Impacts of urbanization on water resources availability using remote sensing data

Yearly assessment 34th cycle

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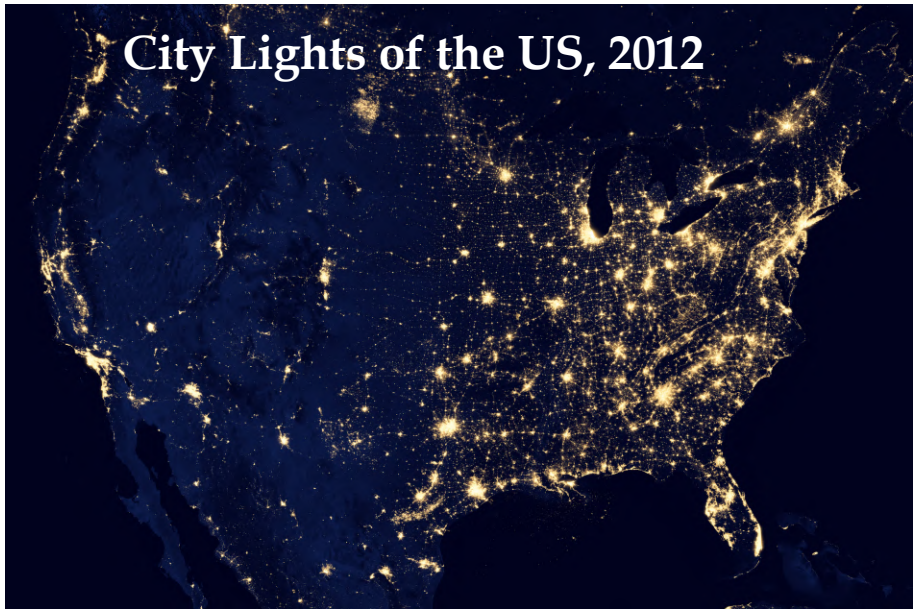
Urbanization and water resources

Urbanization plays a key role in affecting the future of water resources supply

- 3% of global land cover; > 50% of global population
- Expansion of 2.5 by 2050; 67% of global population living in urban areas (United Nations, 2018)
- ½ of the world population could face water stress by 2030 (United Nations Environment Program)
- Potential for cities to serve as “first responders” for water security

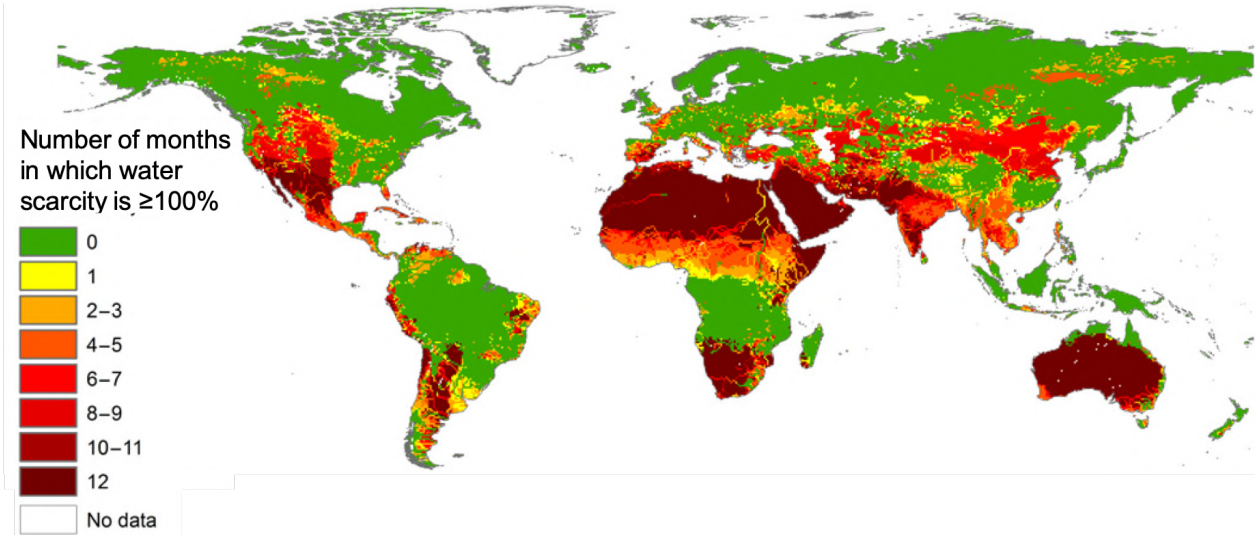


Climate change and water resources

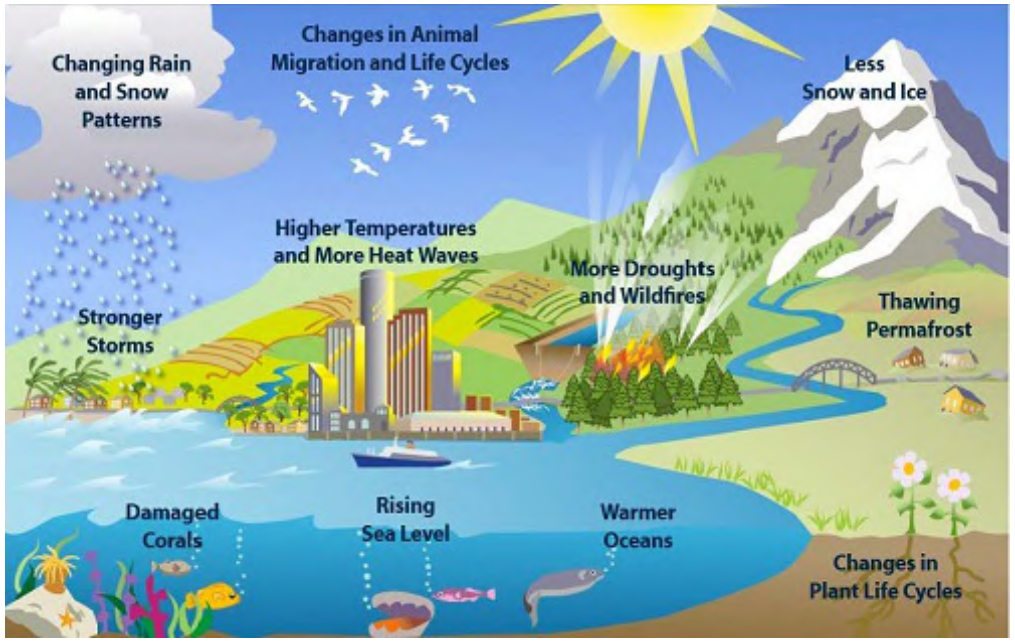
The hydrologic cycle is altered by extreme weather events

- increase in the frequency and intensity of rainfall
- higher temperatures
- more frequent and severe droughts and floods

Urban areas climate change is projected to further increase the risk of water scarcity (IPCC, 2014)



Number of months per year in which water scarcity exceeds 1.0 at 30 × 30 arc min resolution. Period: 1996–2005. From Mekonen et al., 2016.



Goals

Study the **contribution of anthropogenic and climatic factors** to **surface water depletion**

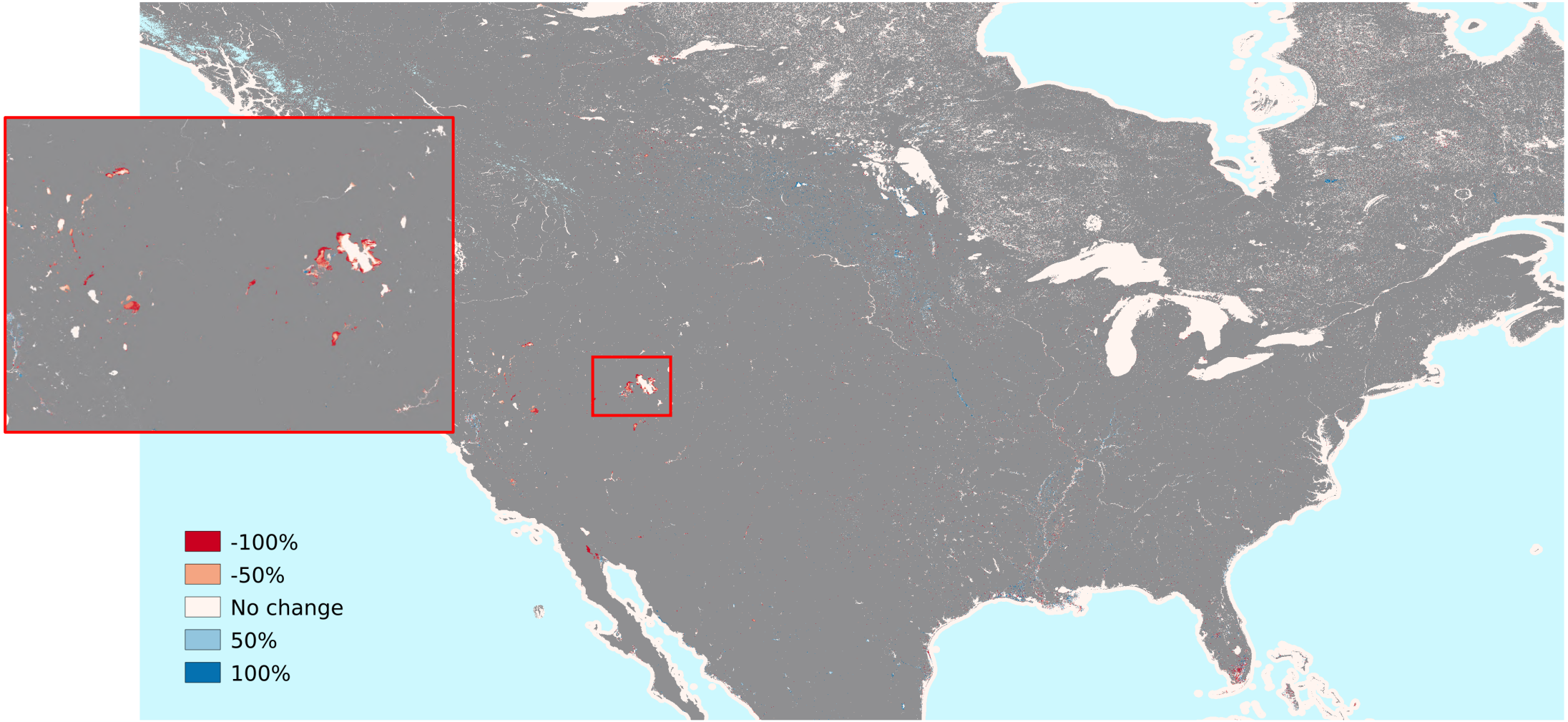
Is there a correlation between surface water decrease, urbanization and climate change?

First case study: **USA basins**

Surface Water Occurrence Change Intensity

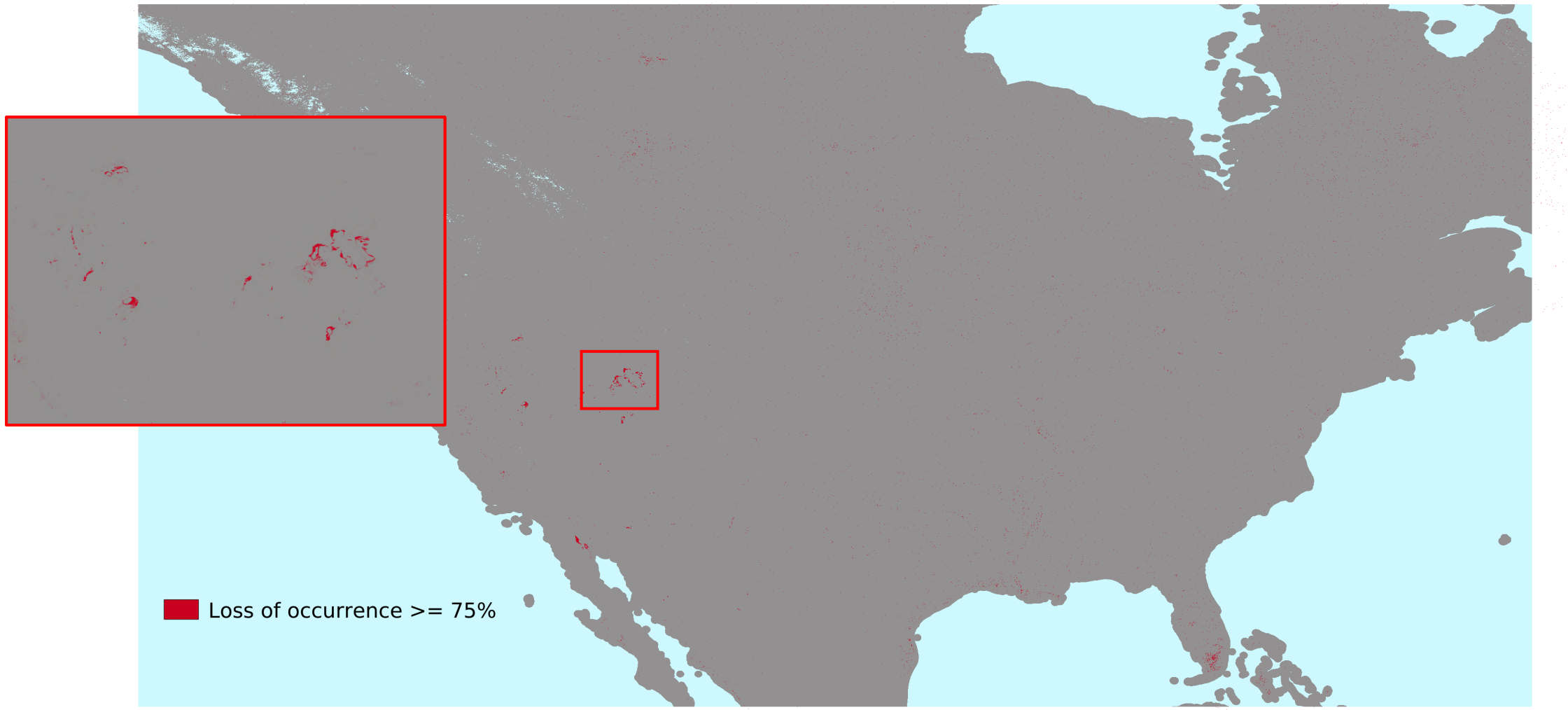
Variation in surface water occurrence between 2 epochs at 30 m resolution (Pekel et al., 2016)

Where surface water occurrence increased, decreased or remained the same between 1984-1999 and 2000-2018



Surface Water Occurrence Change Intensity

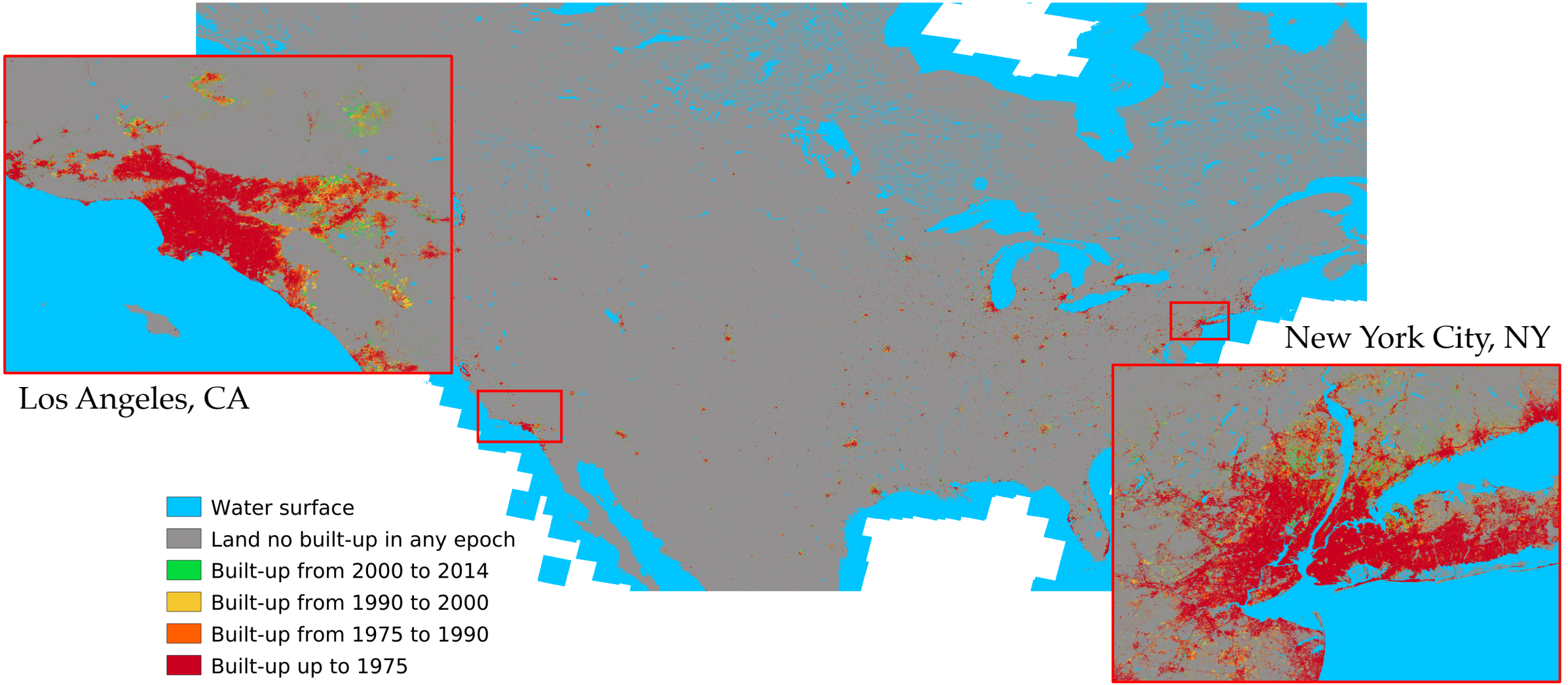
Extraction of locations with a decrease in surface water occurrence ≥ 75%



GHS-BUILT

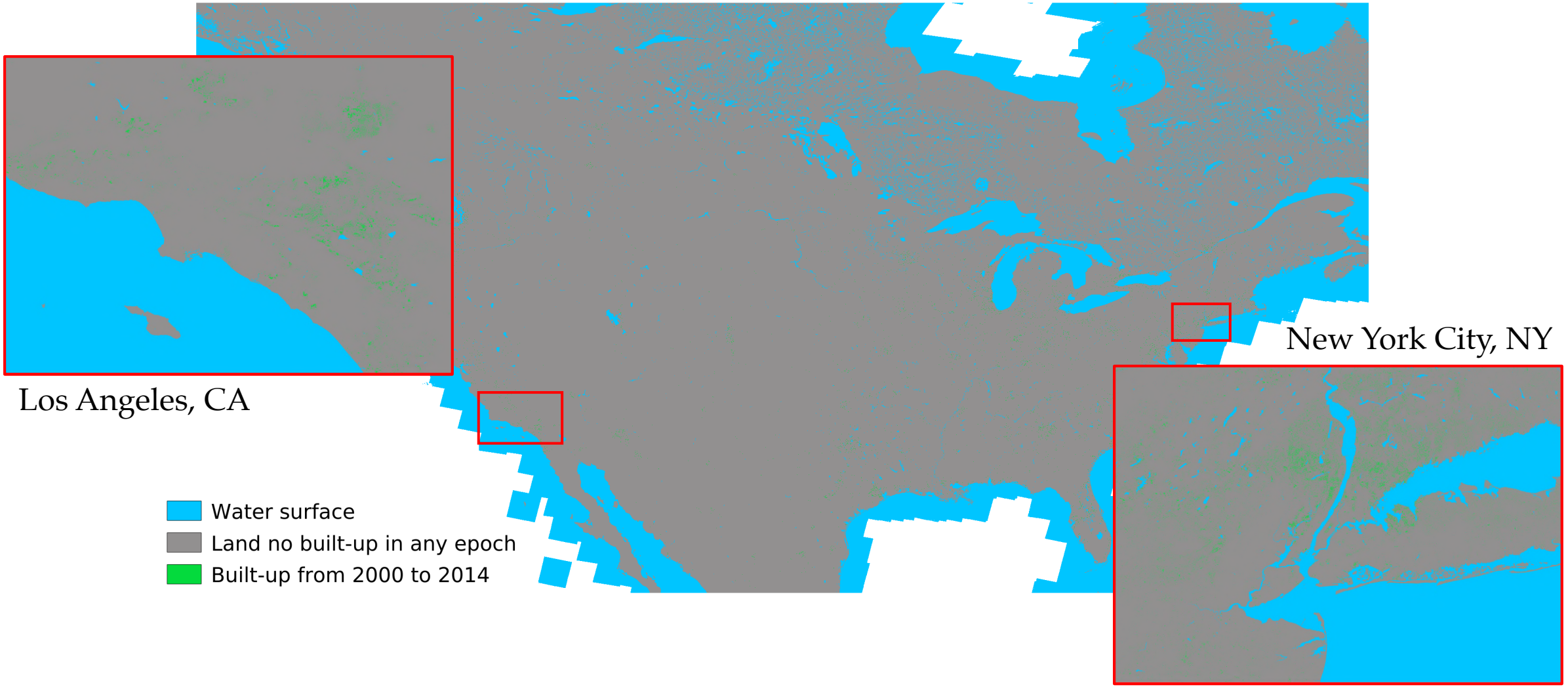
Multitemporal information on built-up presence at 30 m resolution (Corbane et al., 2018)

Urbanization in 4 epochs: until 1975, 1975-1990, 1990-2000, 2000-2014



GHS-BUILT

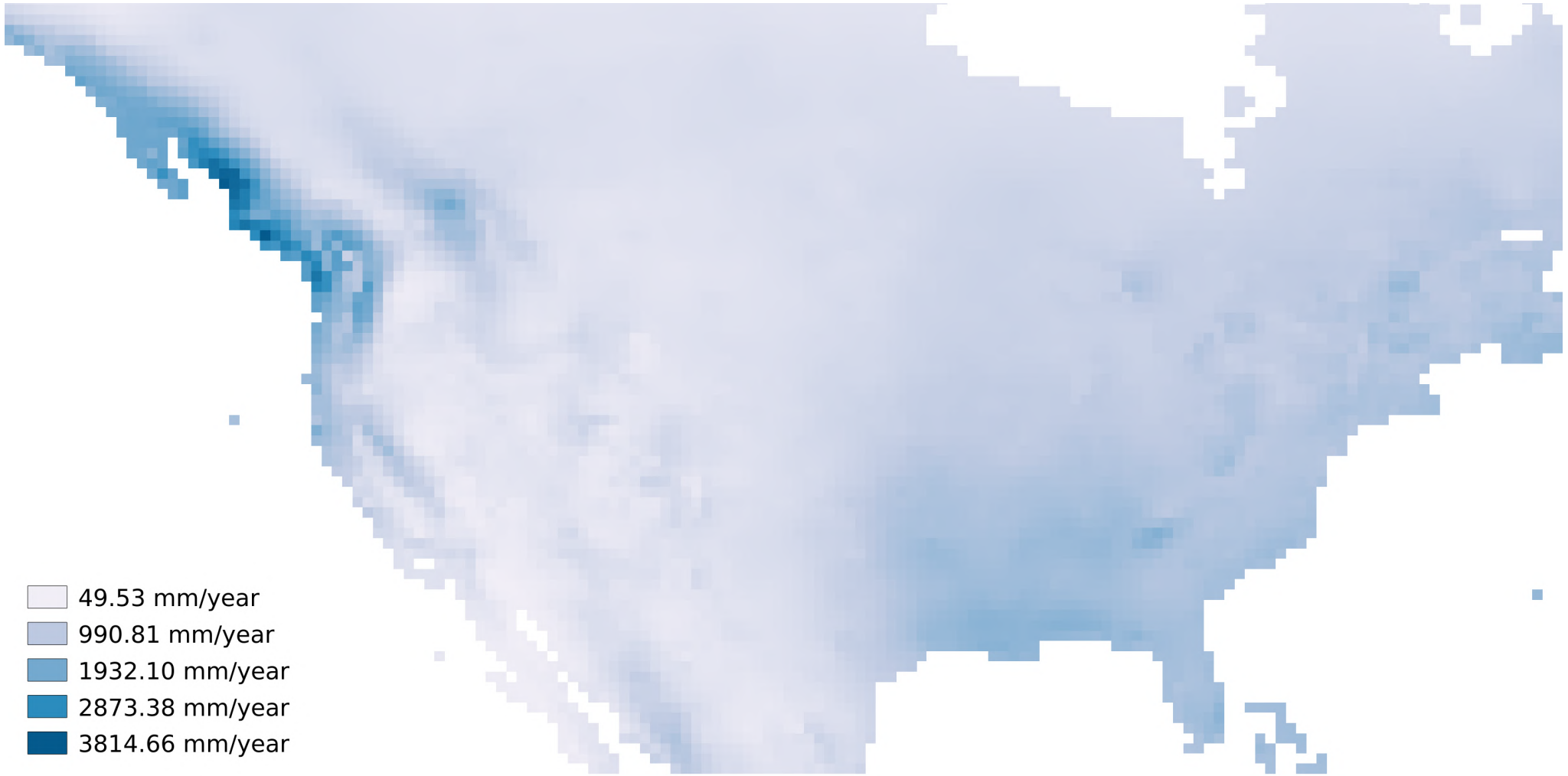
Extraction of locations where urbanization occured in 2000-2014



Land Surface Precipitation

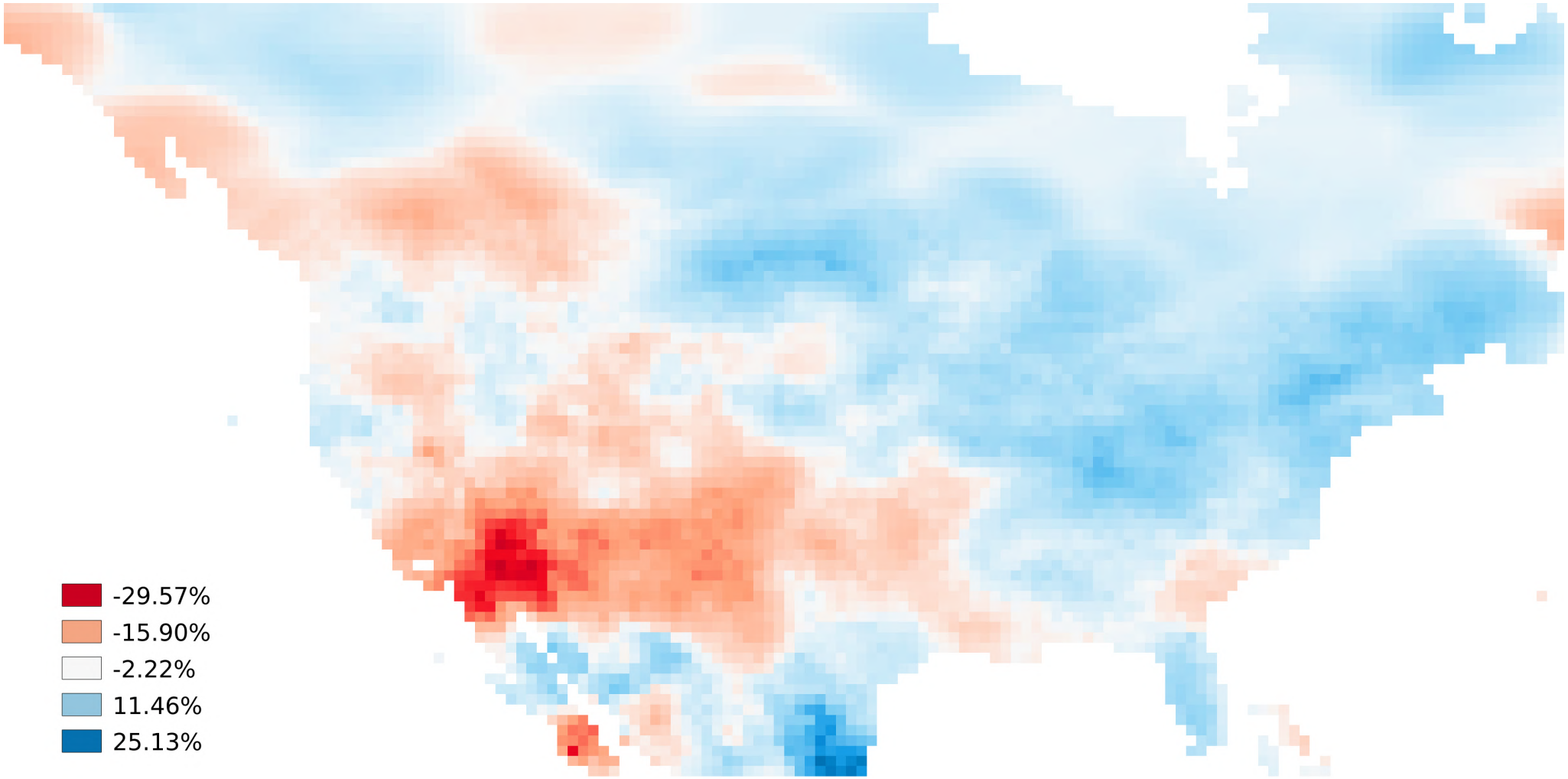
Monthly precipitation data from 1984 to 2018 aggregated at the annual scale (0.5 degree ≈ 25 km resolution)

Annual precipitation averaged over the epoch 1984-1999



Land Surface Precipitation

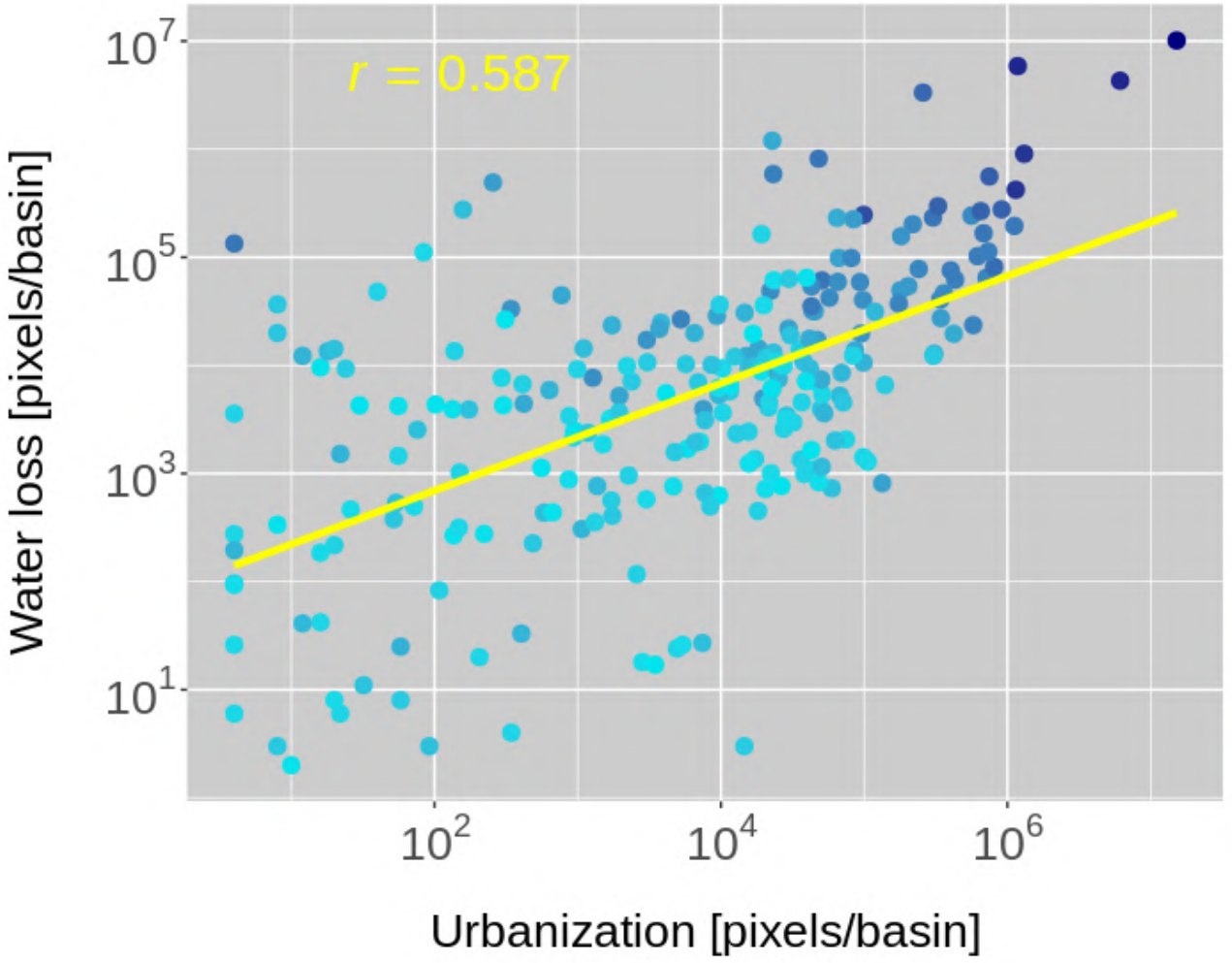
Evaluation of annual precipitation variation between 1984-1999 and 2000-2018

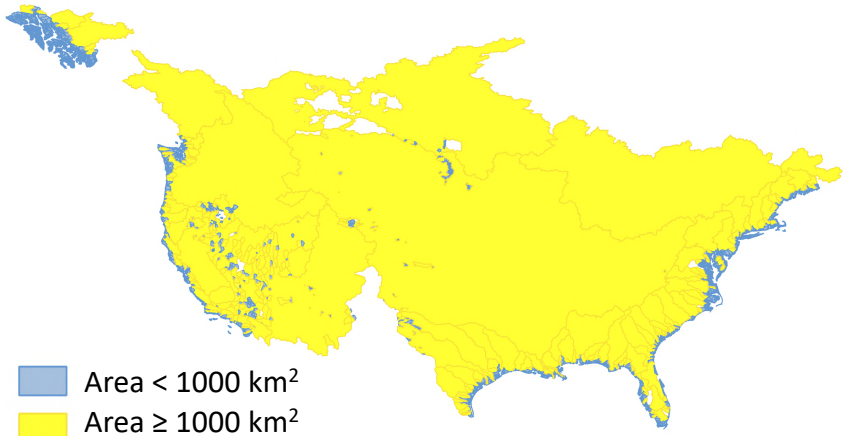


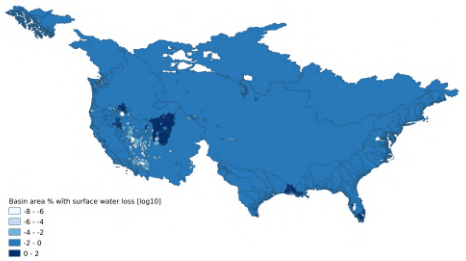
Results

Correlation between surface water loss and urbanization

Basins w/ # water loss and urbanized pixels ≥ 1 and area ≥ 1000 km² (244 basins, 95,31% of total area)



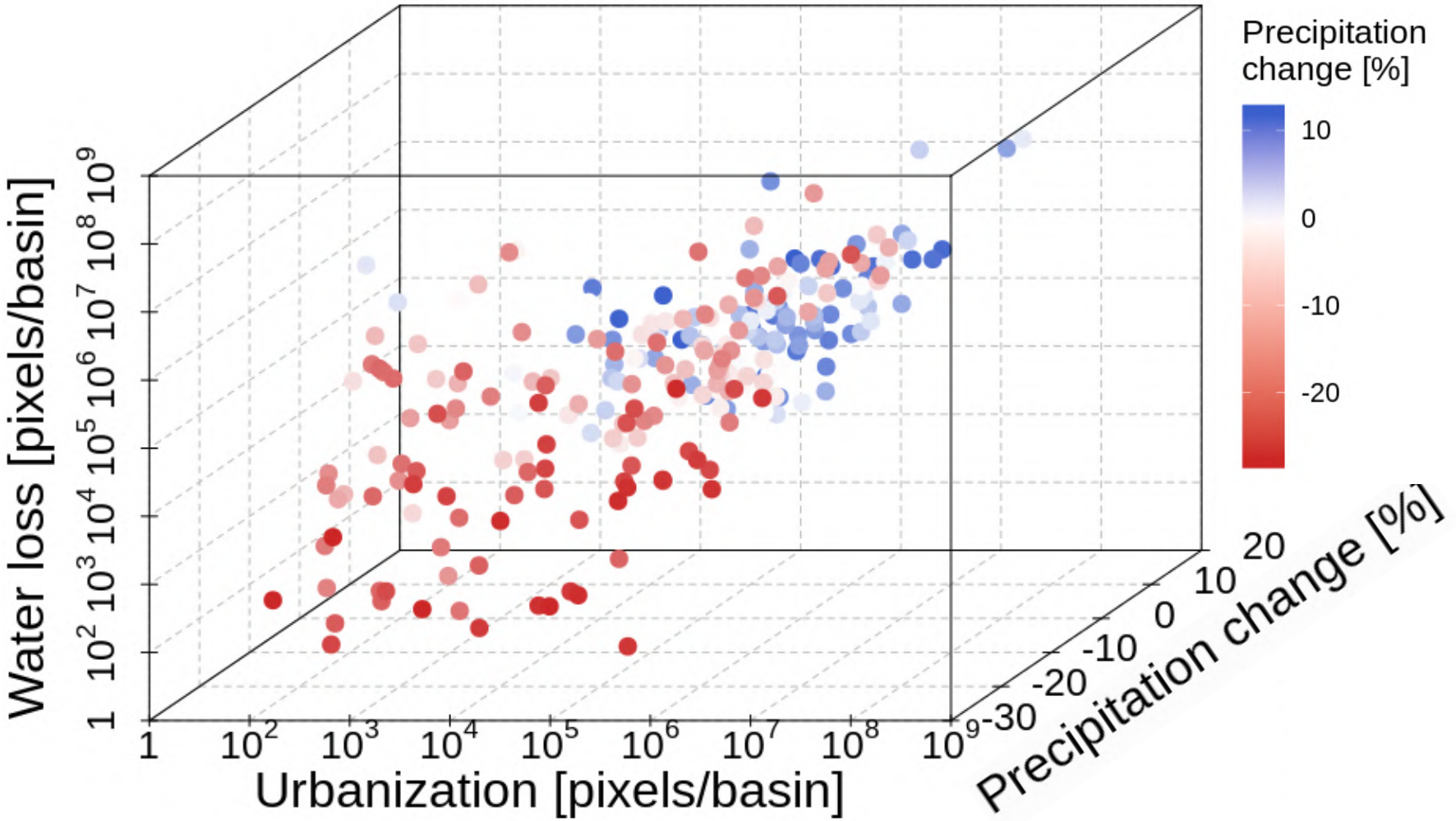




Results

Correlation between surface water loss, urbanization, and precipitation variation

Basins w/ # water loss and urbanized pixels ≥ 1 and area greater than or equal to 1000 km² (244 basins)



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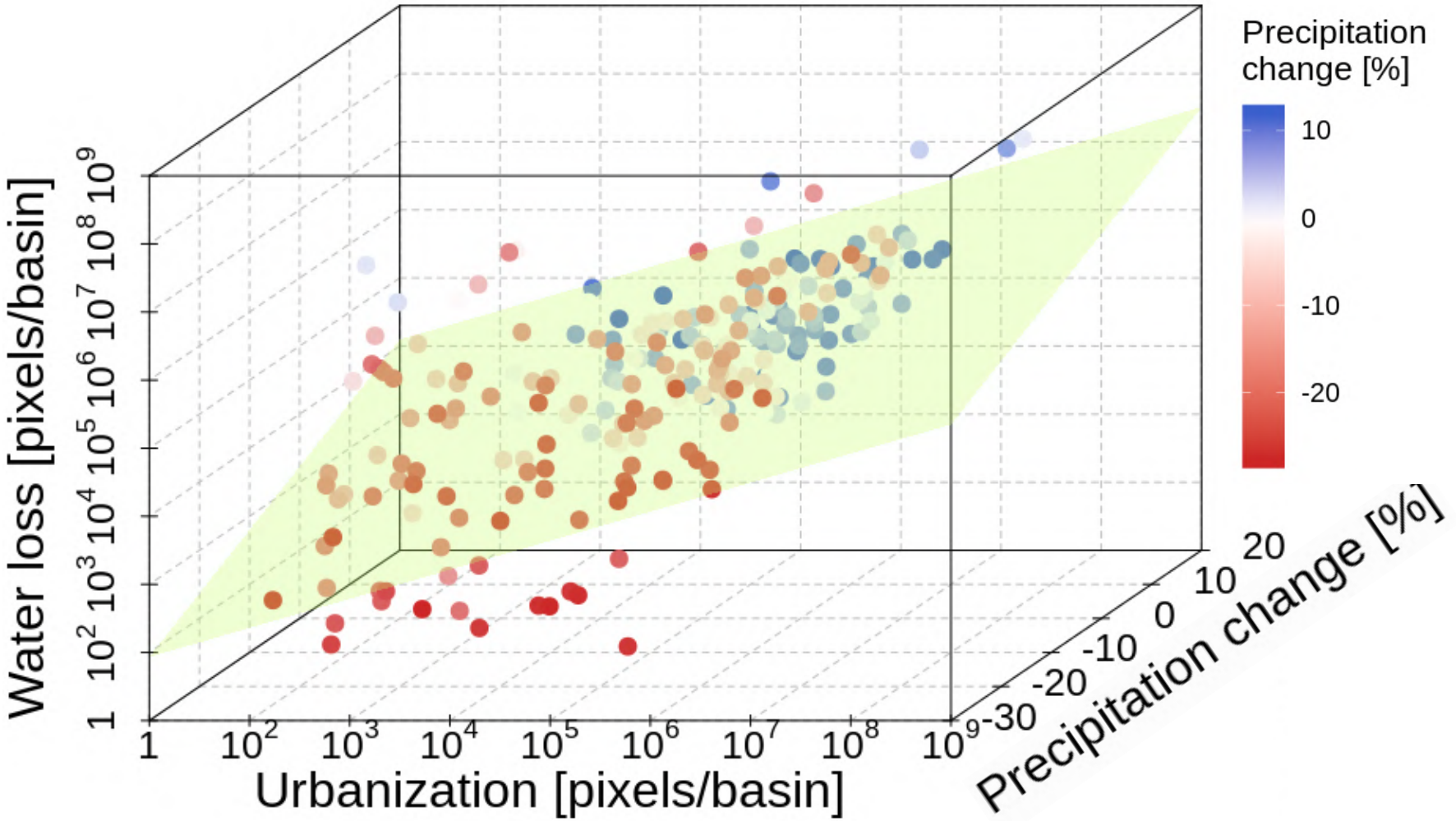

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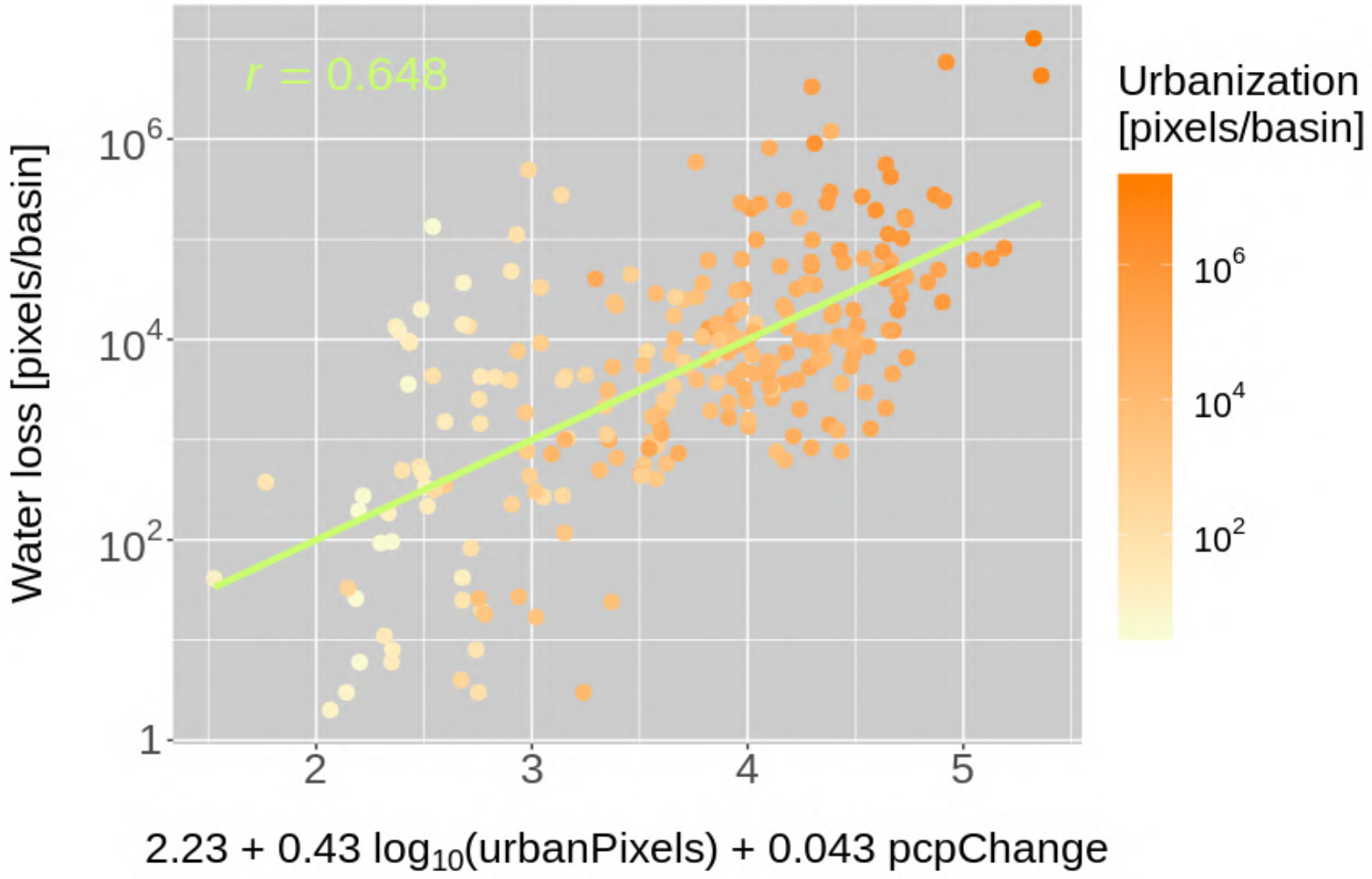
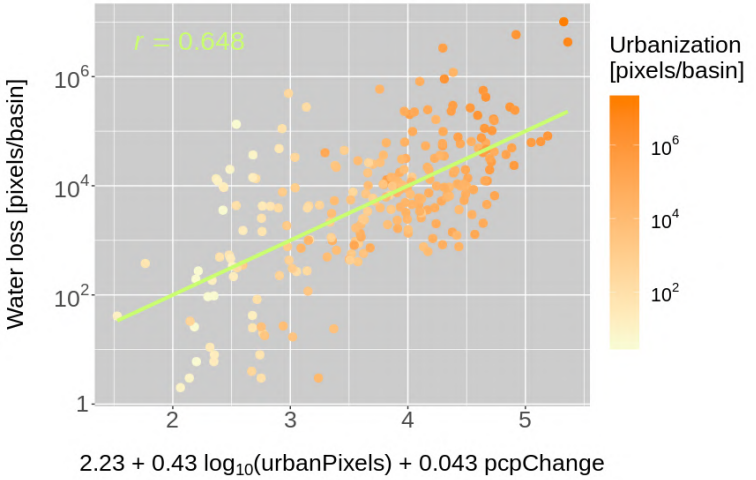


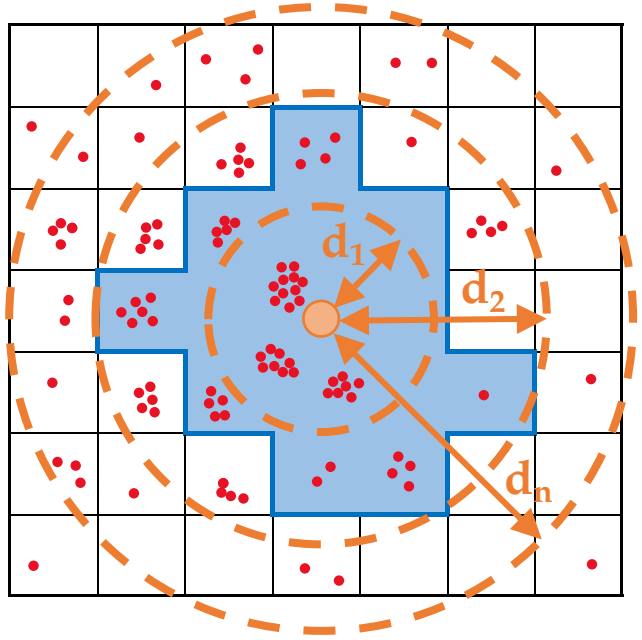
Conclusions and future steps

The analysis of USA study area shows the presence of a correlation between surface water loss, urbanization and climate variation at the basin scale



This correlation needs to be studied at the local scale:

- Identification of surface water loss regions
- Study of data spatial clustering
- Application of this approach to other study areas



Thank you for your attention!

References

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