HAPA
Hydroscience
and Policy Advisory

Policy Interventions and Groundwater Rejuvenations across India

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Groundwater in making of India

Arjun piercing ground to provide water to Bhisma on arrow-bed

Terracotta sculpted scene from Mahabharata (<900 BCE), *Jor Bangla temple, West Bengal*

Mohenjo daro

~2500 BCE

Lalitgiri, *Odisha*

~600 AD

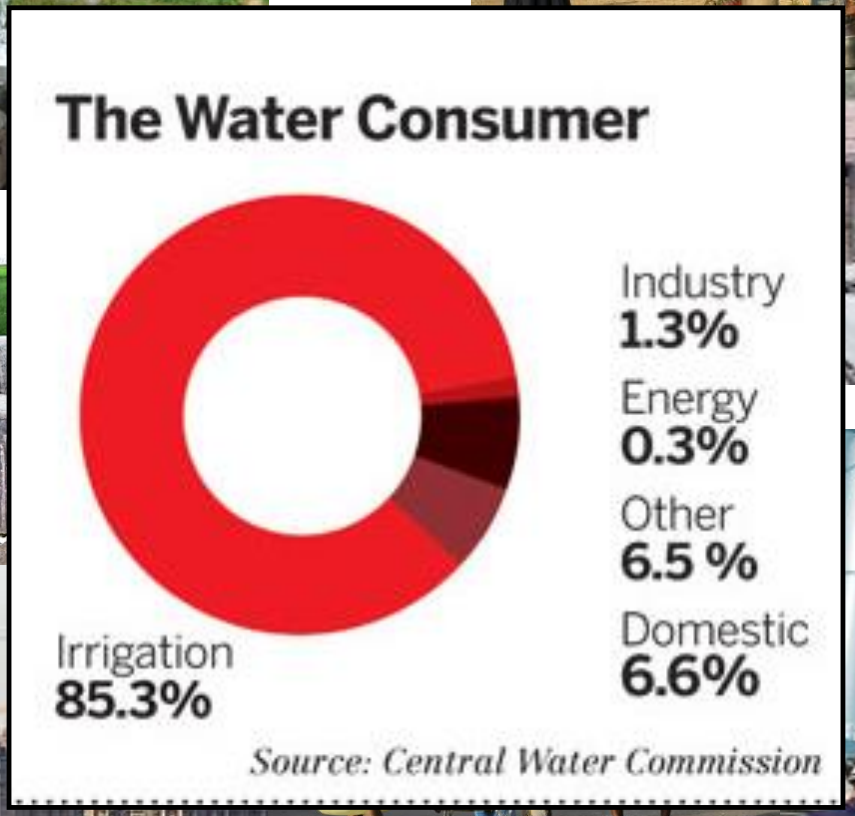
Qutub Minar, *Delhi*

~1200 AD

Adlaaj, *Gujarat*

~1498 AD

Groundwater for modern India



WATER ISSUES in India

Water Excess

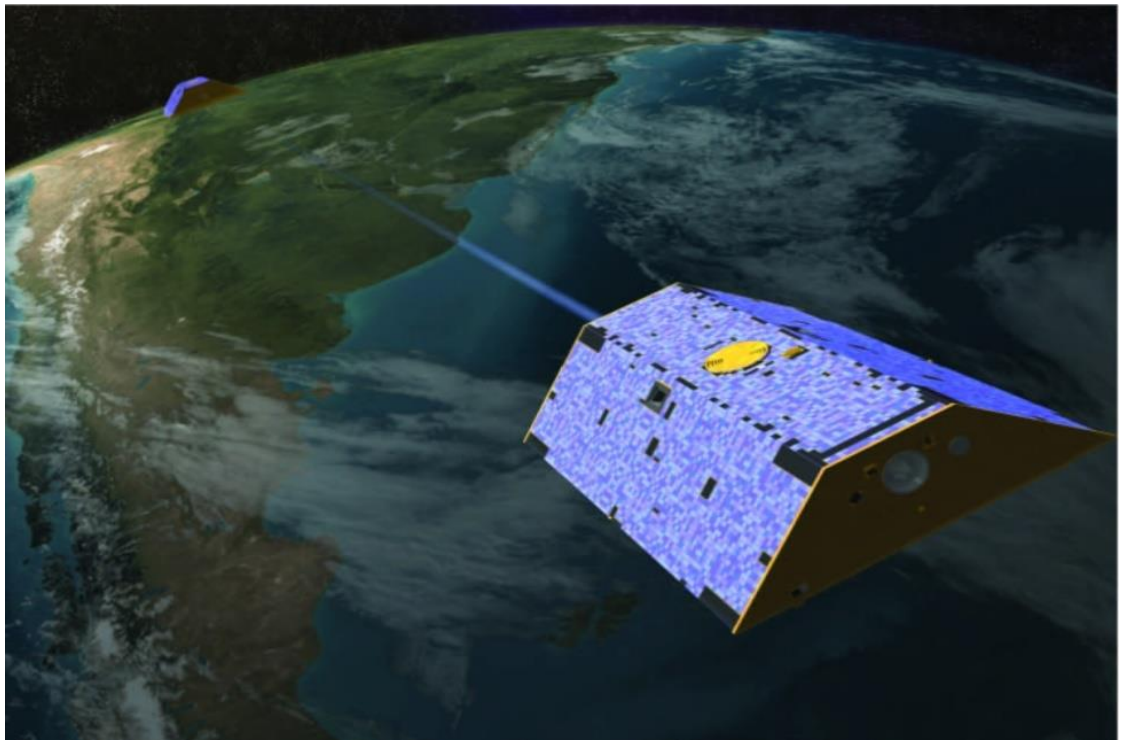
Water Scarcity

Water Quality and Pollution

ing Water Security

Gravity Recovery and Climate Experiment (GRACE)

NASA-UT(CSR)-GFZ/DLR



Launch: 17 Mar 2002

Mission Duration: 5 years

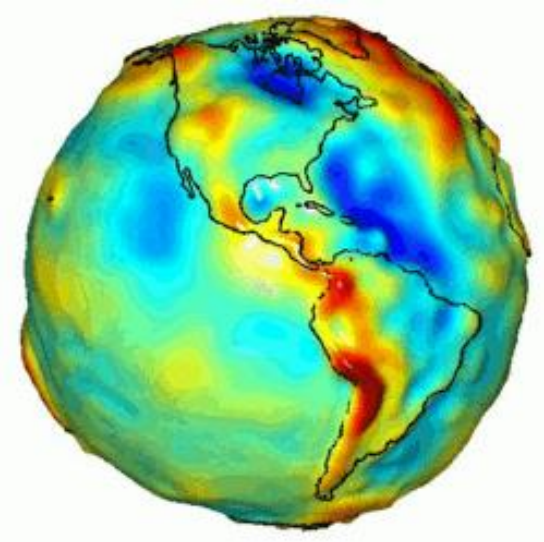
Present Status: Still working after 15 years

Nick named: Tom and Jerry

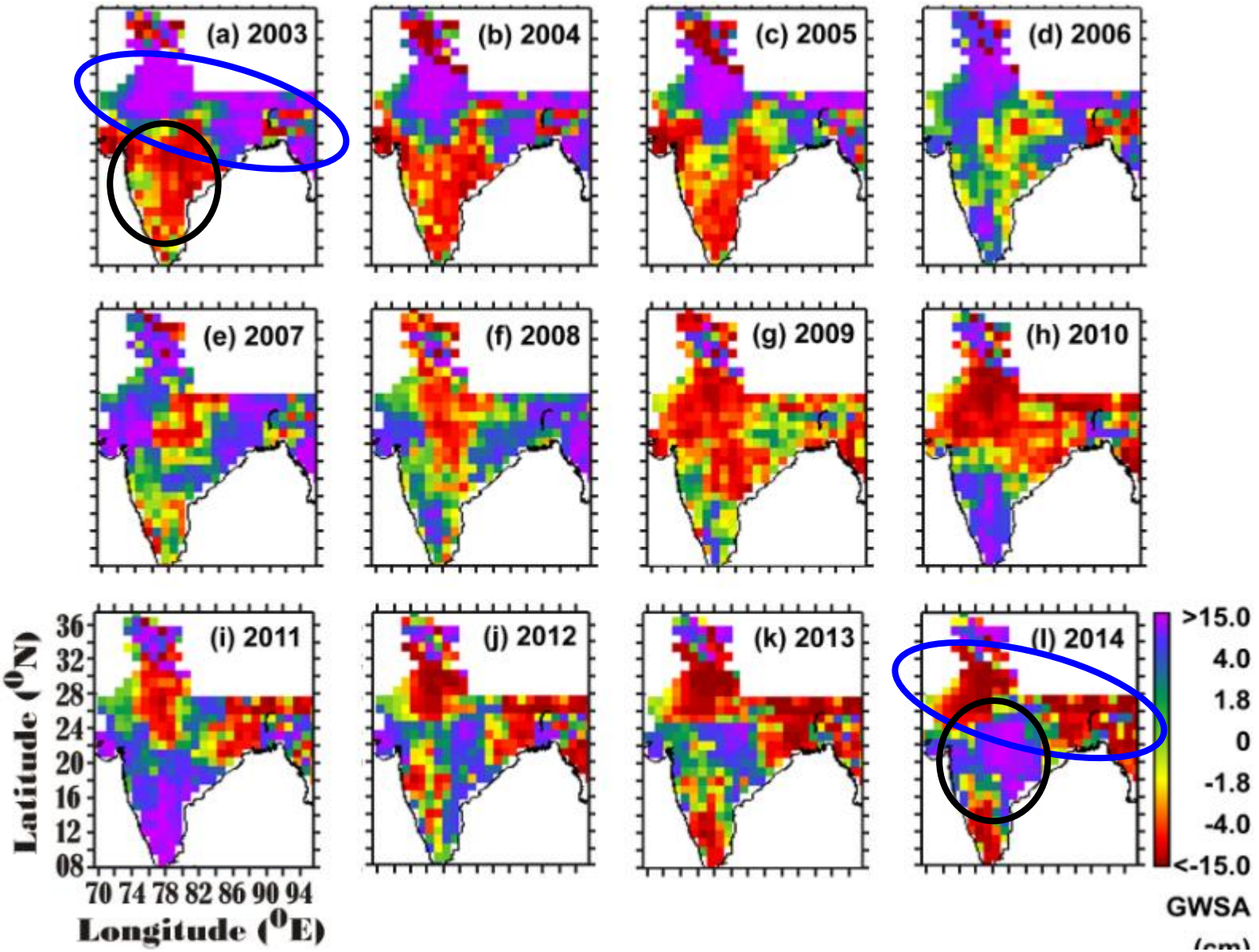
Distance: 220 km (polar orbit)

Elevation: 500 km (approx)

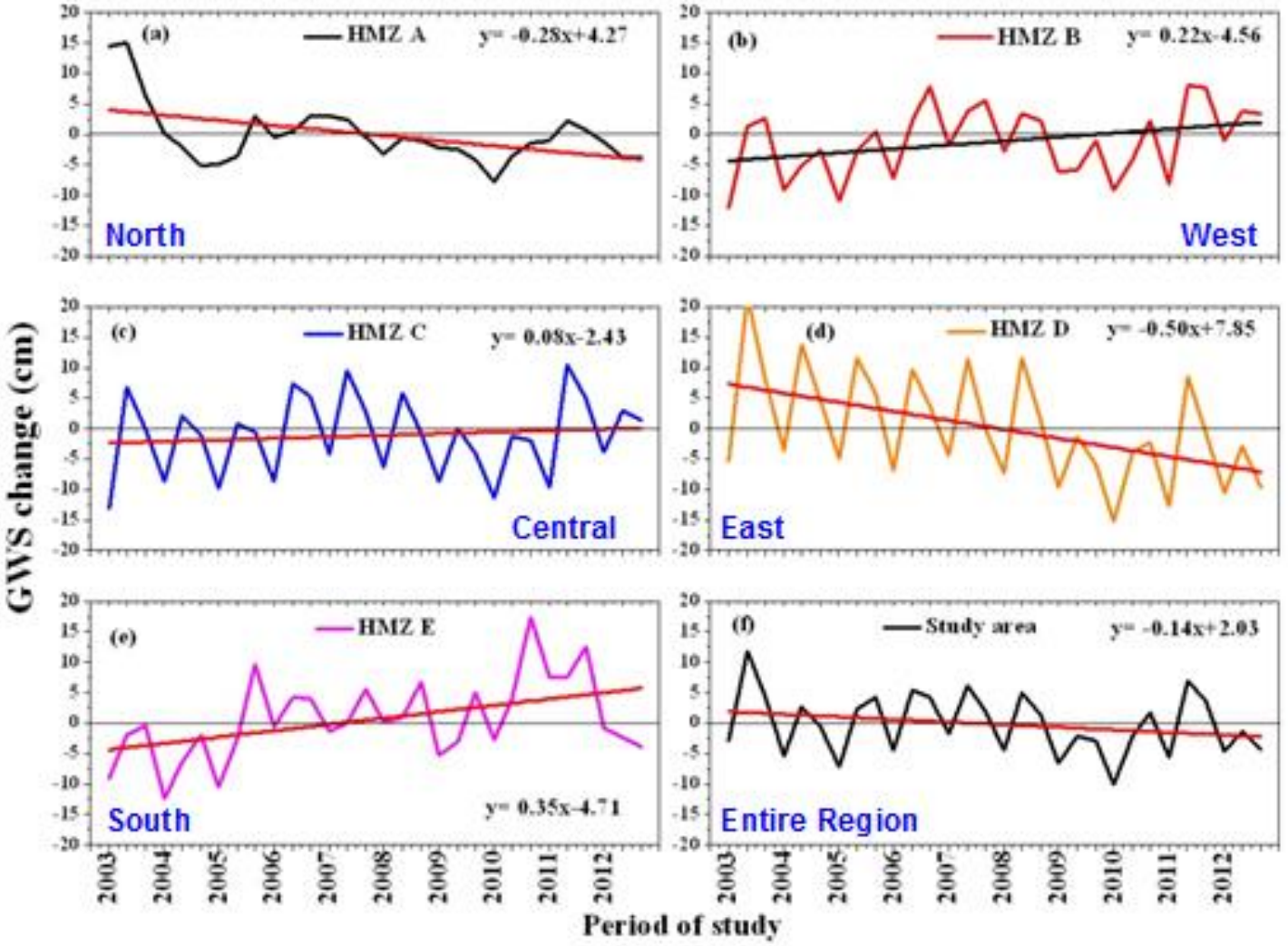
Resolution: 15 revolution/day



Decadal-Scale Groundwater Storage Change

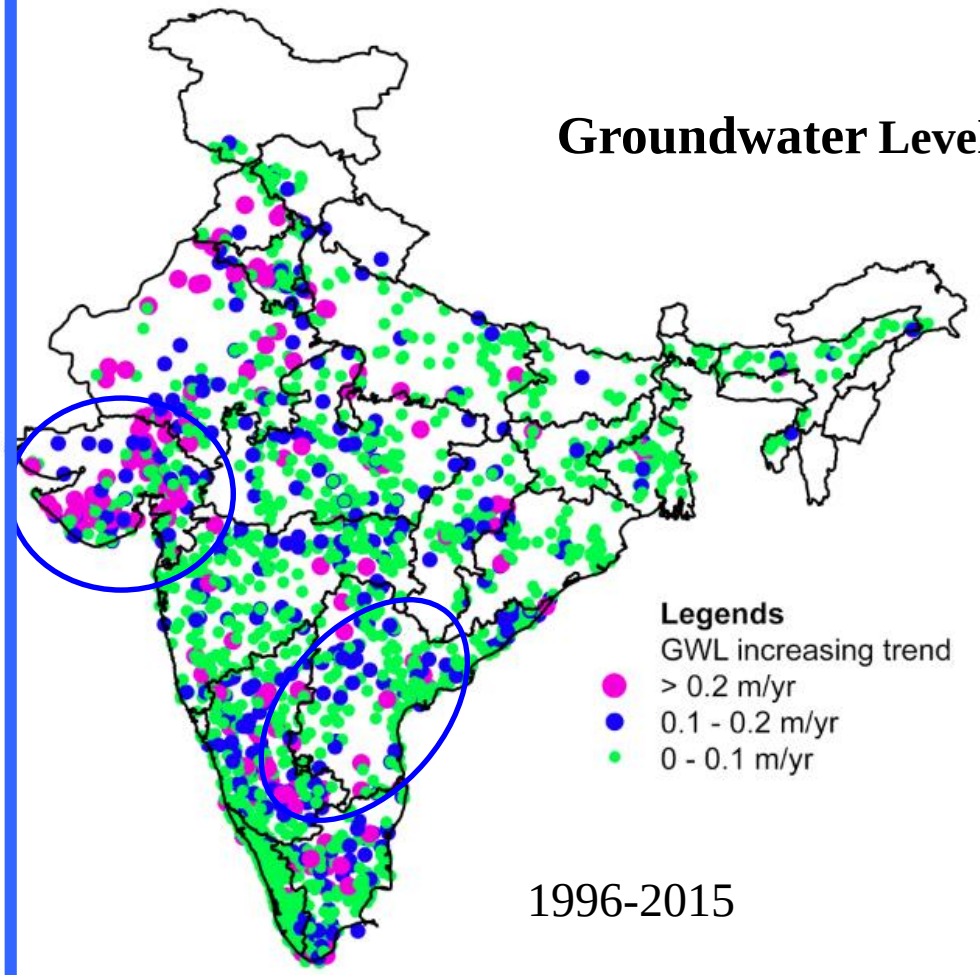


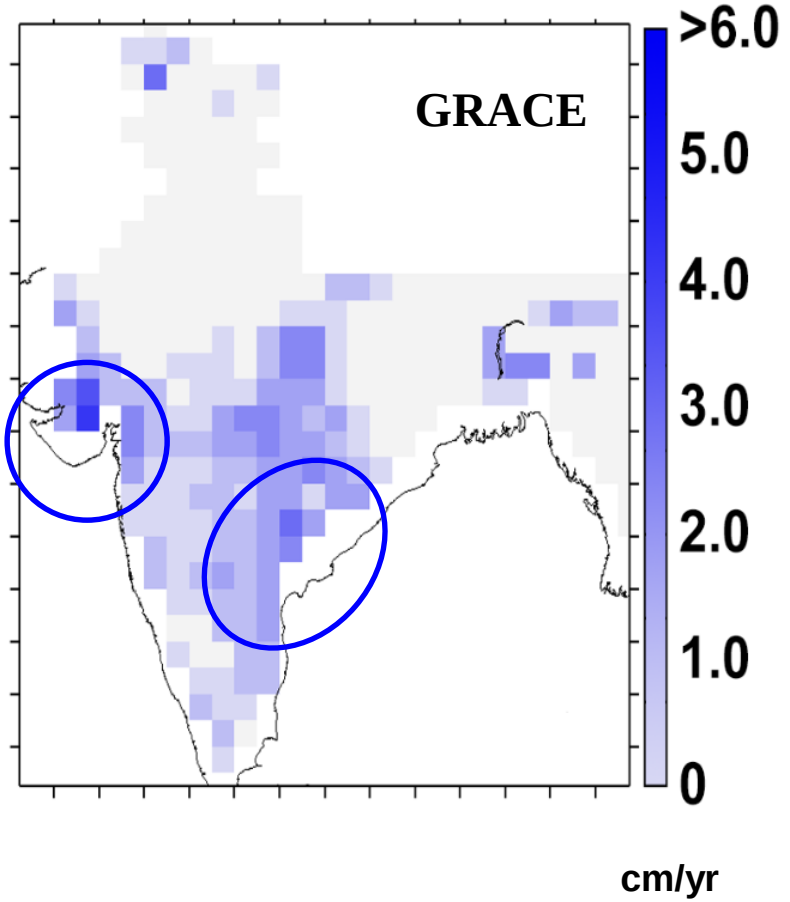
Decadal Time-series of groundwater storage changes (2003-2015)



Bhanja et al., 2017,
Nature Scientific Report

Groundwater Replenishment ?





Bhanja et al., 2017,
Nature Scientific Report

Groundwater Policy Intervention

Rejuvenating dry river beds

Recharge Canals

Infiltration Ponds and tanks

Restricted power for agriculture

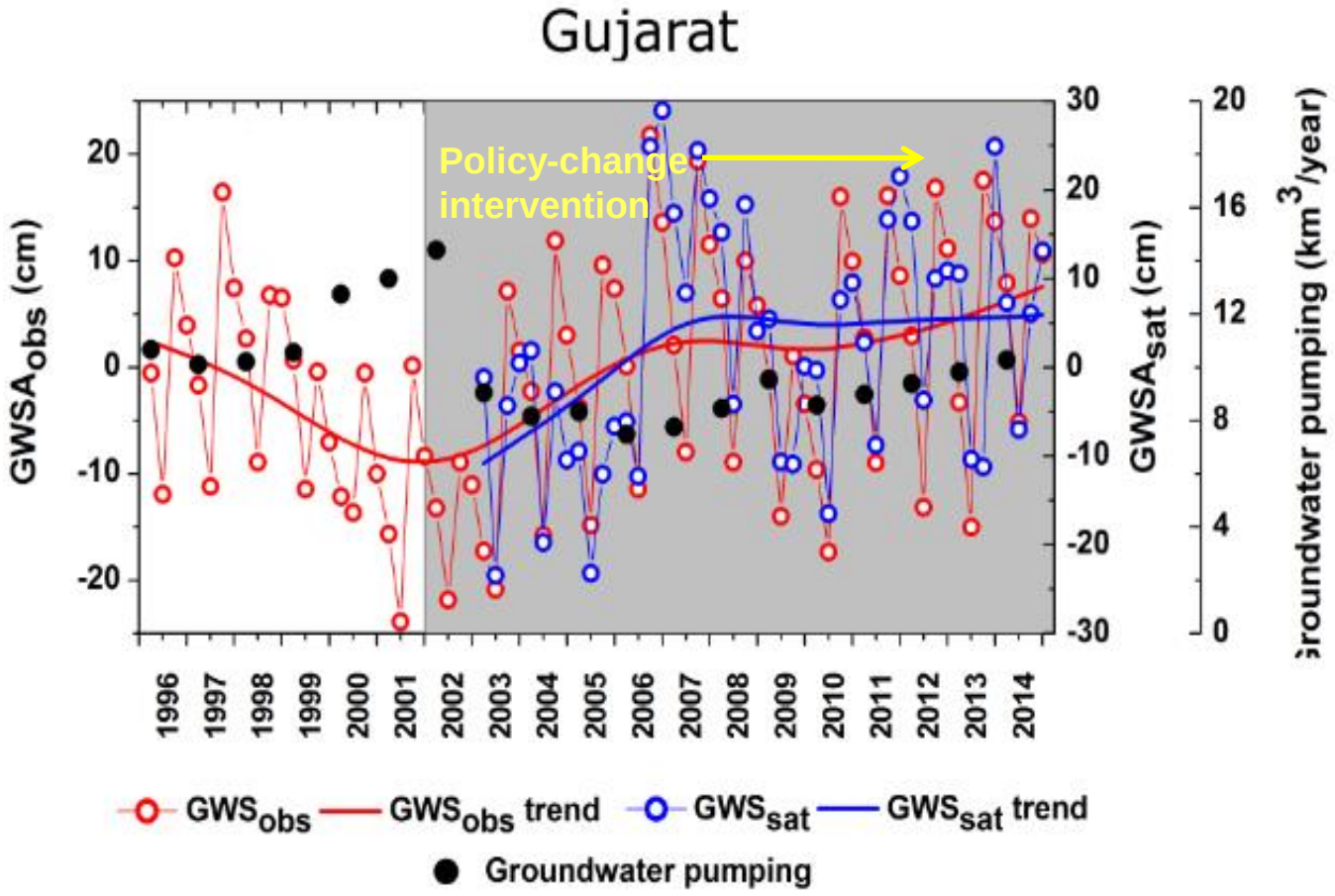
Large-scale water management structures

Check Dams

Artificial Recharge

Rainwater harvesting

Replenishment Case Study: *Hypothesis 1*

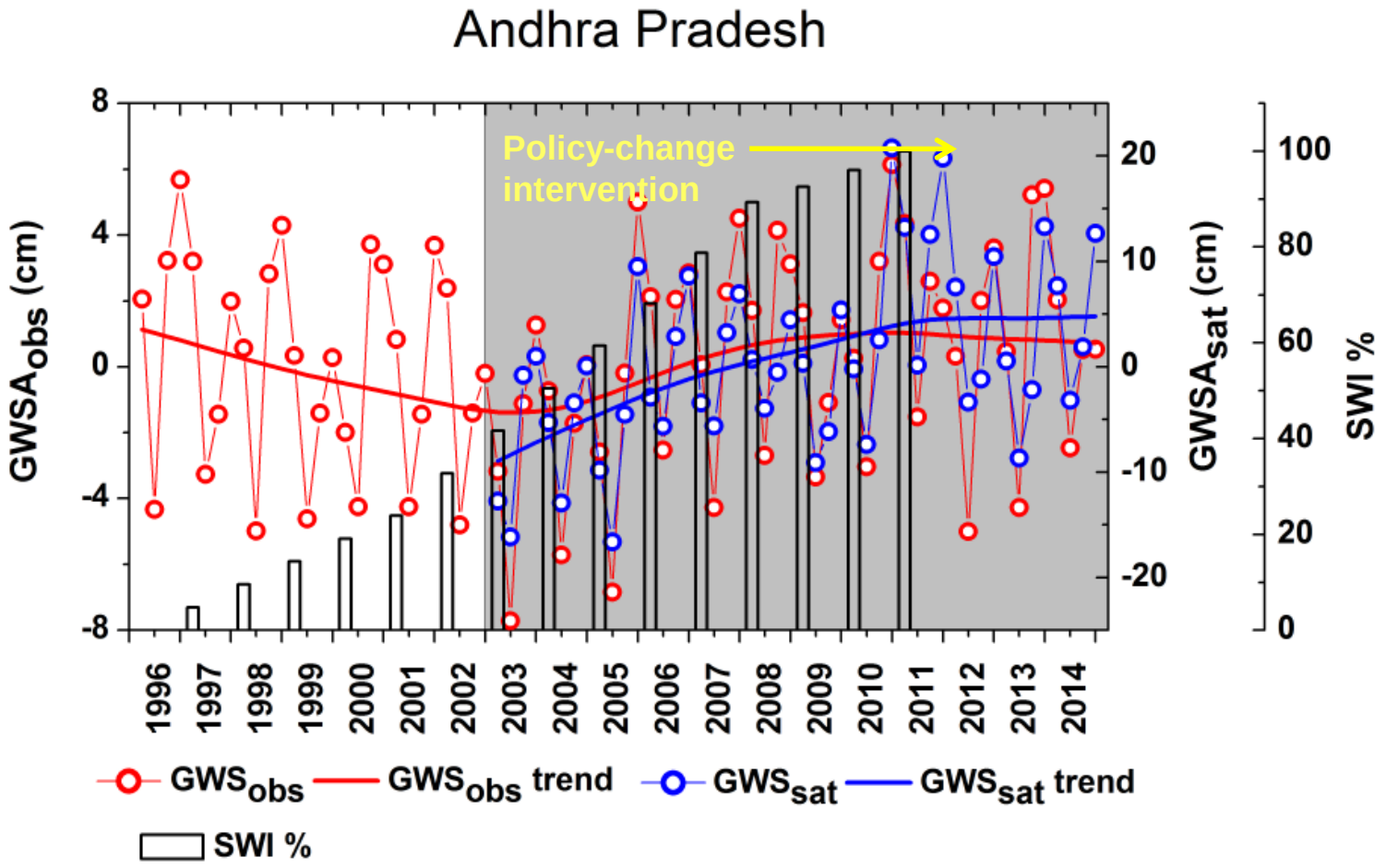


Restricted agricultural electricity usage reduced groundwater pumping

Simulated with information from Shah and Verma, 2008

Bhanja et al., 2017,
Nature Scientific Report

Replenishment Case Study: *Hypothesis 2*



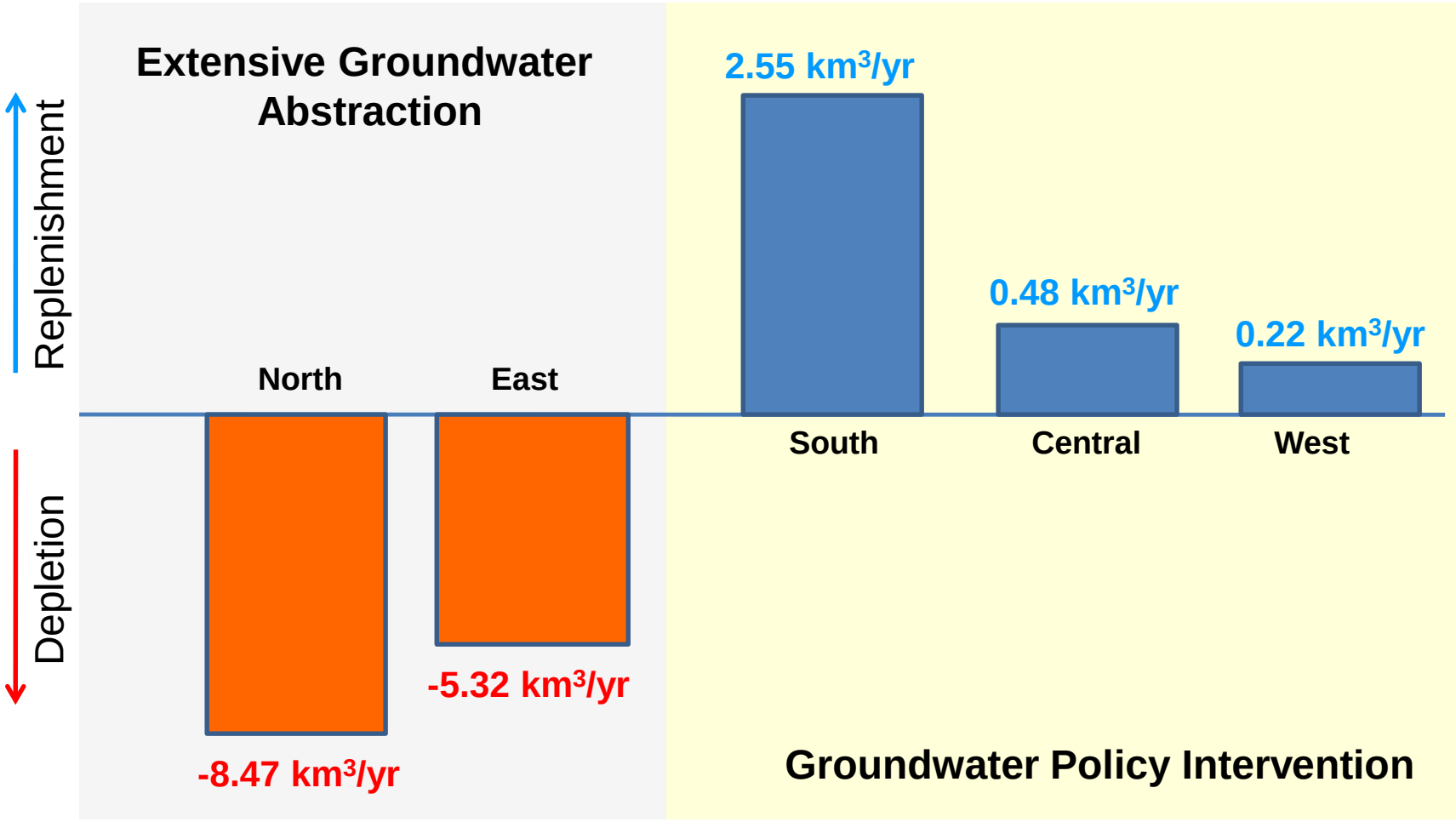
Increased creation of Surface water ponds, enhancing recharge

Statistical test with information from A.P.Govt Rep., 2014

Mukherjee and Bhanja, 2018

Conclusion:

Groundwater storage condition in INDIA in last decade



Mukherjee and Bhanja, 2018

The Indian EXPRESS

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India's falling groundwater sto replenished: Study

For the first time, researchers from India and abroad have given positive co replenishment of groundwater storage at the regional scale.

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Replenishment of groundwater storage at regional scale

PTI
August 11, 2017 | UPDATED 20:30 IST

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Kharagpur (WB), Aug 11 (PTI) Amid concern over dwindling groundwater resources in India, a research team from IIT Kharagpur in collaboration with NASA scientists have reported regi h long-term observations.

The gro 201

Outlook

THE NEWS SCROLL

11 AUGUST 2017 Last Updated at 8:27 PM

Replenishment of groundwater storage at regional

"We have been able to demonstrate the initial scenarios of rejuvenating groundwater in parts optimistically has the potential to eventually become the largest groundwater replenishment oc hu

TIMES - MUM

Business Standard

Groundwater replenishment noted in west, south India: Scientists

IANS | Kolkata
August 11, 2017 Last Updated at 19:16 IST

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Groundwater replenishment noted in west, south India: Scientists

Kolkata, Aug 11 (IANS) An international team of researchers, including experts from IIT-Kharagpur and NASA, has reported discernible groundwater storage replenishment in certain Indian regions, in a n

By IANS Feeds | Published: August 11, 2017 7:21 PM IST
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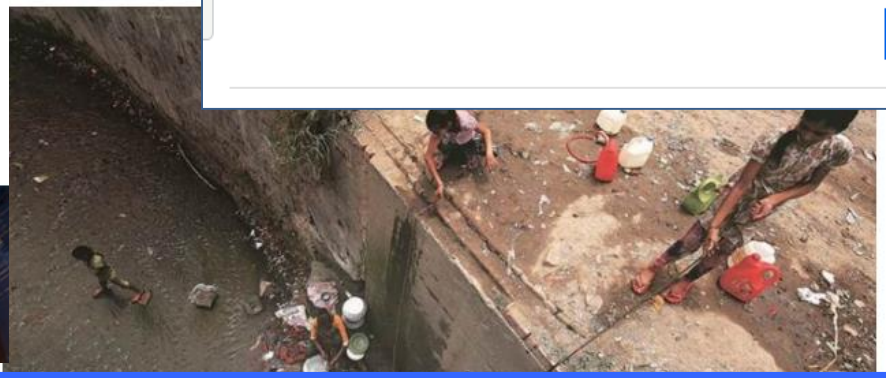

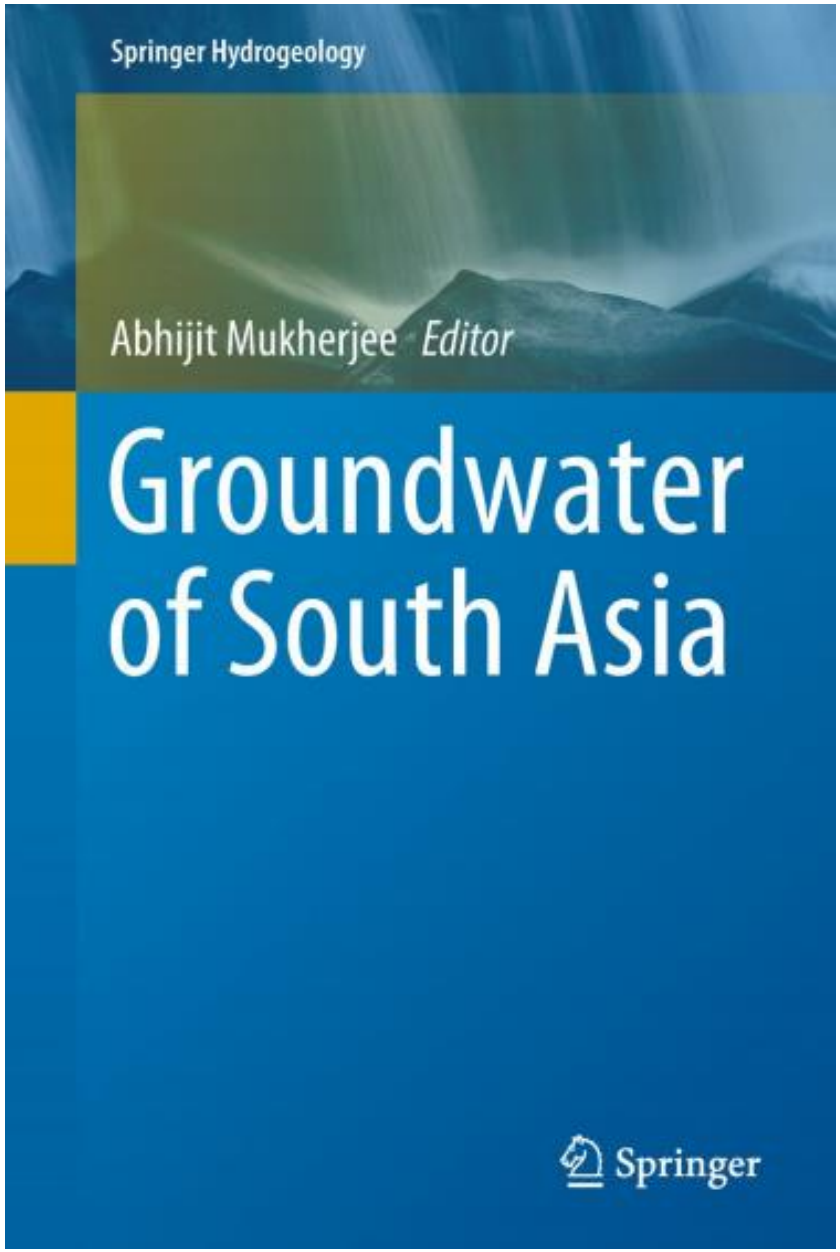

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