EGU General Assembly 2020

Online | 4–8 May 2020

Why and how do surface reservoirs "disappear"?

Spatio-temporal dynamics of reservoir (de-)commissioning in Ceará, NE Brazil

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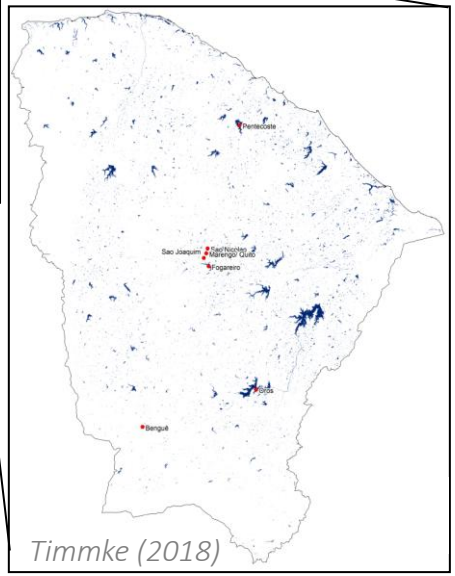
Background and Scope

- high variability of rainfall (pronounced wet and dry seasons)
- water supply ensured by implementation of reservoir network but mostly built without documentation → no complete state-wide inventory



This study aimed at investigating

i. the location,

ii. the size,

iii. the commissioning and decommissioning years, and

iv. the spatio-temporal dynamics

of reservoirs in Ceará for the period 1984 –2015, based on the global surface water dataset (GSW)

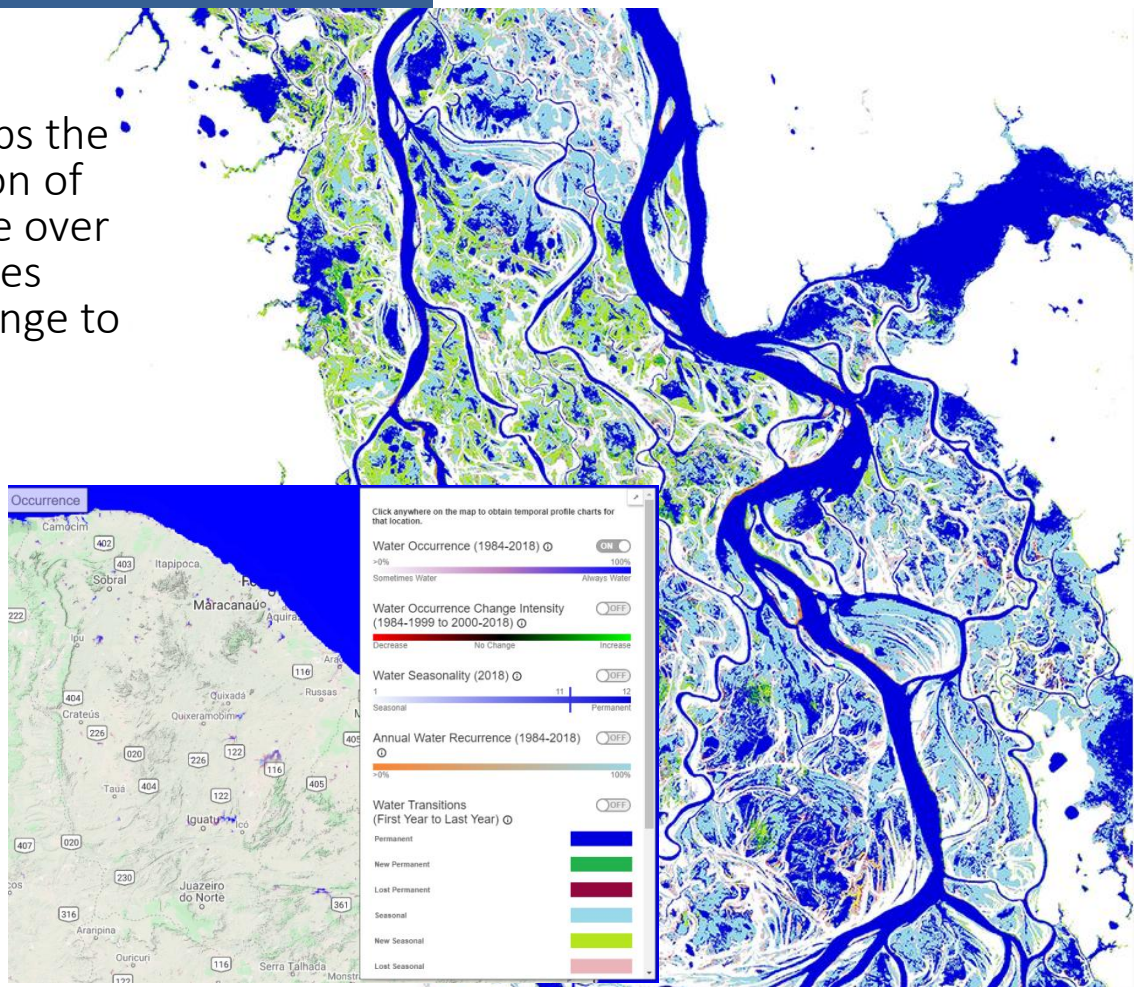
Database

Global surface water exlorer

„A virtual time machine that maps the location and temporal distribution of water surfaces at the global scale over the past 3.5 decades, and provides statistics on their extent and change to support better informed water-management decision-making.”

https://global-surface-water.appspot.com

- Developed by the European Commission's Joint Research Centre (JRC) (Pekel et al. 2016)
- produced from Landsat imagery
- Interactive maps
- Free data download

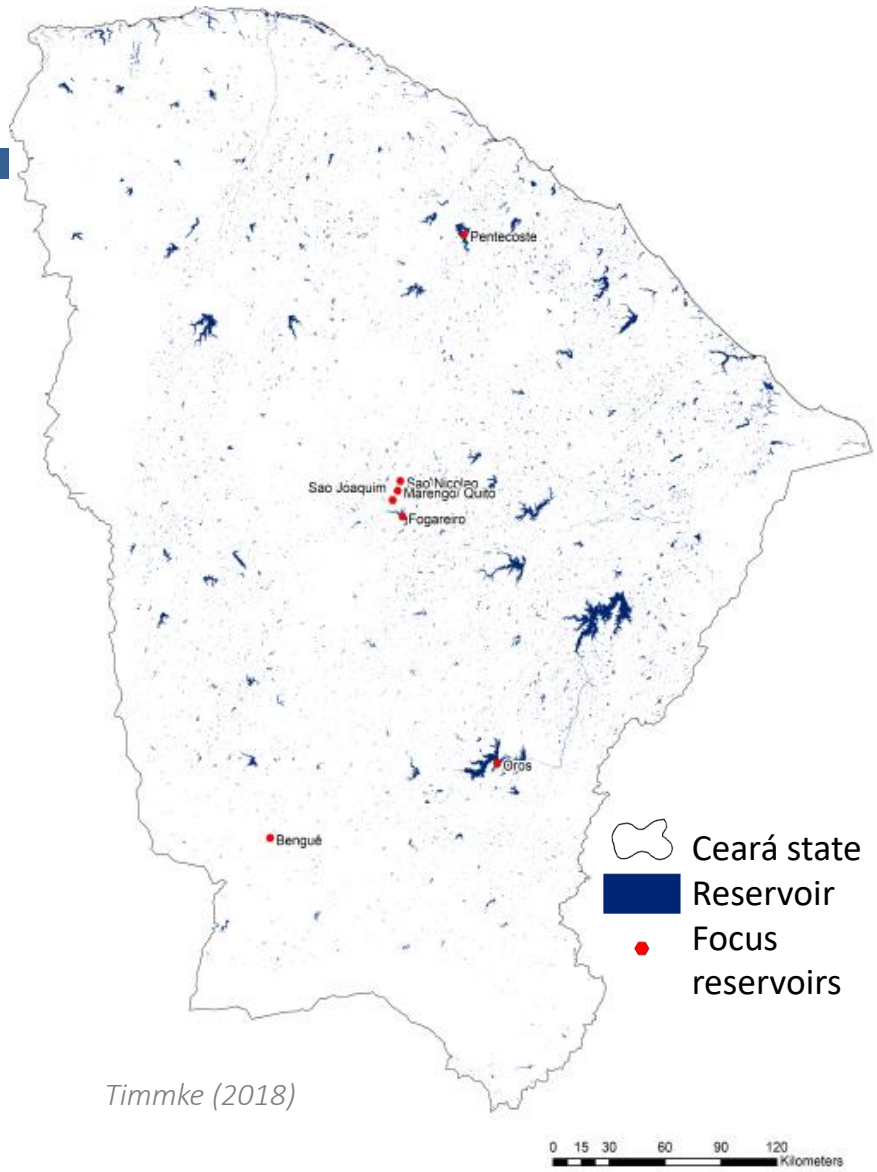


Source: https://global-surface-water.appspot.com/

Location and size

- Based on *maximum water extent*
  - ❖ 17 919 reservoirs > 90 x 90 m
  - ❖ 28 682 reservoirs > 30 x 30 m

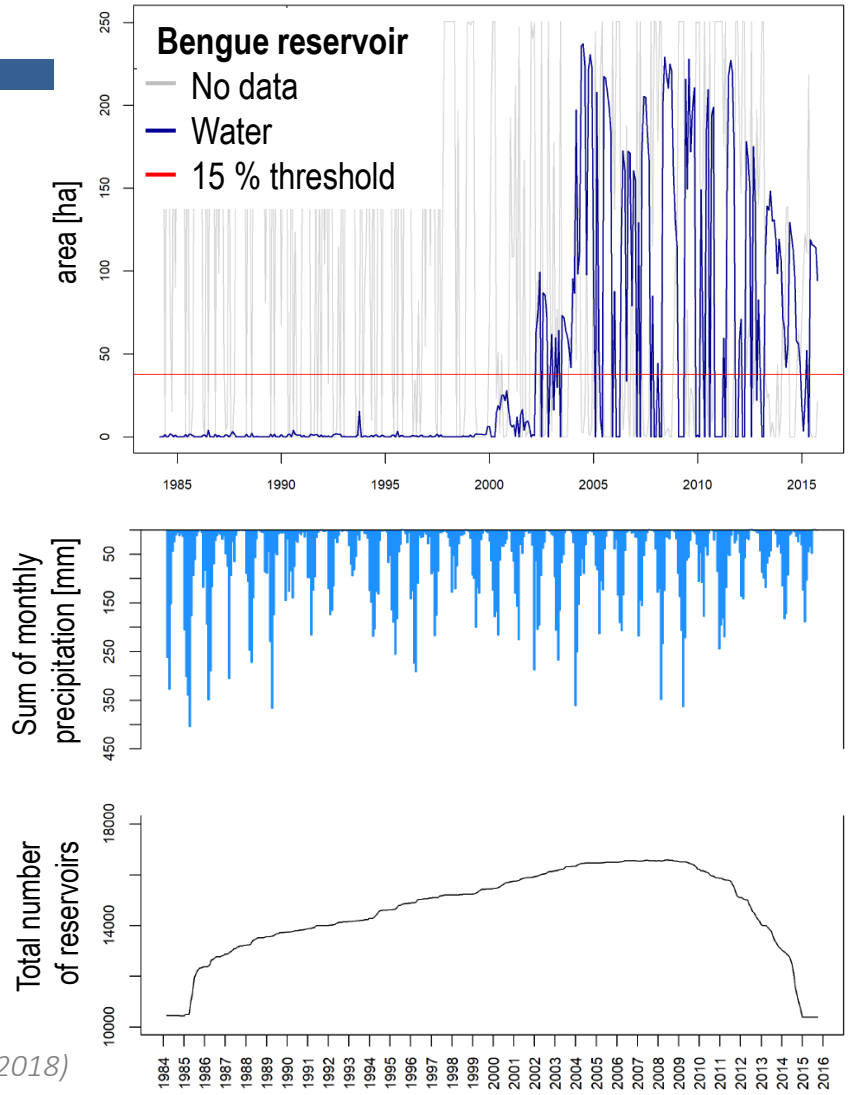
  confirmed (87 % accuracy) for 157 reservoir validation dataset (regularly monitored by FUNCEME).
- Reservoirs < 2.05 ha (category 1) form the largest and reservoirs (category 6) form the smallest share in number …
- … but reservoirs > 50 ha (category 6) contribute most to the water storage capacity while category 1 reservoirs contribute least



Timmke (2018)

(De-)commissioning

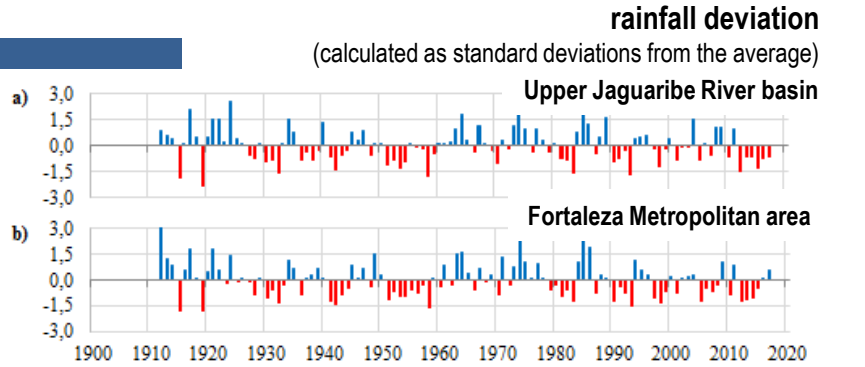
- (De-)commissioning years were determined from the *monthly water history* dataset as the first and last year, respectively, of water being detected
- commissioning years were validated against the FUNCEME dataset (157 reservoirs) → Deviations are mainly small and can be attributed to uncertainties inherent to satellite observations
- no validation data (yet) to confirm the decommissioning of reservoirs



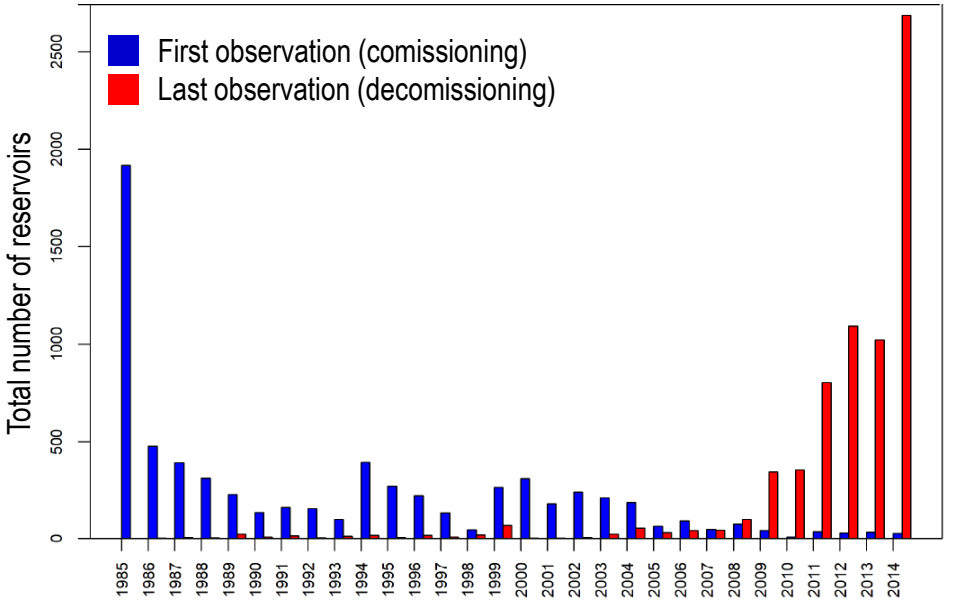
Timmke (2018)

Temporal dynamics

- spatially variable increase of reservoirs until approx. 2010, followed by intensive decrease until 2015
- high bars in the beginning/end of the study period are most likely artifacts from analyses
- detected comissioning of reservoirs partly reflects periods of drought (e.g. Marengo et al. 2018)
- comissioning of reservoirs seems to decrease from 2005, possibly due to changes in legislation
- decomissioning of reservoirs towards the end of the study period reflects a major drought from 2012-2016. Still, that does not explain the observed increase in decomissioning from 2009 (possibly due to the break of earth dams in wet years)



Medeiros & Sivapalan (accepted)

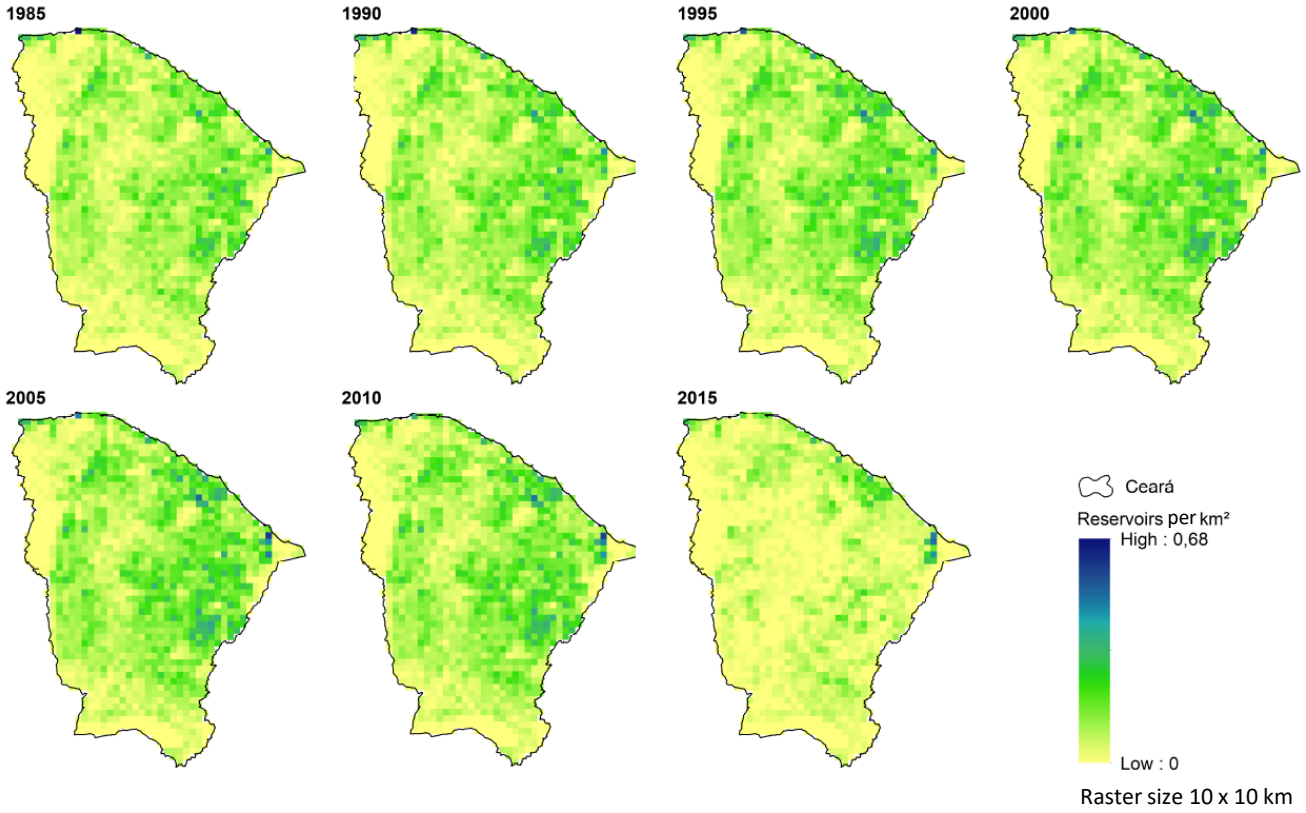


Timmke (2018)

Spatial dynamics

Differences due to

- climatic variability?
  (e.g. 2012 drought most pronounced in centre and East of Ceará (Marengo et al. 2018)
- reservoir size?
- geology?
- land use?
- human influence?
- others?



We value your feedback! ...

... particularly on the questions:

- on reservoir size and location:
  - How to (automatically) select only water surfaces that are reservoirs (from the GSWE maximum water extent or possibly another database)?
- on reservoir (de-)comissioning:
  - How to (better) adapt the determination of comissioning (threshold definition)?
  - How to validate decommissioning?
- on spatio-temporal variability:
  - what could be reasons for observed massive decomissioning (except for drought)?
  - Which factors influence influence the observed spatiotemporal dynamics?
  - How to best parameterize spatial variability (with respect to temporal changes)?

Thank you ...

... for visiting our contribution and providing valuable feedback to our work!

Funding

DAAD

CAPES

References

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