Hydroclimate: Impacts of Climate Change on Water Resources in Africa, Asia and Australia

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Environmental Challenges

Queensland-2007 (source: http://www.smh.com.au/news/scorchedearth/rising-temperatures-show-not-all-is-well/2007/01/02/1167500125122.html)

The greatest exploiter for all of us are floods today, droughts tomorrow, earthquake some times and all of these multiply our trauma of deprivation, pains of poverty and hunger. These disasters take away not only our crops, shelters, lives of our families, friends, but also destroy our hopes and dreams of the future. Is there any event comparable to these, which causes so much human sufferings and injustice?—This is the cry of a common farmer of Koshi River basin, Bihar (India) in the midst of recurrent floods and droughts (Jayaraman et al. 1997).

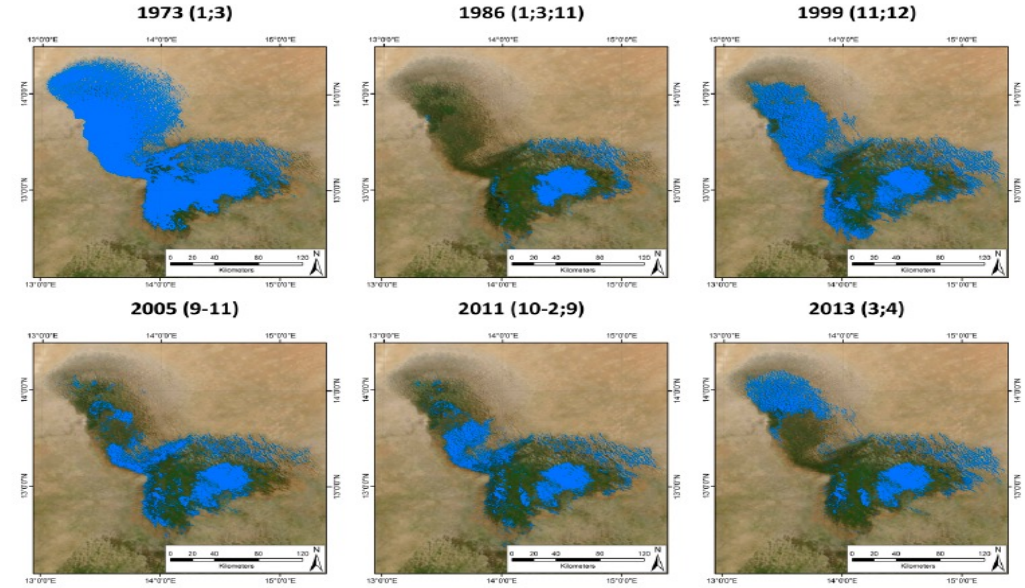
Western Australia (source: http://www.abc.net.au/news/stories/2007/06/22/1958999.htm)

Queensland-January 2011 (source: http://www.bbc.co.uk/news/world-asia-pacific-12149921

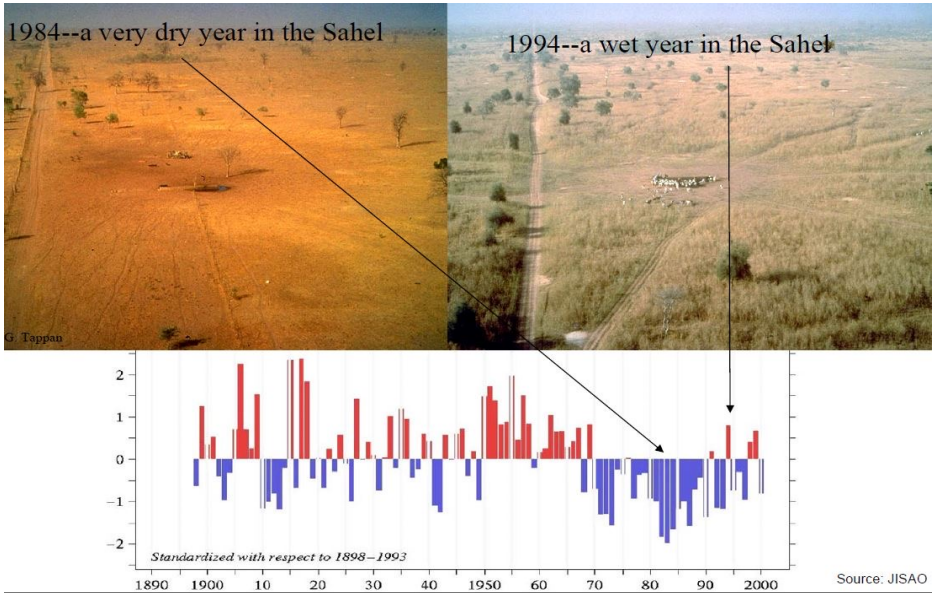
Japan: The 2015 Floods

Challenges Farcing Water Resources in Africa

- Sparse monitoring networks
- Insufficient large scale in-situ data
- Lack of systematic approach
- Impact of climate variability
- Human-induced factors, e.g., water withdrawals, etc.



Guzinski et al., 2014; *remote sensing;*



Challenges

- ✓ With ever increasing global population, intense pressure is being exerted on the Earth's resources leading to severe changes in its land cover (e.g., deforestation), diminishing biodiversity and natural habitats, dwindling fresh water supplies, and changing weather and climatic patterns (e.g., global warming, changing sea level).

- ✓ Environmental monitoring techniques that may provide such information are under scrutiny from an increasingly environmentally conscious society that demands the efficient delivery of such information at a minimal cost.

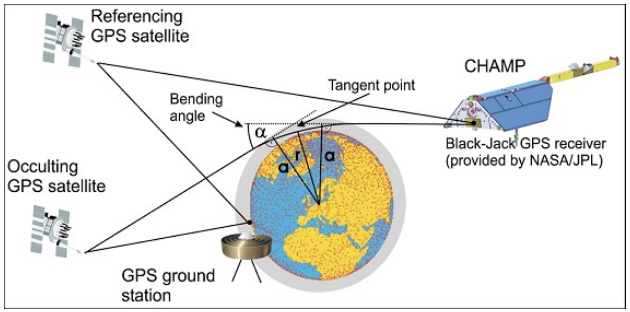
- ✓ Environmental changes vary both spatially and temporally, thereby putting pressure on traditional methods of data acquisition, some of which are very labour intensive, such as animal tracking for conservation purposes.

"With these challenges, conventional monitoring techniques, particularly those that record spatial changes, call for more sophisticated approaches that deliver the necessary information at an affordable cost. One direction being followed in the development of such techniques involves Geospatial space techniques, which can act as stand-alone method, or to complement traditional methods."

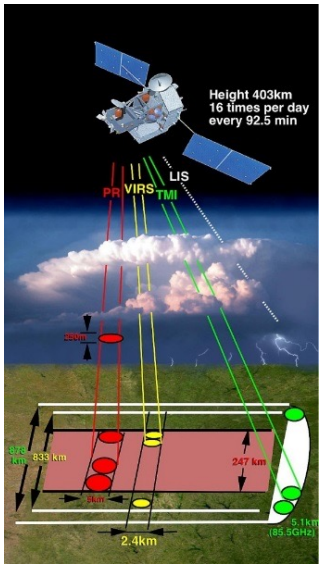
Earth Observing Satellites (EOS)

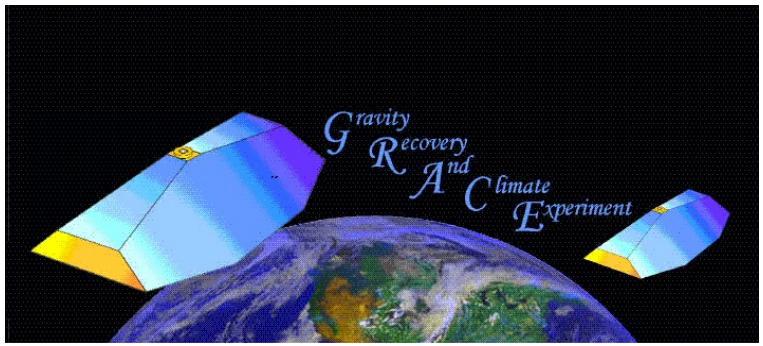
Studying water quality, e.g, using MODIS-derived maps of water quality (Secchi Depth and chlorophyll) and MERIS imagery

Global Warming
Flood monitoring/ENSO impacts.



Monitoring Droughts (Meteorological, Hydrological, & Agricultural) and its potential linkage to the spread of diseases and infections.



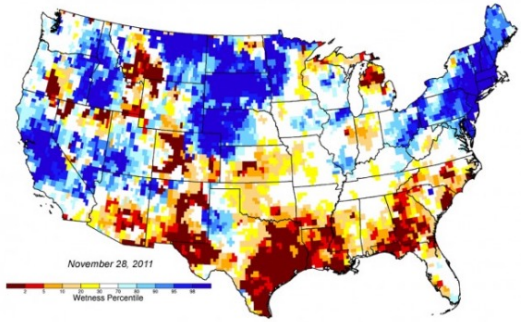


Monitoring water quantity changes (surface, groundwater and soil moisture) and its effects on agriculture linked to monitoring deterioration of groundwater quality and impacts on health.

Satellite data products are also capable of improving models (e.g., hydrological and flood forecasting models) performances using data assimilation process.

Applications of GRACE

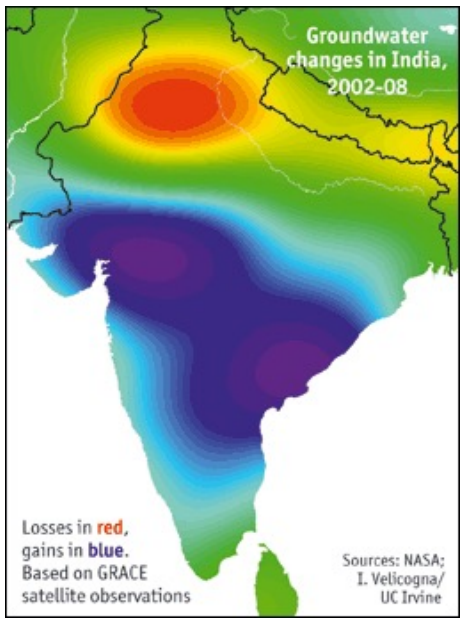
- ✓ Drought monitoring (Source: NASA).



- ✓ Polar wander and sea level change linked to climate change: Monitoring changes in glaciers and ice sheet.

- ✓ Remote sensing spatial and temporal changes in total water storage (TWS), e.g., BBC News (http://news.bbc.co.uk/1/hi/sci/tech/8197287.stm): India's water use 'unsustainable'

Image: Patrick Robert/Corbis



For more news on GRACE Applications, visit http://www.csr.utexas.edu/grace/publications/press/:

Examples

Remote Sensing of Environment 260 (2021) 112416

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Peng Yuan [a,*], Addisu Hunegnaw [b], Fadwa Alshawaf [c], Joseph Awange [d], Anna Klos [e], Felix Norman Teferle [b], Hansjörg Kutterer [a]

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Inference of the spatio-temporal variability and storage potential of groundwater in data-deficient regions through groundwater models and inversion of impact factors on groundwater, as exemplified by the Lake Victoria Basin

K.X. Hu [a,*], J.L. Awange [a,b], M. Kuhn [a], J. Nanteza [c]

Science of the Total Environment

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Impacts of extreme climate on Australia's green cover (2003–2018): A MODIS and mascon probe

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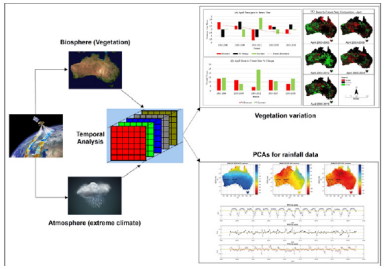
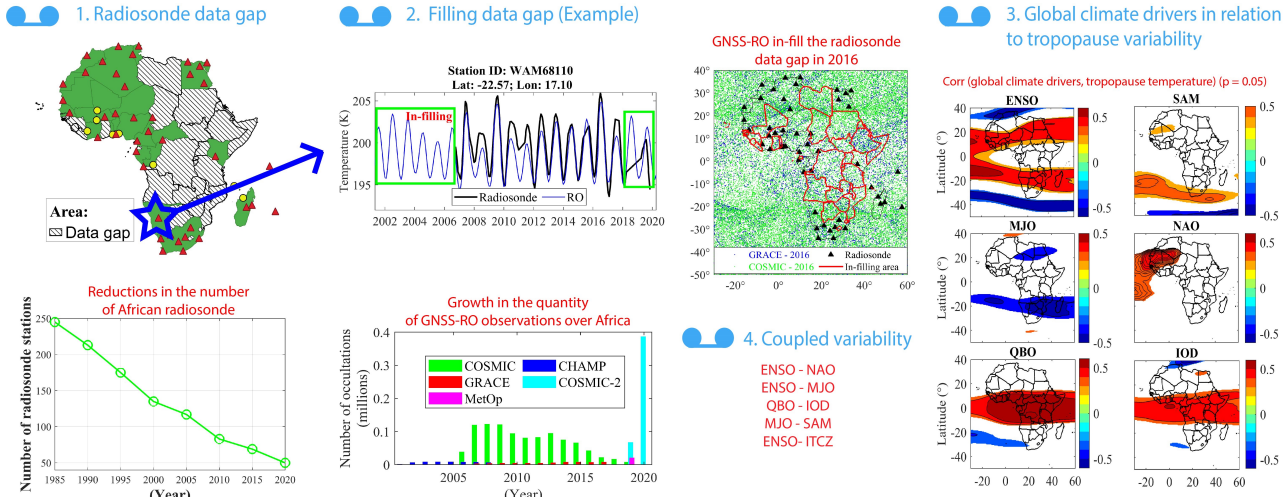
HIGHLIGHTS

- Over Australia (2003–2018), vegetation exhibited increase (April) and decrease (October).
- South Australia and Western Australia are "hotspots" with most vegetation changes.
- The hotspots experienced decrease in vegetation (October) and no change (April).
- Both hotspots experienced hydrological decrease (2003–2009) and increase (2009–2012) that peaked in 2011.
- Climate variability (El' Nino and La' Nina) influenced vegetation variations.

GRAPHICAL ABSTRACT





Future Direction

Photo: Vicki Pender, Australian Koala Foundation No: 0024

- ✓ Data Fusion: Develop high spatial resolution GRACE/GRACE-FO and radar remote sensing products
- ✓ Aridity: What is the state of the art?
- ✓ Mathematical Geosciences-Ongoing →

Photo: Scott Harmsen, Australian Koala Foundation No: 0025

Source: http://3.bp.blogspot.com/_A8VfEwwxh_g/TF6z-Ido_PI/AAAAAAAAALE/r0ksWa6o3_s/s1600/how%2Bis%2Bthis%2Bkangaru-774139.jpg