Hot Science Cool Talks

UT Environmental Science Institute

80

Last Call at the Oasis: Will There Be Enough Water for the 21st Century?

Dr. Jay Famiglietti

October 26, 2012

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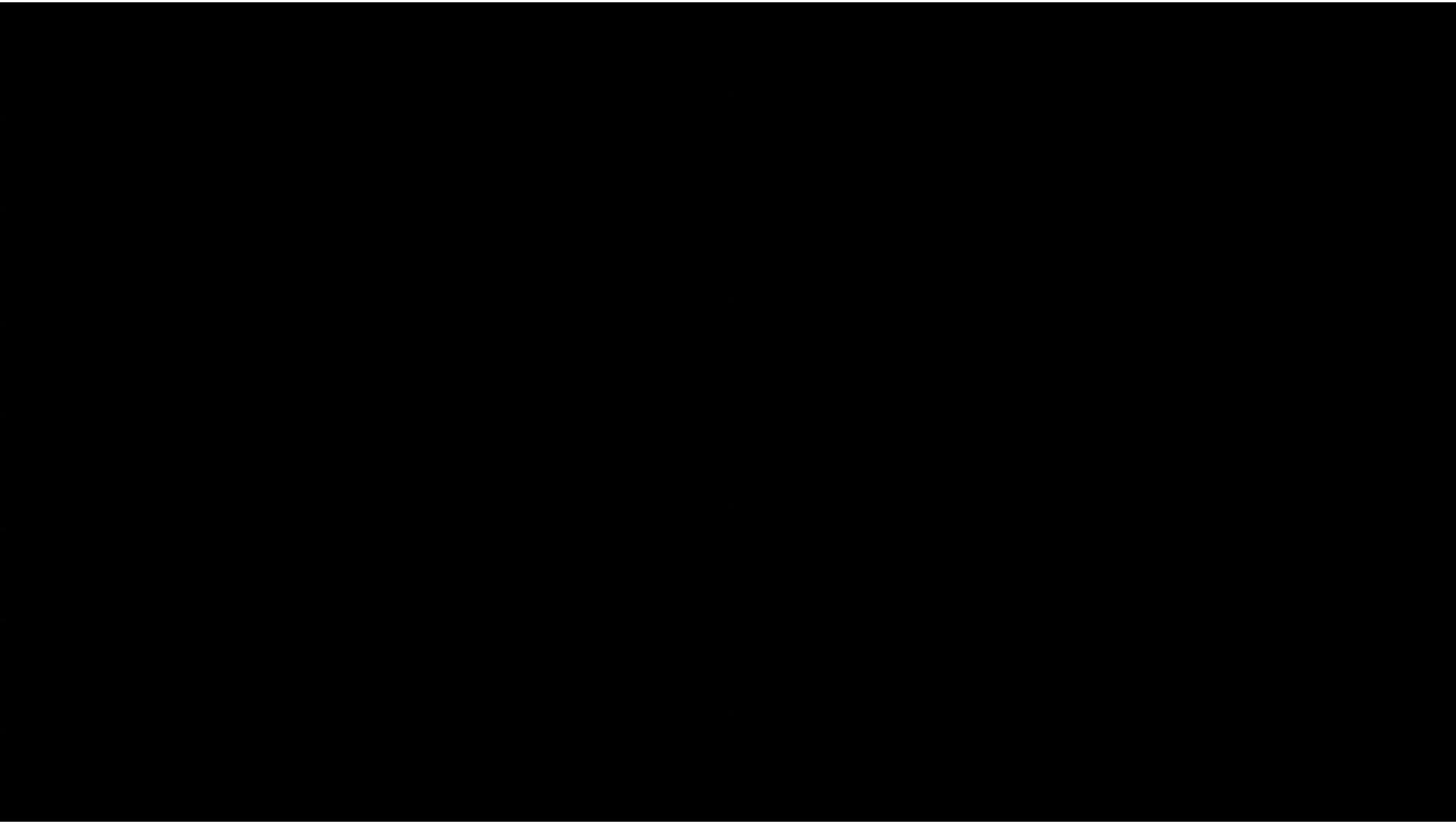
Prof. Jay Famiglietti, University of California, Irvine

Hot Science - Cool Talks
26 October 2012, Environmental Science Institute
University of Texas at Austin

Austin American-Statesman
50TH ANNIVERSARY
April 6th
1997
CAPITOL
10,000

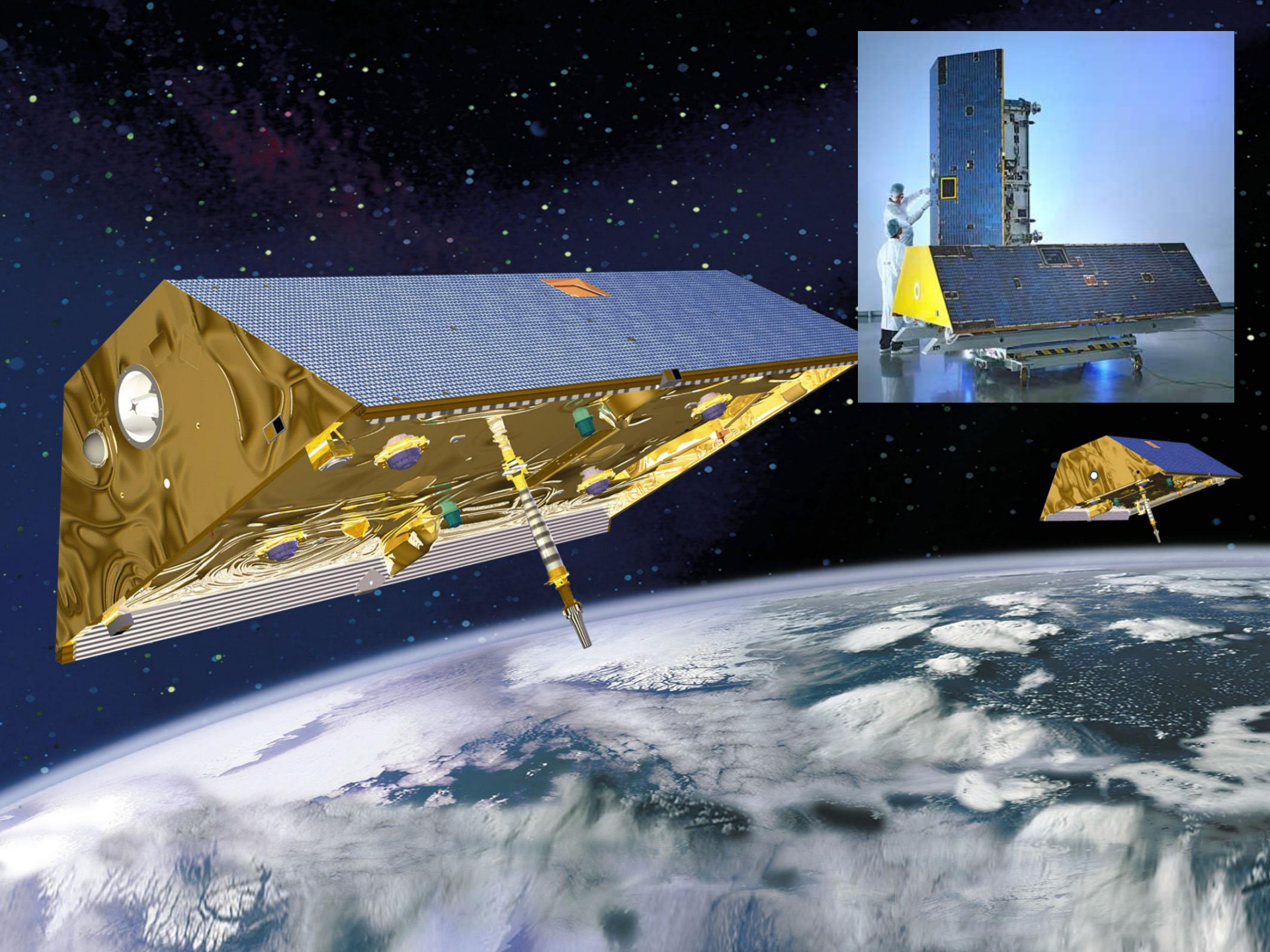
2012 SXSW FILM FESTIVAL
LAST CALL AT THE OASIS

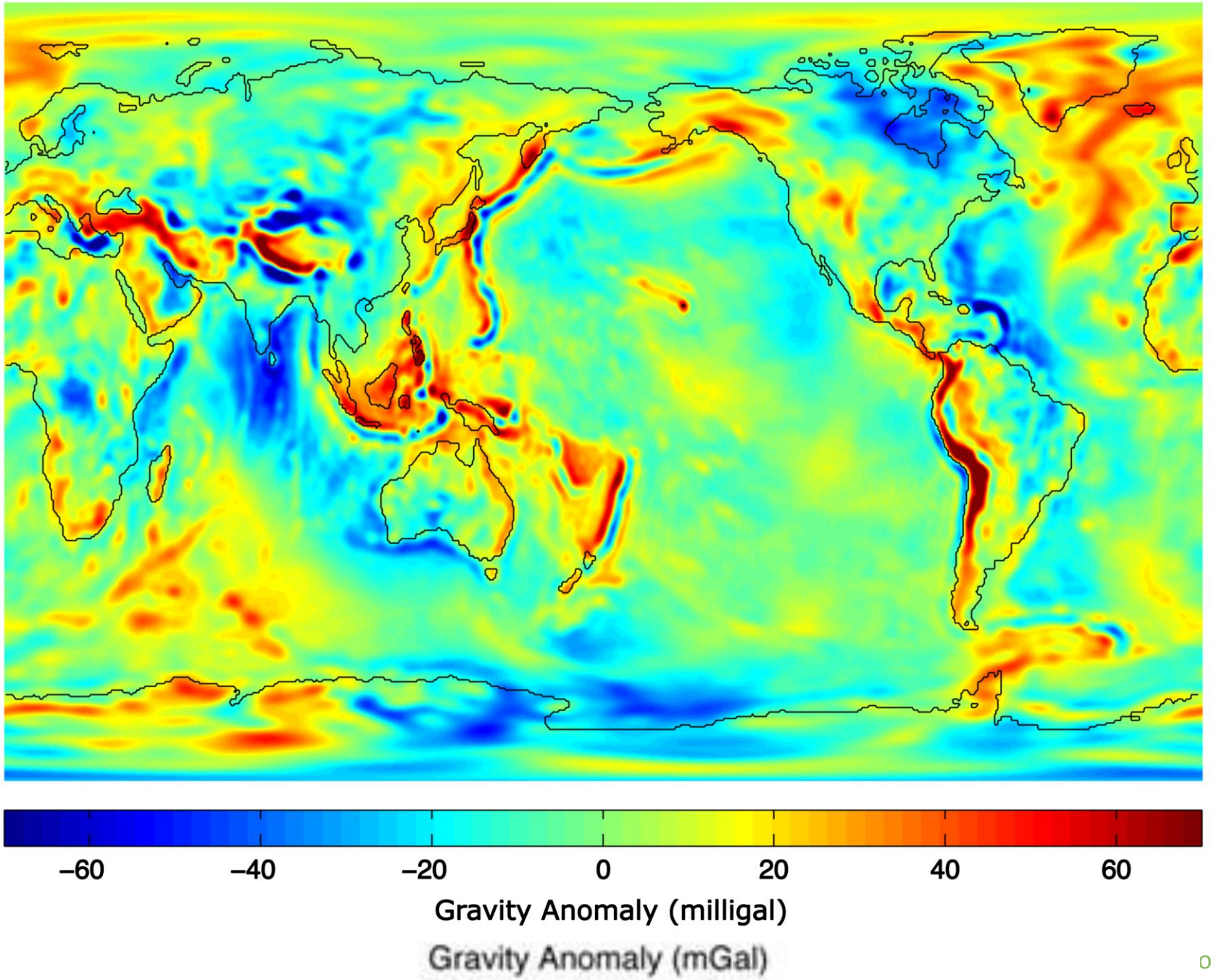
The original trailer



My Big Screen debut

With UT DGS PhD Matt Rodell, December, 2012

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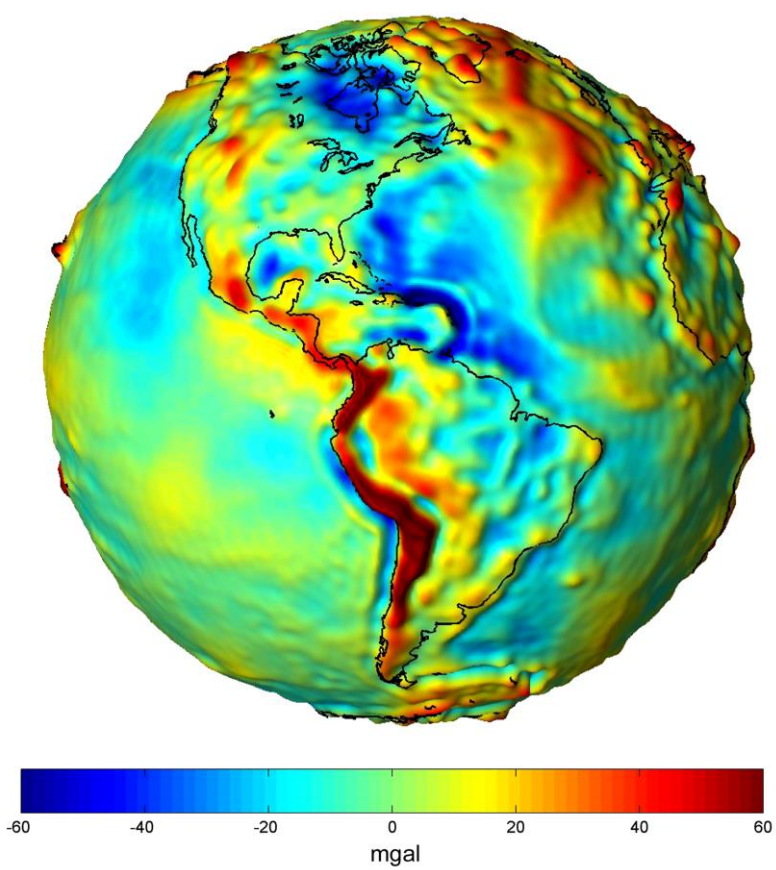
Gravity Anomaly (milligal)
Gravity Anomaly (mGal)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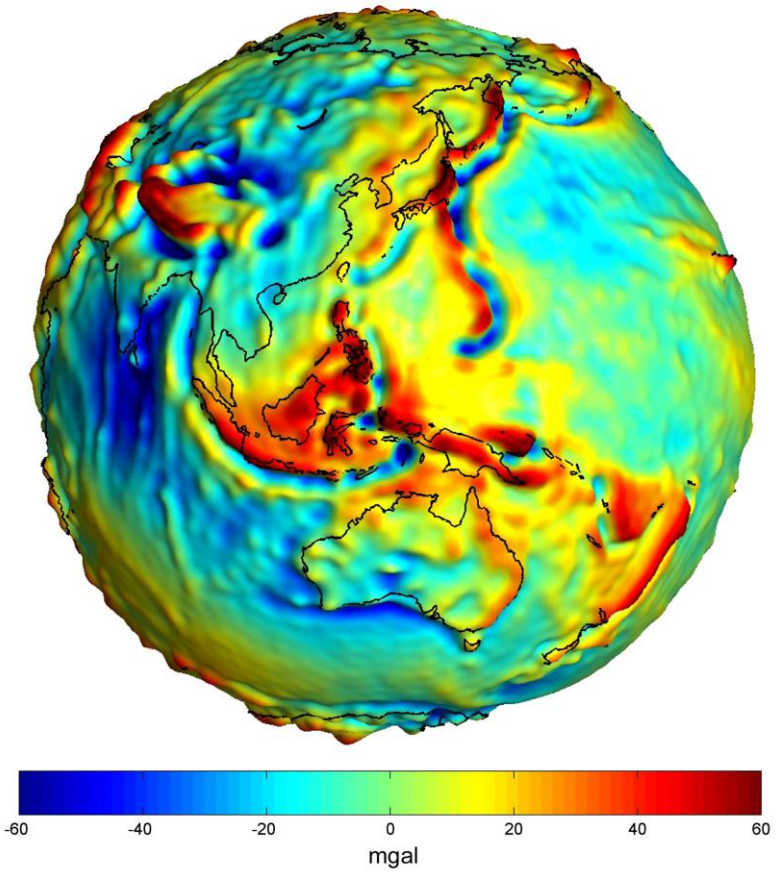
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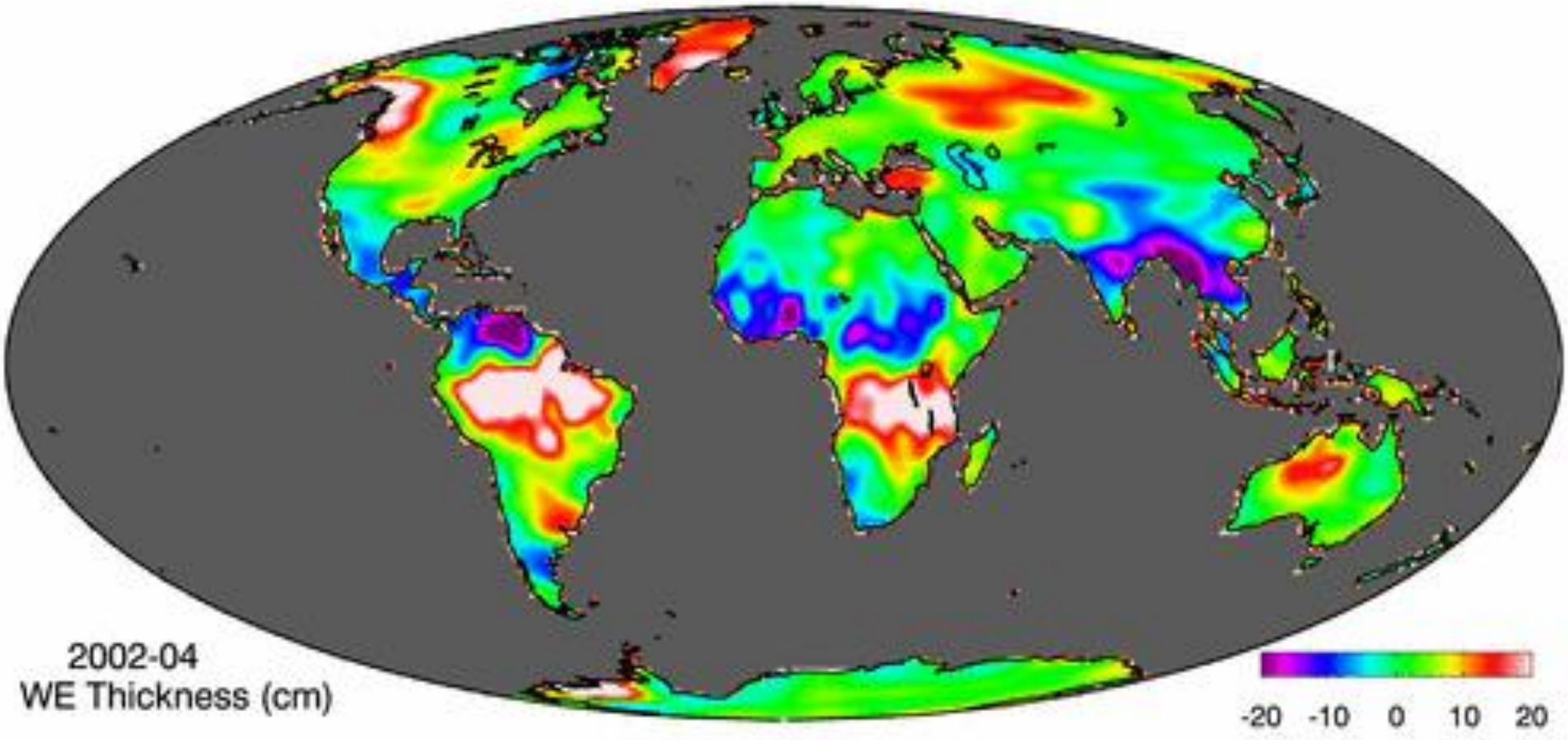
Estimating water storage changes with GRACE

GRACE is like a giant scale in the sky that tells you how much weight you've gained or lost each month

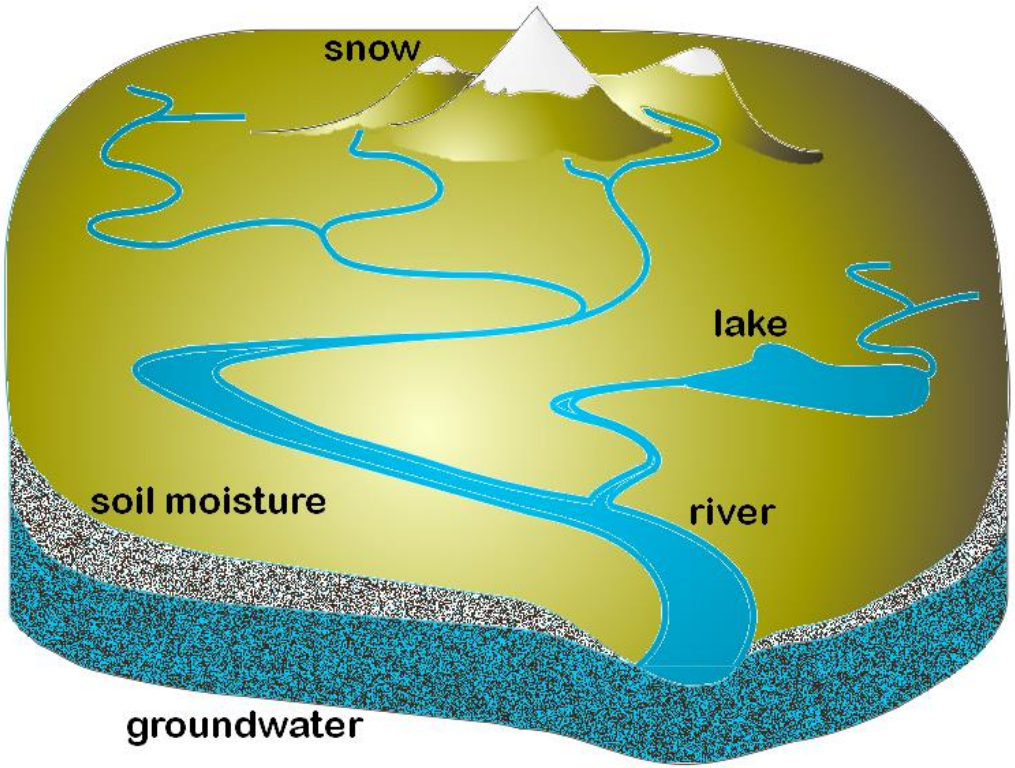
Estimating water storage changes with GRACE



Estimating groundwater storage changes with GRACE

$$\Delta S_{LAND} = \Delta S_{SNOW} + \Delta S_{SW} + \Delta S_{SM} + \Delta S_{GW}$$

$$\Delta S_{GW} = \Delta S_{LAND} - \Delta S_{SNOW} - \Delta S_{SW} - \Delta S_{SM}$$



ΔS_{LAND}

Remove this ($\Delta S_{SNOW} + \Delta S_{SW} + \Delta S_{SM}$) from ΔS_{LAND}…

To isolate this (ΔS_{GW})

Groundwater depletion in California's Central Valley

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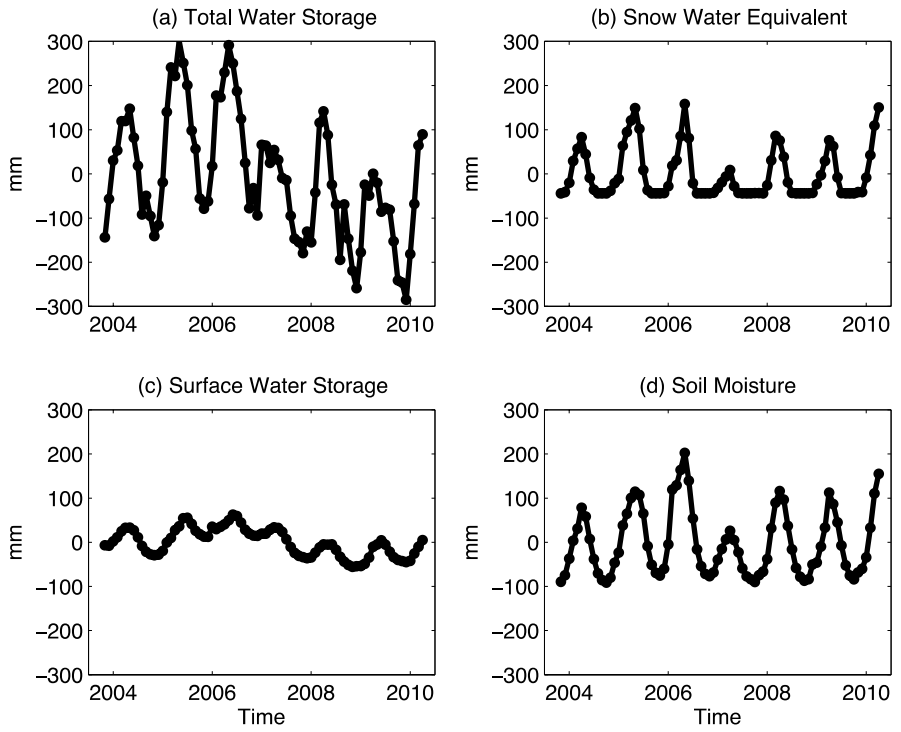
Groundwater depletion in California's Central Valley, October, 2003-March, 2009

- Since GRACE 'sees' all the water storage changes on land, in order to estimate the groundwater storage change signal, the snow, surface water and soil moisture mass changes must be estimated and removed

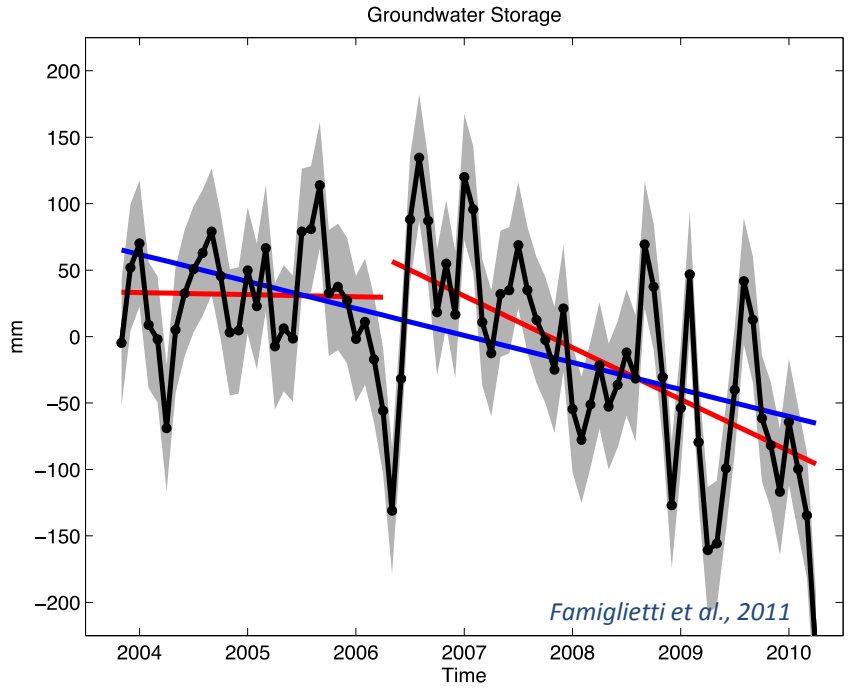
$$\Delta S_{Groundwater} = \Delta S_{Total} - \Delta S_{Snow} - \Delta S_{Surface\ Water} - \Delta S_{Soil\ Moisture}$$

- The snow, surface water and soil moisture signals were estimated using best available observed and modeled data sets



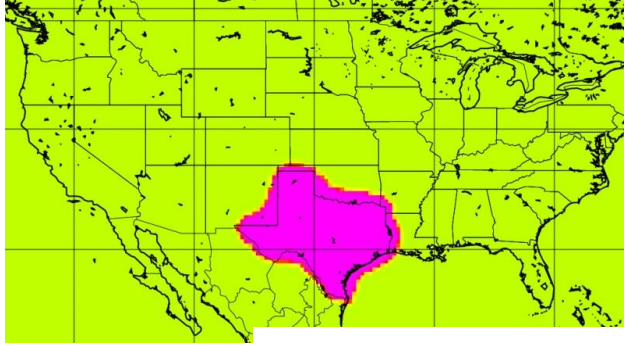
Famiglietti et al., 2011

Groundwater depletion in California's Central Valley, October, 2003-March, 2009



	Trend (mm/yr)	Volume lost (km^3)
GRACE Total Water Storage	-37	31.3
Snow	-2	1.7
Surface Water	-9	7.6
Soil Moisture	-2	1.7
Groundwater	-24	20.3

- In the 78 month period analyzed, the water stored in the combined Sacramento-San Joaquin River Basin decreased by over 31 km^3, or nearly the volume of Lake Mead
- Nearly two-thirds of this, or roughly 20 km^3, came from changes in groundwater storage, primarily from the Central Valley

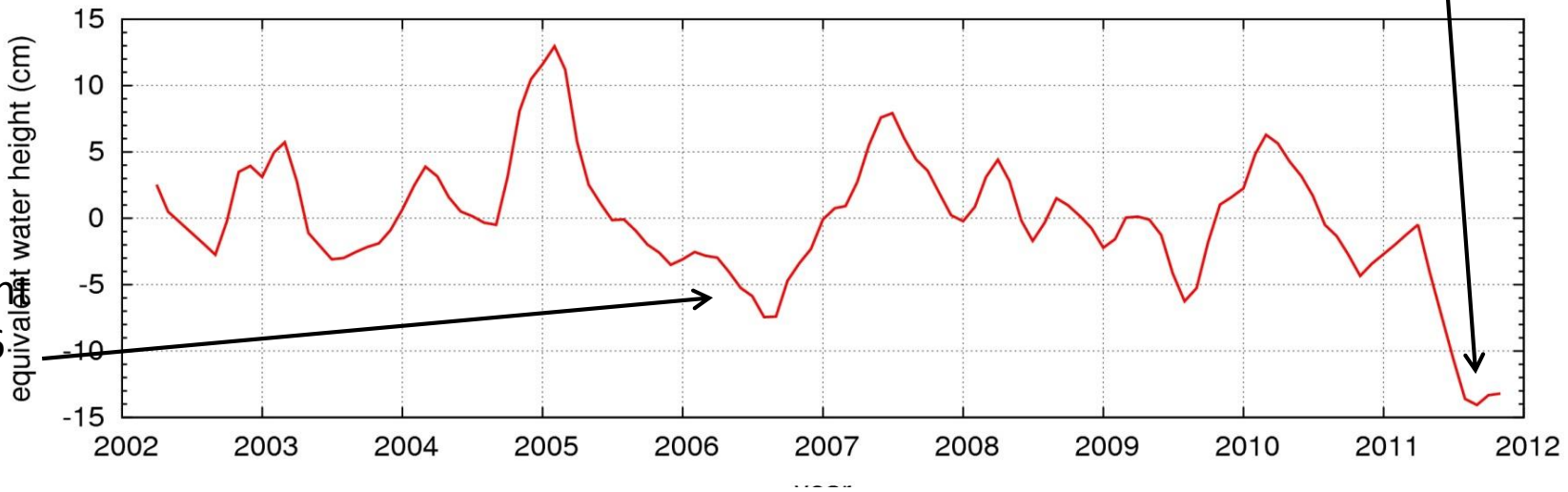


GRACE Observed Total Water Variation

Courtesy of Bridget Scanlon, BEG, Jackson School of Geosciences

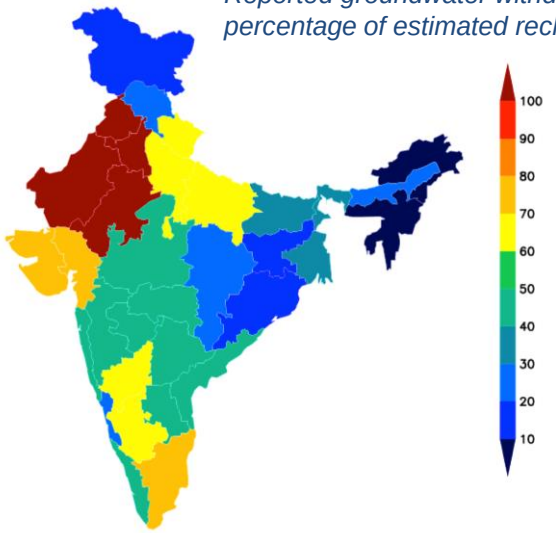
Texas Drought 2011

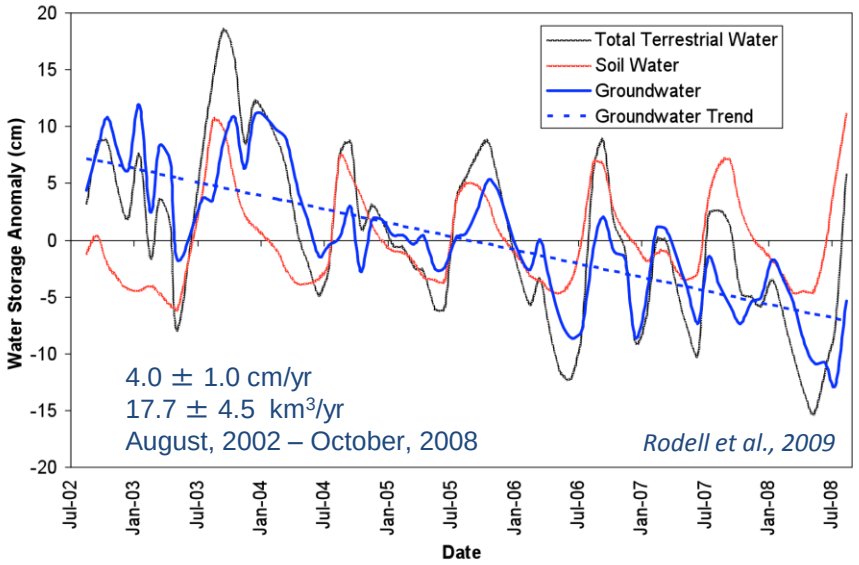
Texas Drought 2005-2006

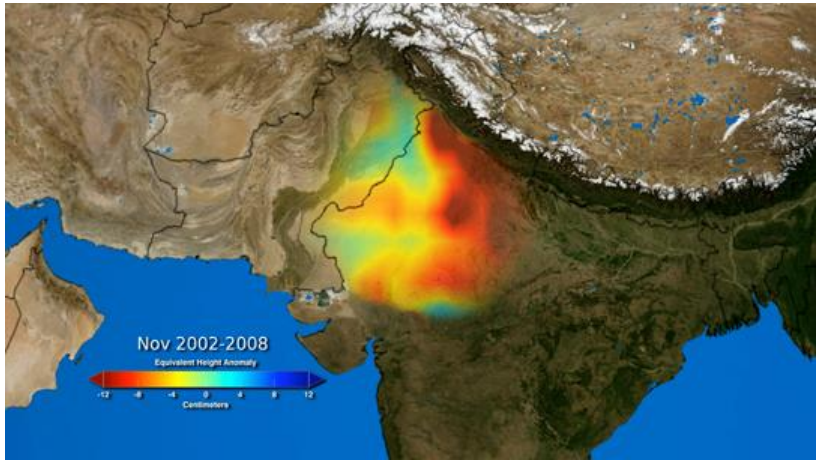


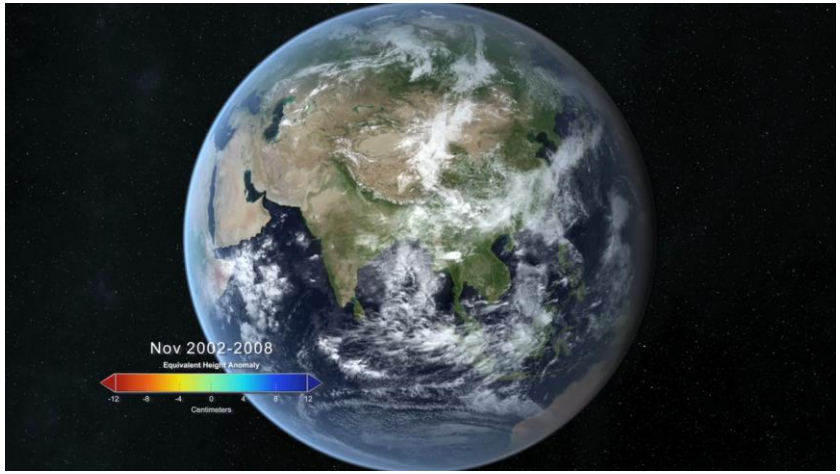
Groundwater depletion in India, August, 2002 – October, 2008

Reported groundwater withdrawals as a percentage of estimated recharge in India



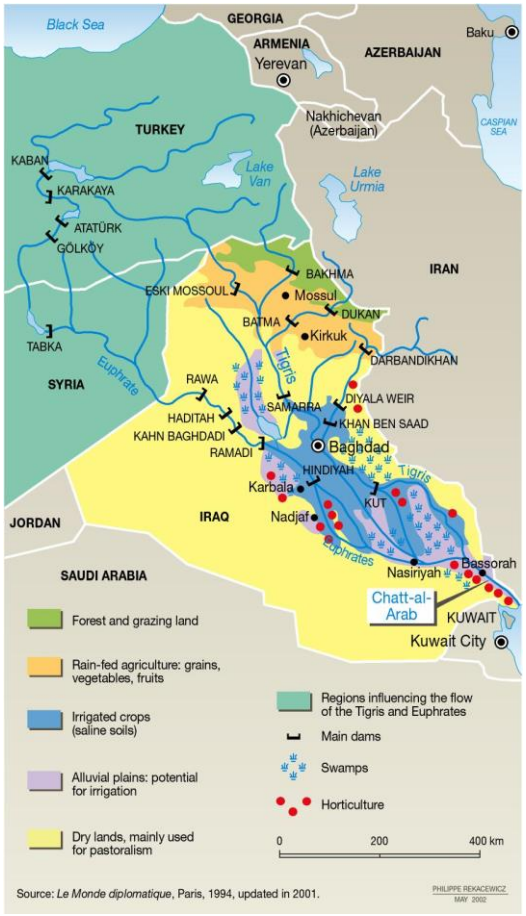




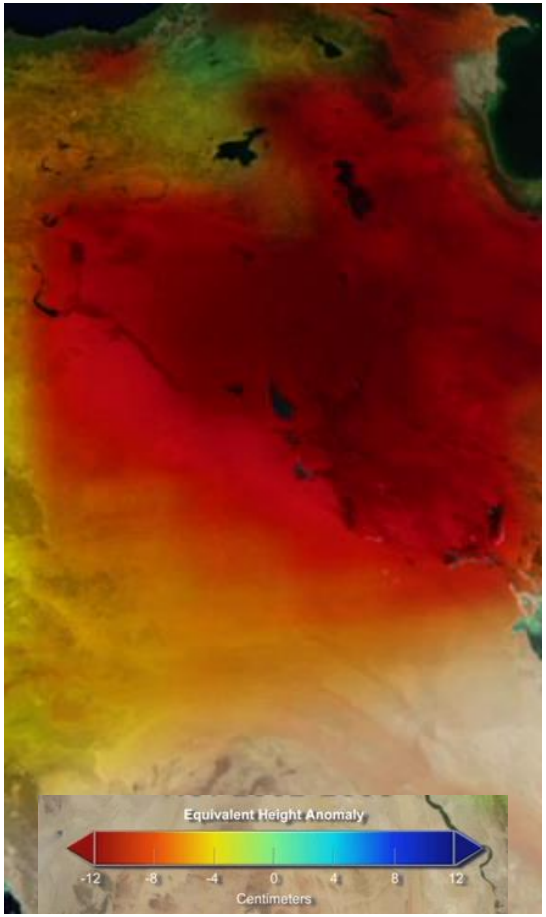


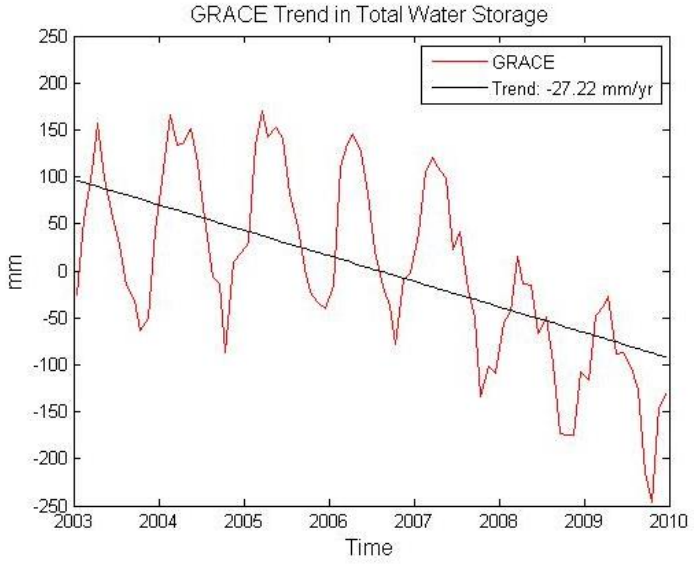
Groundwater depletion in the Tigris-Euphrates River Basins, 2003-2010

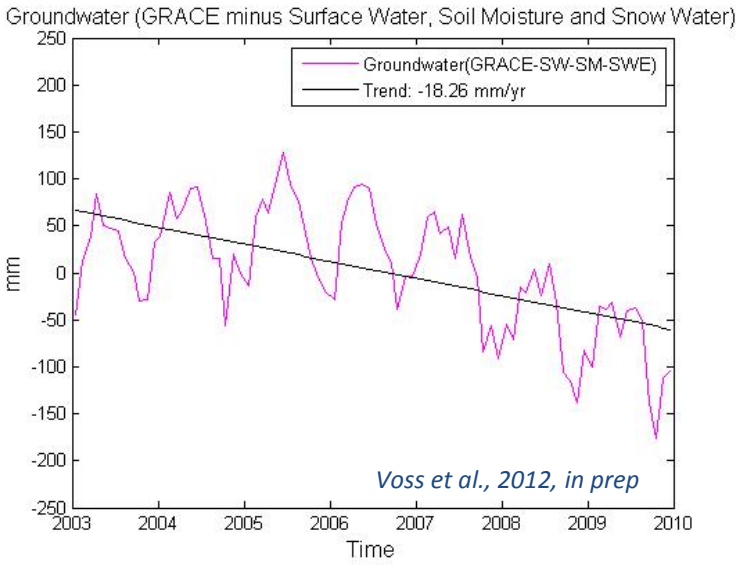
Tigris-Euphrates River Basins



Water storage change from GRACE

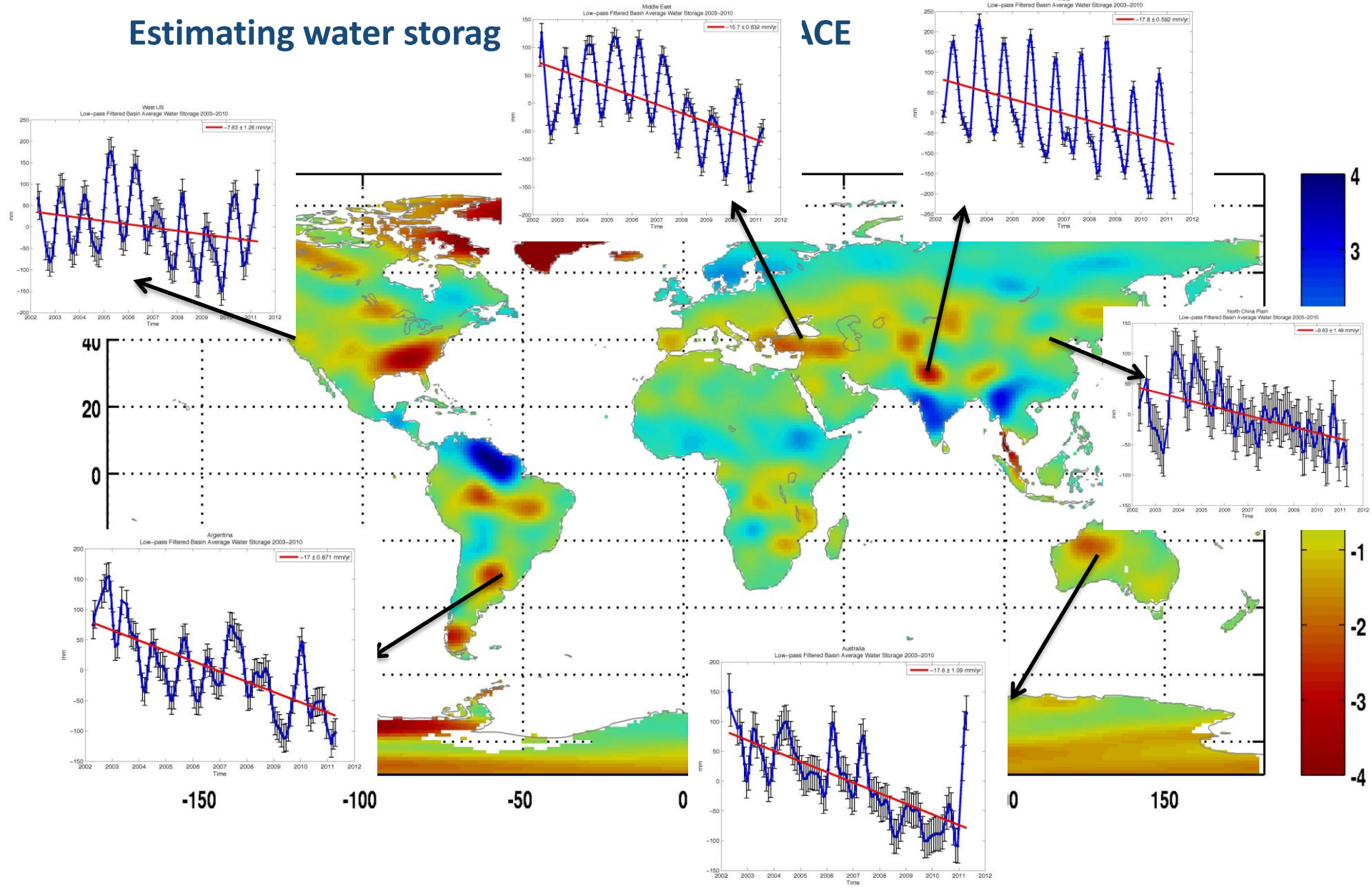




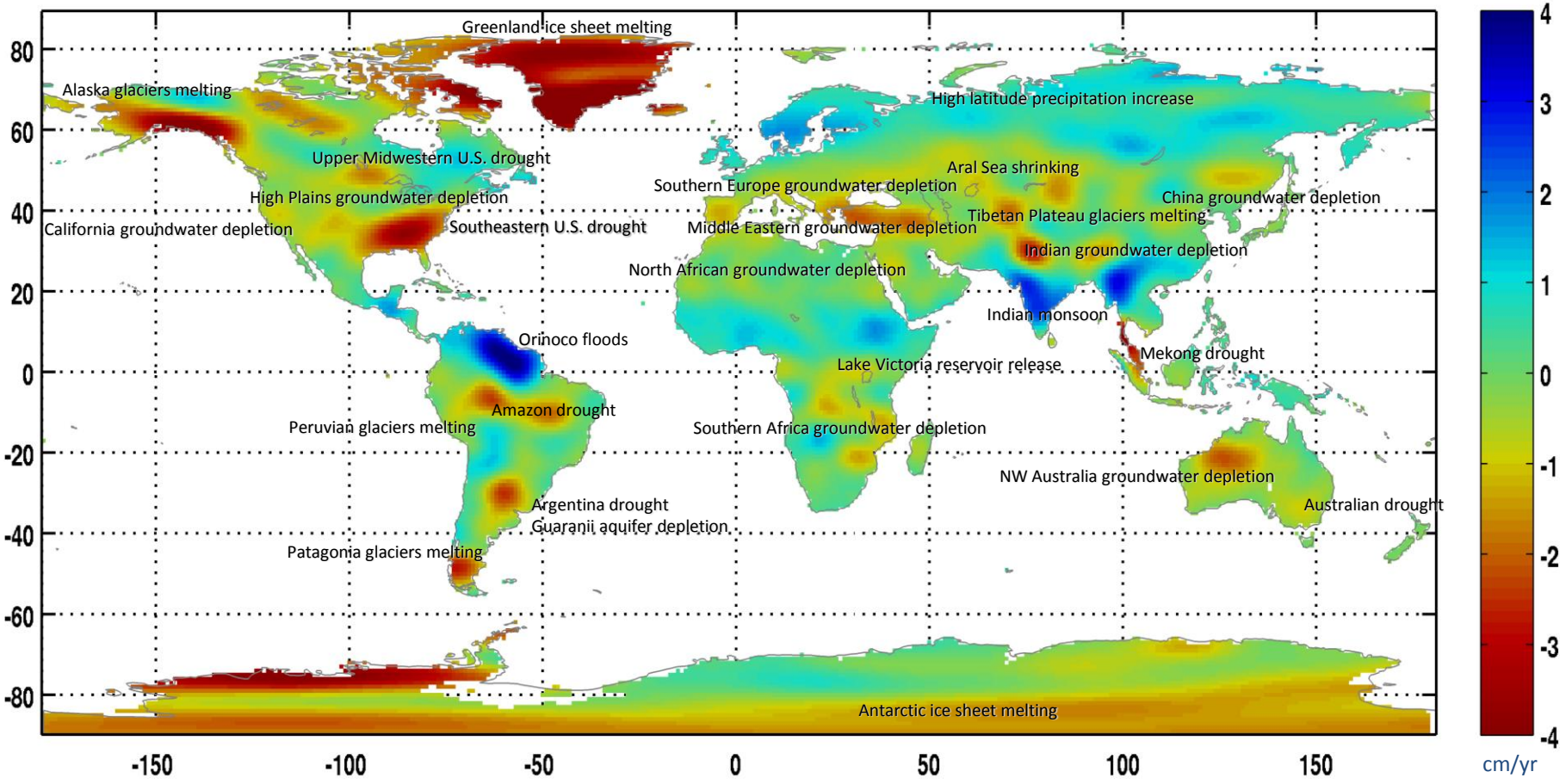


- Total water loss of 143 km^3 between 2003 and 2010
- Equivalent to the volume of the Dead Sea, or more than 4 times the volume of Lake Mead in the U.S.
- Roughly two-thirds of this attributed to a loss of groundwater

Estimating water storag ACE

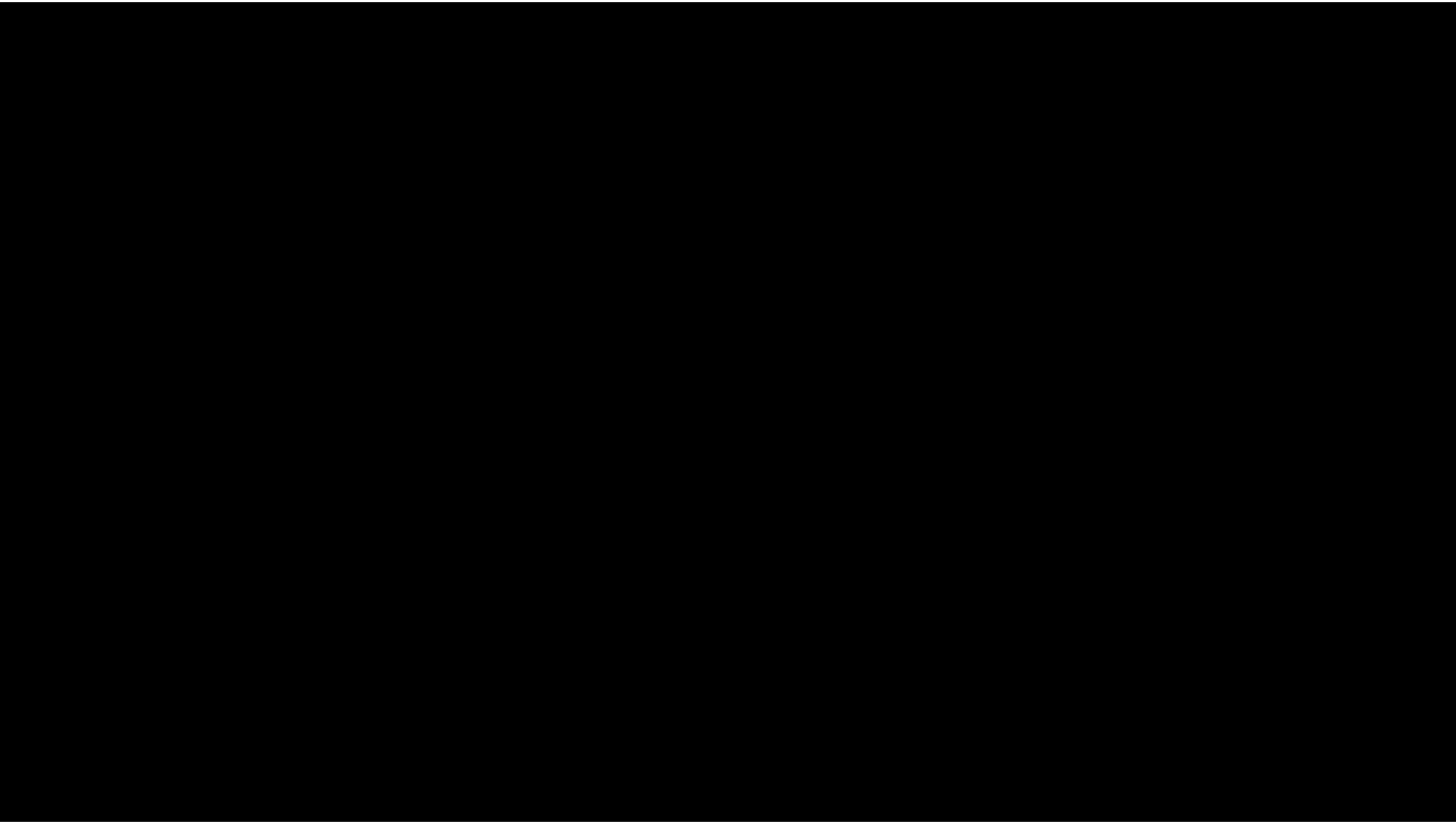


Trends in Freshwater Storage from GRACE, 2002-2010



Famiglietti et al., 2012, in prep

Is the water cycle changing?



Are wet areas getting wetter, dry areas getting drier?

IPCC AR4, Projected Patterns of Precipitation Change

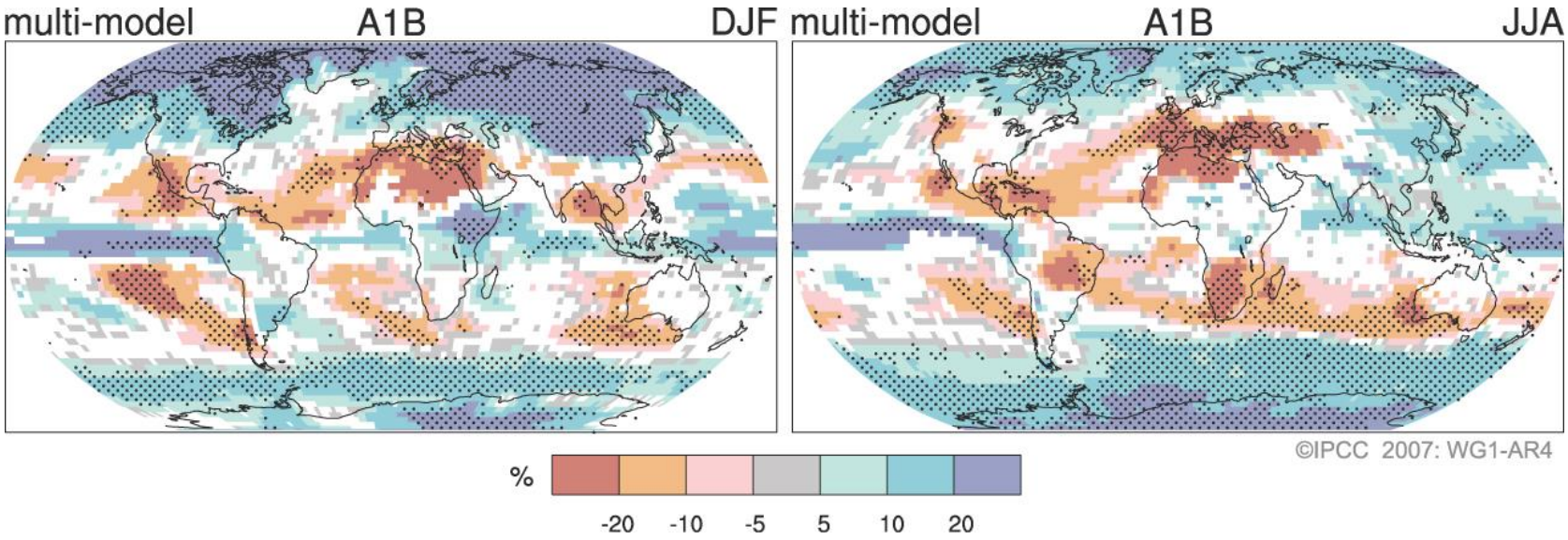
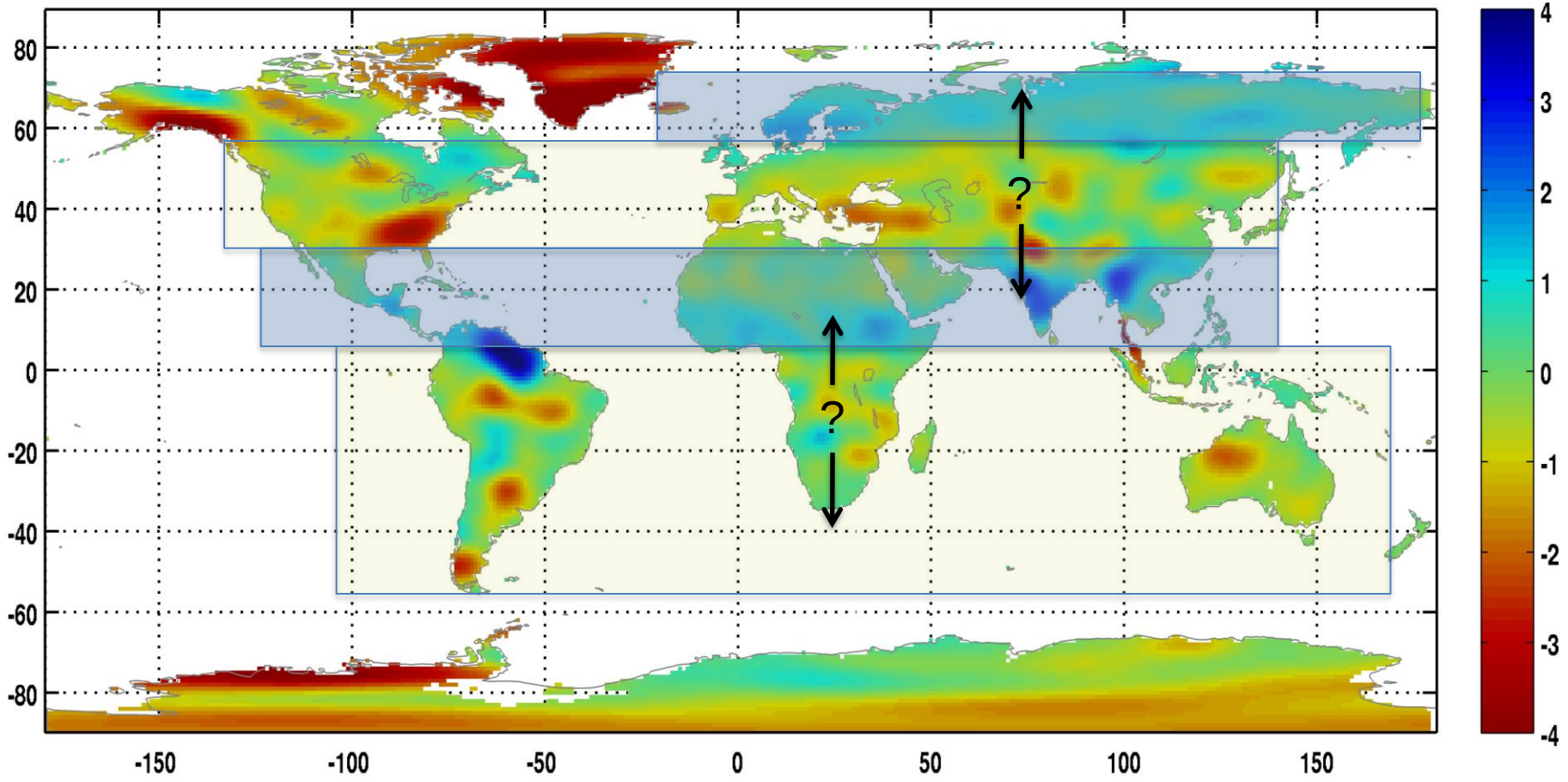


Figure SPM.7. Relative changes in precipitation (in percent) for the period 2090–2099, relative to 1980–1999. Values are multi-model averages based on the SRES A1B scenario for December to February (left) and June to August (right). White areas are where less than 66% of the models agree in the sign of the change and stippled areas are where more than 90% of the models agree in the sign of the change.

Are wet areas getting wetter, dry areas getting drier?

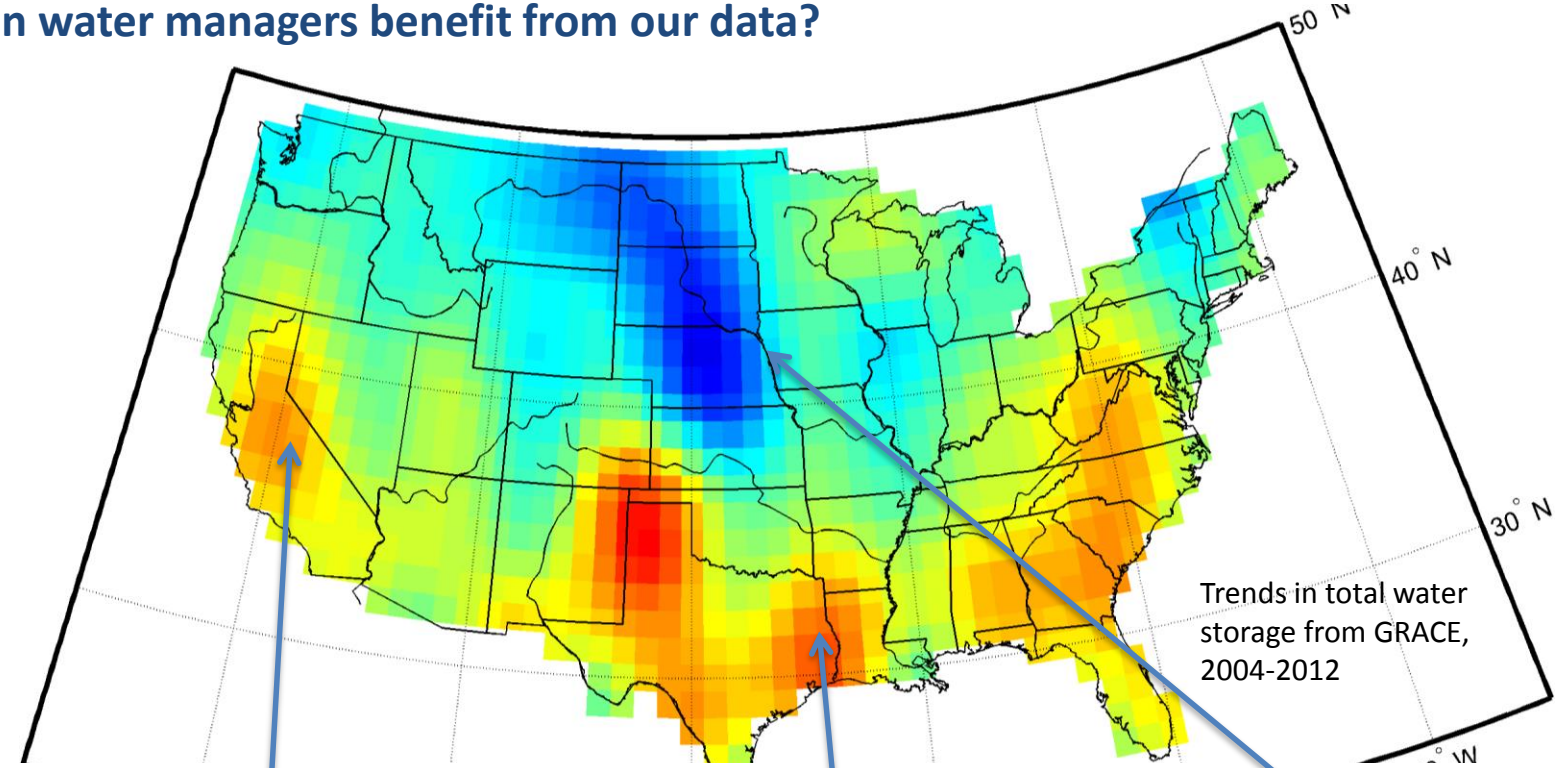
Trends in Freshwater Storage from GRACE, 2002-2010



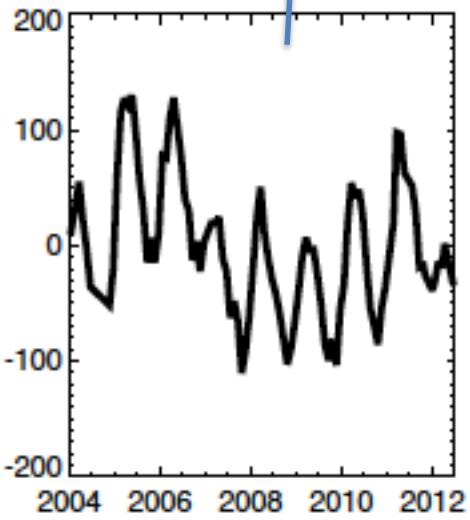
Are we already seeing the predicted redistribution?

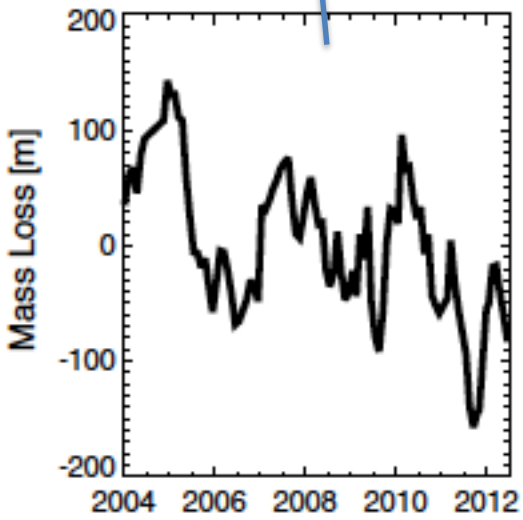
Famiglietti et al., 2012, in prep

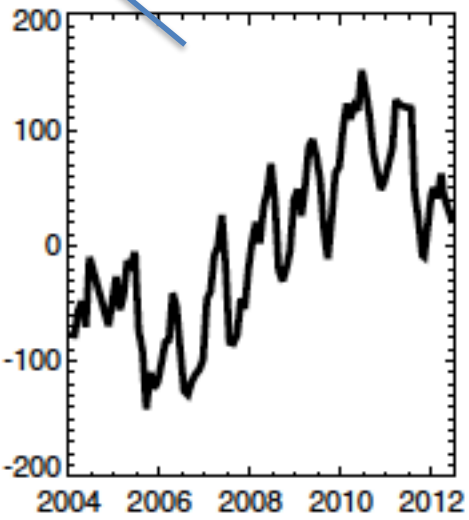
Can water managers benefit from our data?

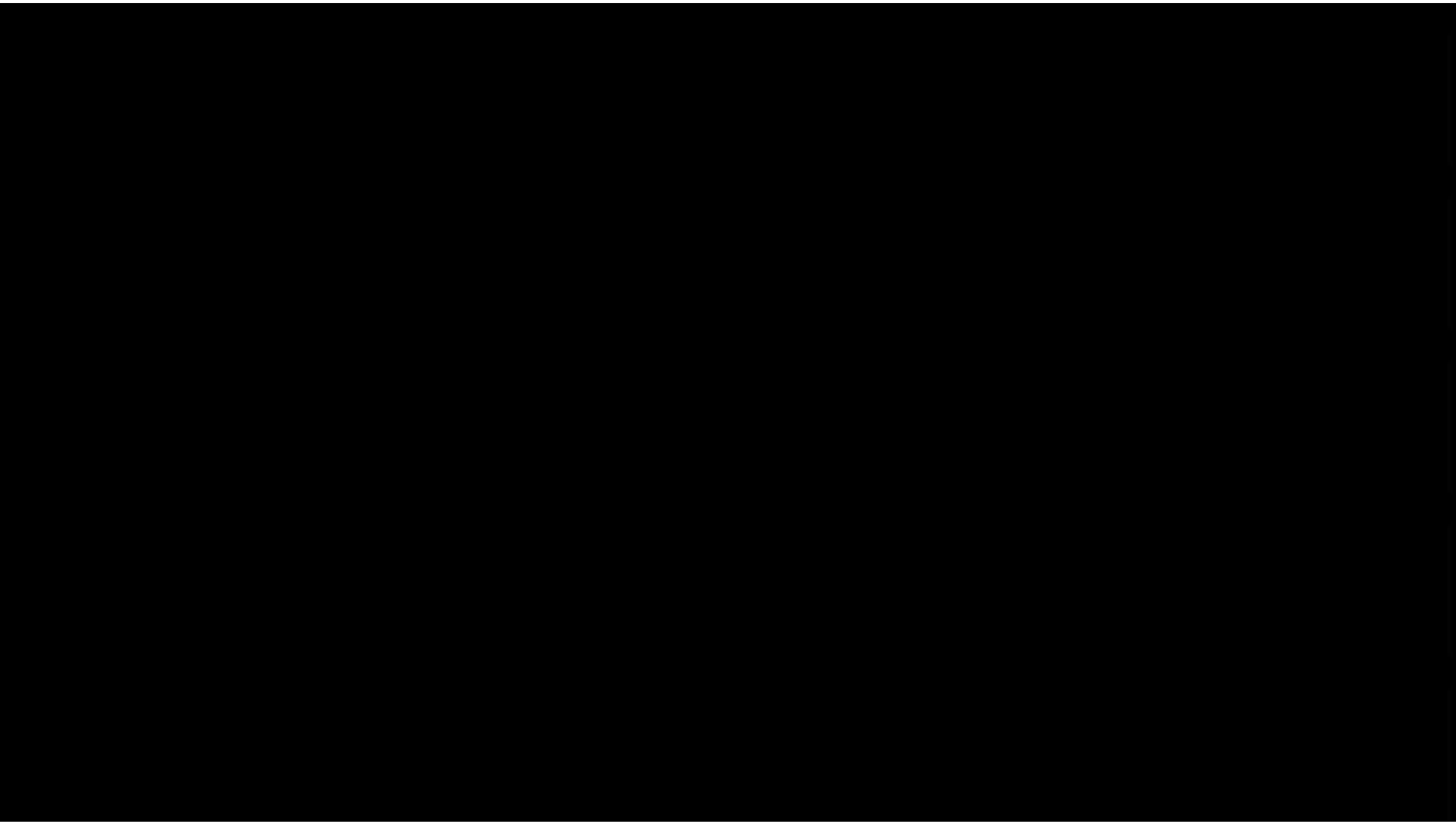


Trends in total water storage from GRACE, 2004-2012



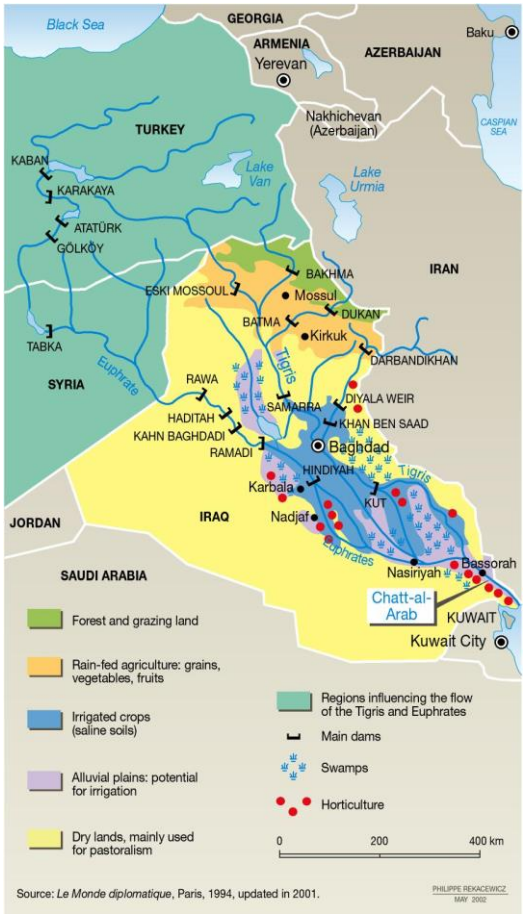






Groundwater depletion in the Tigris-Euphrates River Basins, 2003-2010

Tigris-Euphrates River Basins



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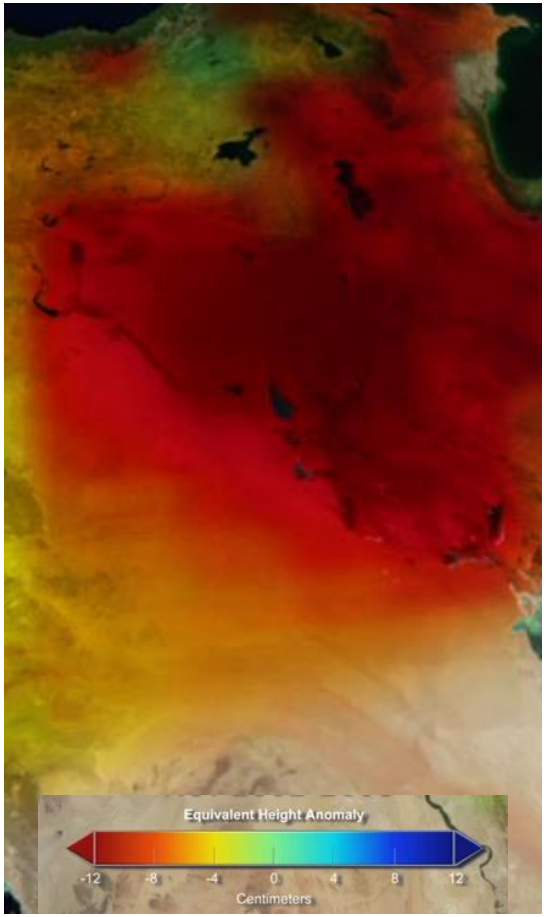

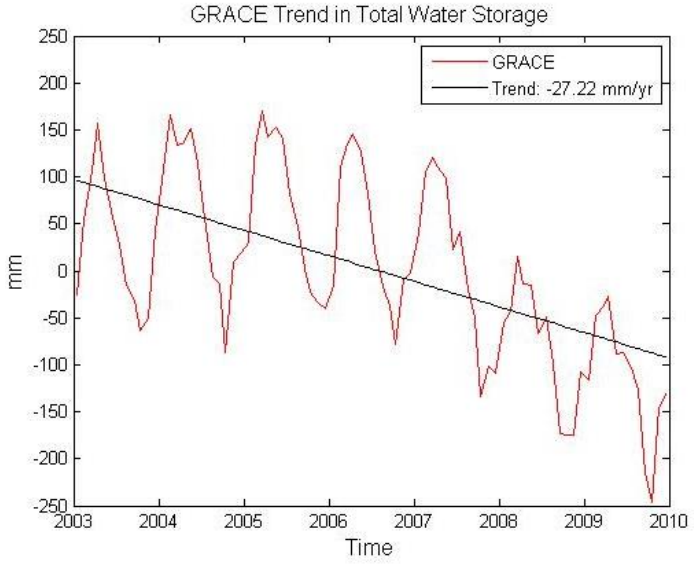

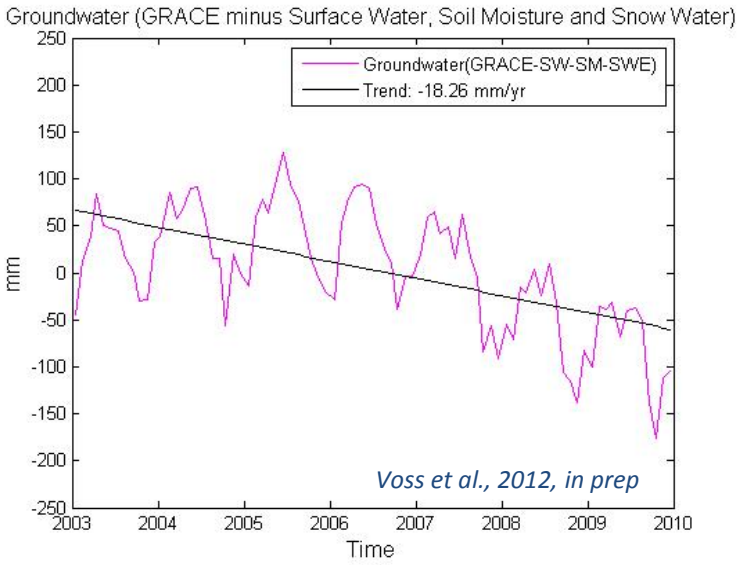

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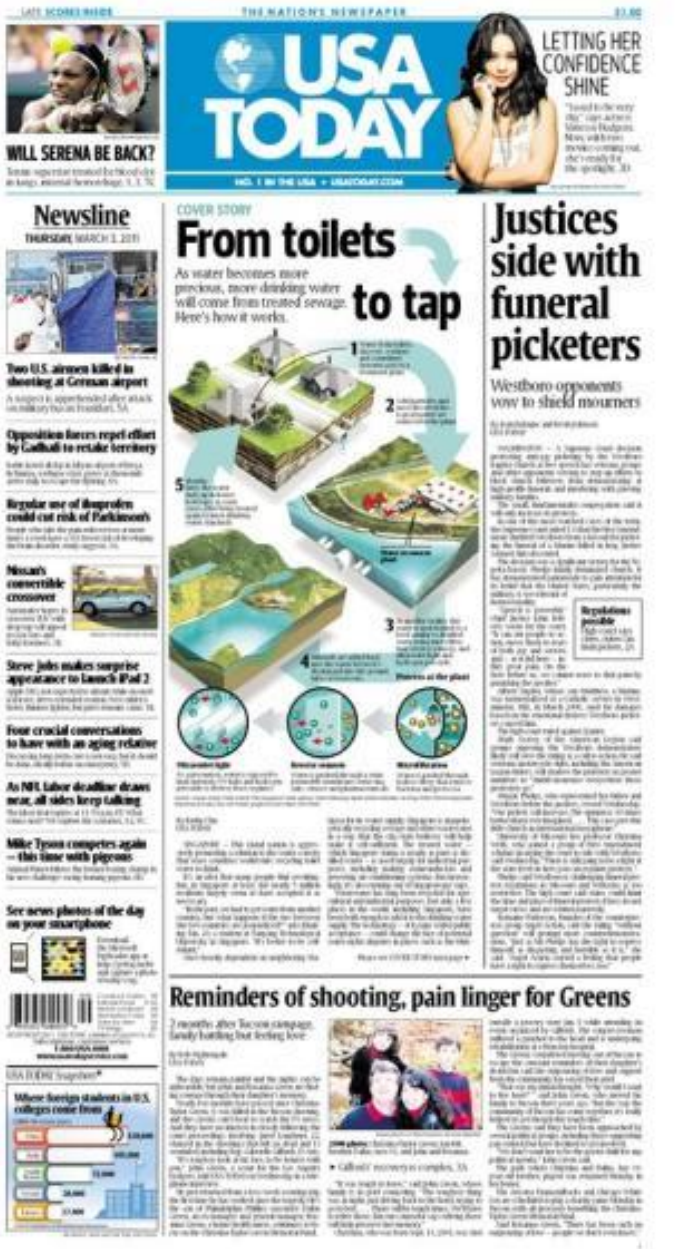

LATE SCORES INSIDE

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WILL SERENA BE BACK?

LETTING HER CONFIDENCE SHINE

Newsline

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COVER STORY

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Regulations possible

Reminders of shooting, pain linger for Greens

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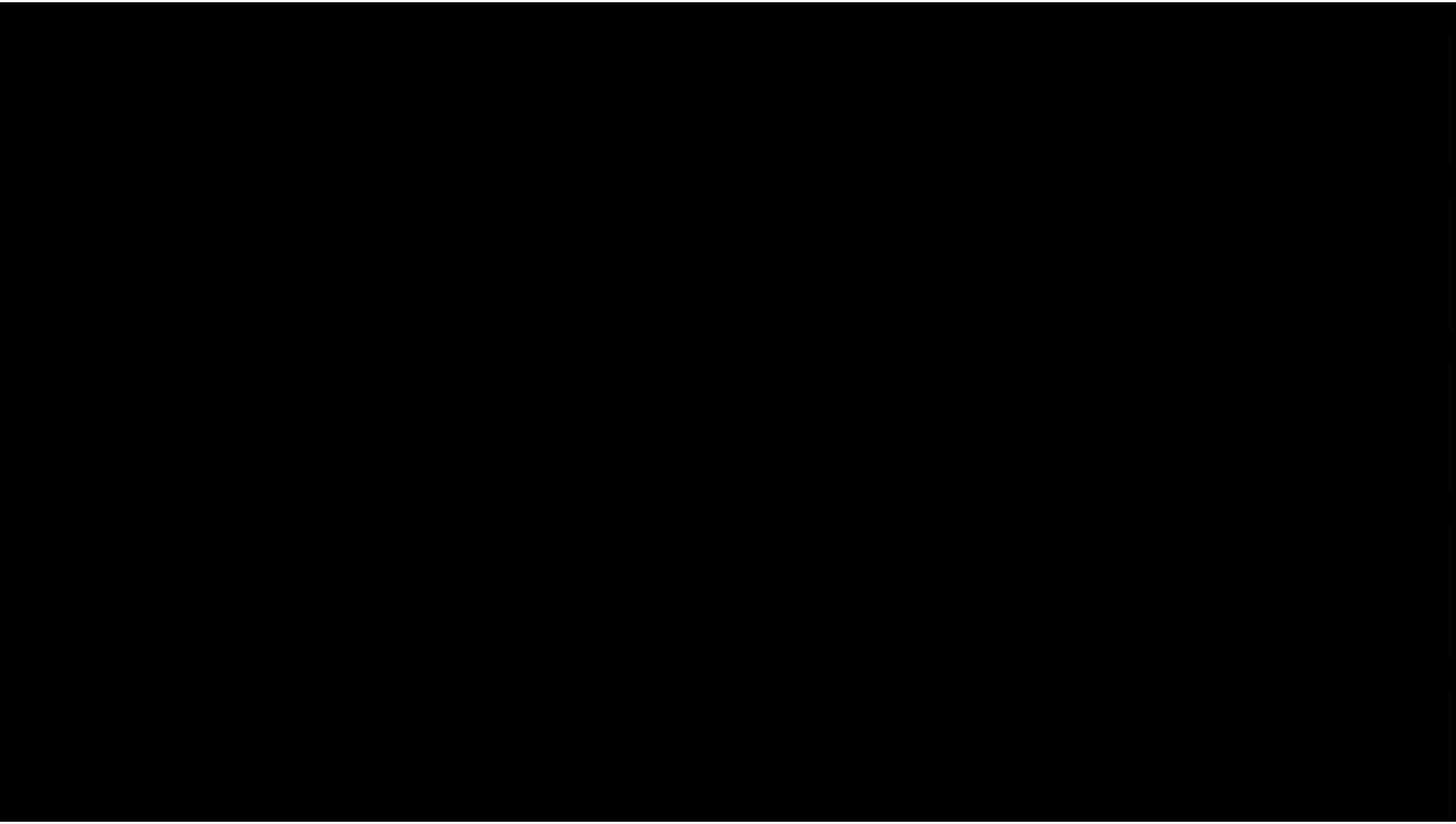
water for california

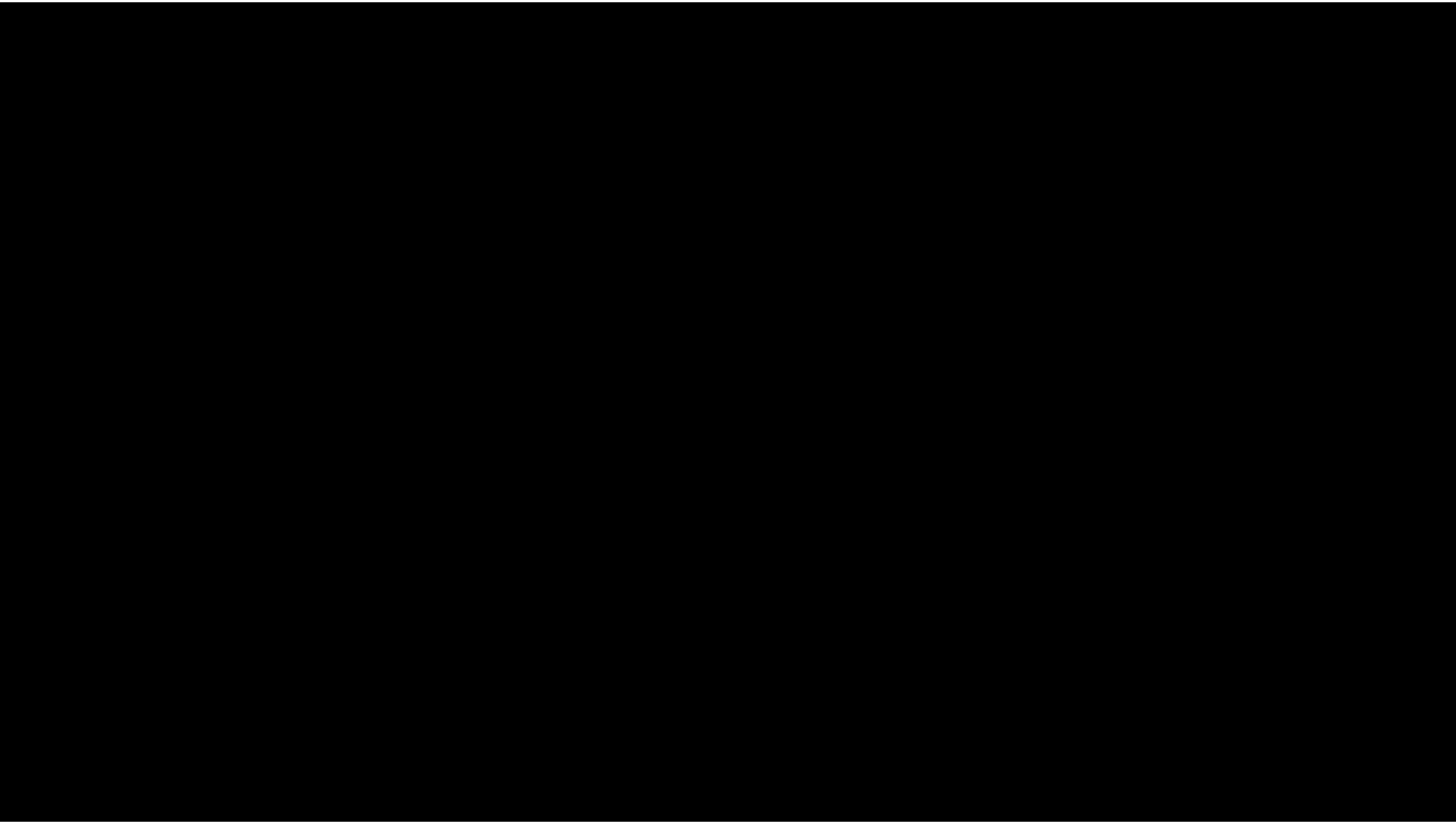
ucchm.org



Groundwater
Replenishment System
A Pure Solution to Orange County's Water Needs
OCWD

Perhaps…we need a pitch man!

The Communication Challenge



Communcation: Responsibility or Pain in the Neck?

As a community, we need to elevate our issues to the level of everyday understanding

KNOW YOUR
WATER:
TAKEPART.COM/LASTCALL

ucchm.org

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Dr. Jay Famiglietti

Jay Famiglietti has a passion for, and commitment to, preserving Earth's environment for future generations. As Director of the UC Center for Hydrologic Modeling at the University of California – Irvine, Dr. Famiglietti focuses on modeling and remote sensing of the terrestrial and global water cycles. His Hydrology & Climate Research Group is taking a lead role in accelerating the development of next-generation hydrological models for use in addressing a number of high priority issues.

Dr. Famiglietti's work has implications for how we understand the Earth's water cycle, its interactions in the land-ocean-atmosphere-ice system, and for monitoring changes in freshwater availability in the face of global environmental change. He was a featured scientist in a film entitled Last Call at the Oasis, which was produced by the same company that brought us An Inconvenient Truth.