drying

over the past five years.

Part of the Congo River (Photo courtesy CBM Ireland)

At the same time in the United States, the Mississippi and Colorado River basins show water storage increases.

This type of data can be used to make more informed regional water management decisions.

GRACE also is allowing scientists to estimate another key component of the water cycle for the first time - water discharged by freshwater streams from Earth's continents.

Stream flow measurements are often not shared among nations for economic, political or national defense reasons.

"GRACE detects water storage changes from Earth's surface to its deepest aquifers, water can't hide from it," said Michael Watkins, GRACE project scientist at NASA's Jet Propulsion Laboratory in Pasadena, California.

GRACE measurements of the 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.

Analysis of GRACE data indicates that the Antarctic ice sheet has lost enough mass to cause the world's oceans to rise about 1.2 millimeters, on the average, from between 2002 and 2005. The equivalent amount of water is about 150 trillion liters, equal to the amount of water used by U.S. residents in three months. (Photo by Ben Holt Sr., GRACE team, DLR, NASA)

The twin GRACE satellites monitor tiny month-to-month changes in Earth's gravity field caused by the movement of water in Earth's land, ocean, ice and atmosphere reservoirs.

Matt Rodell, a hydrologist at NASA's Goddard Space Flight Center in Greenbelt, Maryland, said GRACE data correspond well with ground observations.

As a result, hydrologists can now apply GRACE data in ways that will impact regional water management.

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

forecasts worldwide."

GRACE's abilities to detect water are particularly vital for the emerging field of groundwater remote sensing. "Remote sensing of groundwater has been a Holy Grail for hydrologists because it is stored beneath the surface and is not detected by most sensors," said Famiglietti.

"Outside of the United States and a few other developed nations, it is not well monitored," Famiglietti said. 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."

With additional data, such as measurements of surface water and soil moisture, the hydrologists say they can use GRACE to solve this problem.

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