Global scale mapping of the when and where of inland and coastal waters over 32 years at 30m resolution

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DOI: 10.1038/nature20584

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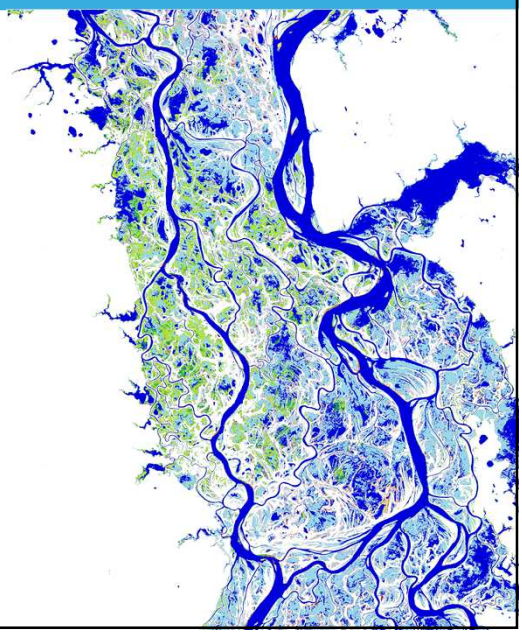
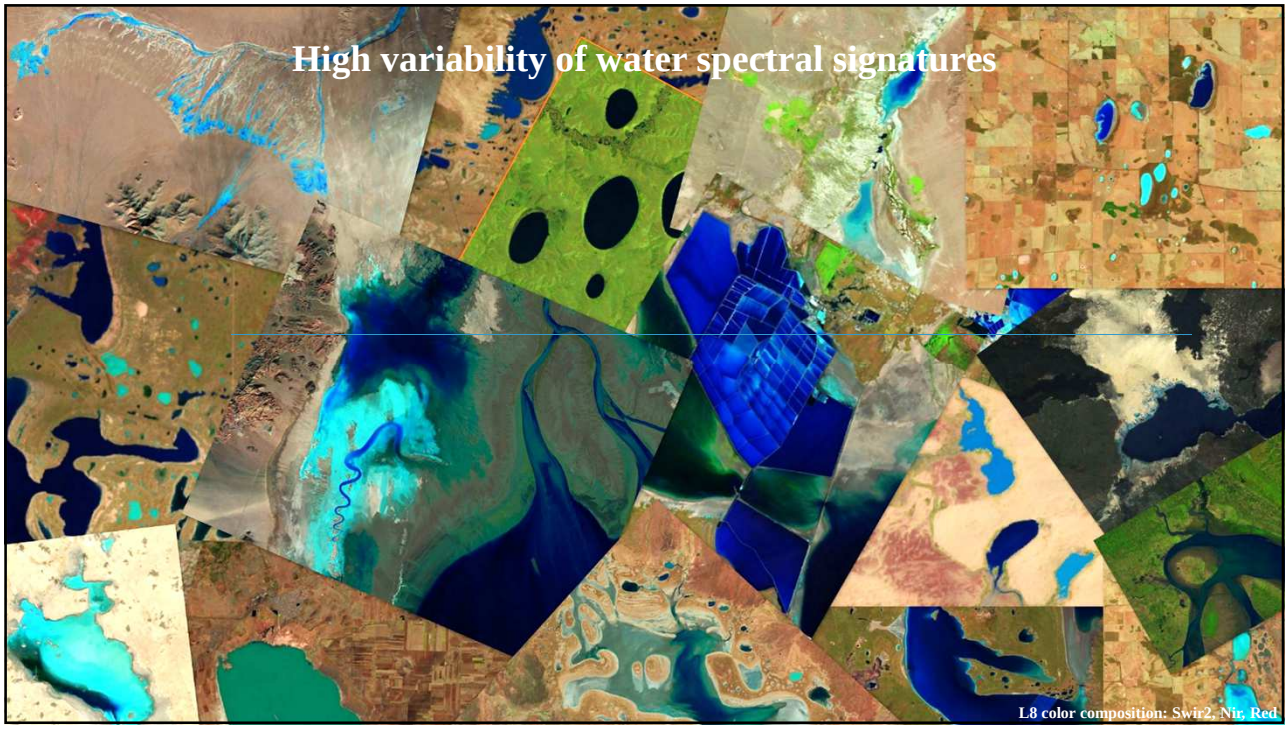
° Google Earth Engine

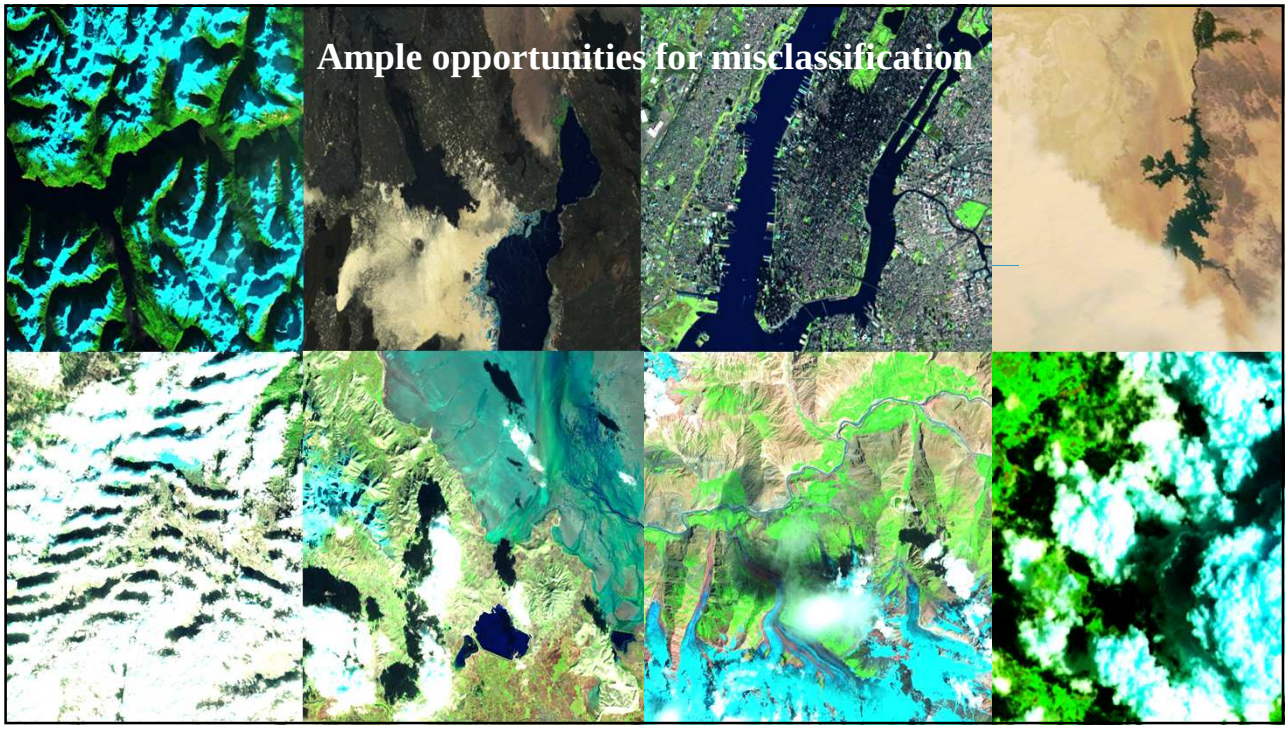


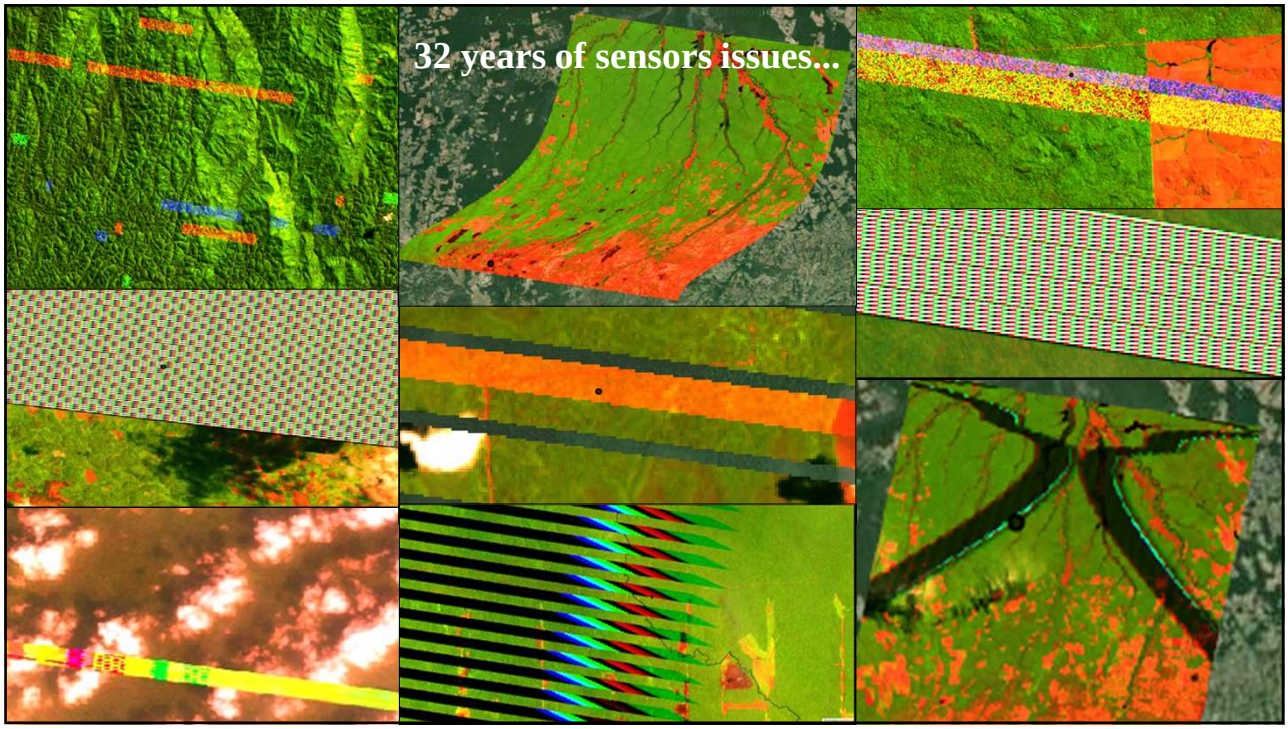
Objectives

Addressing some of the key questions related to the surface water dynamics

- Where has surface water occurred over the past 3 decades ?
- When do water bodies fill and empty ?
- What about their inter and intra-annual variability ?
- How likely is it to find water in any given place and month ?
- When and where have new/ex water-bodies formed/disappeared ?
- What form did changes take, in terms of seasonality and persistence ?
- What about trends ?


High variability of water spectral signatures
L8 color composition: Swir2, Nir, Red

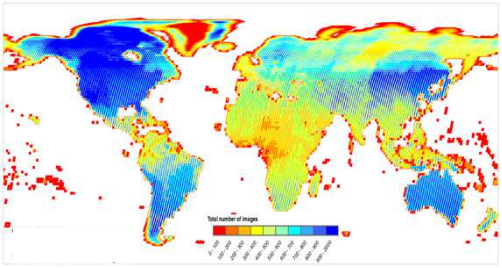

Ample opportunities for misclassification



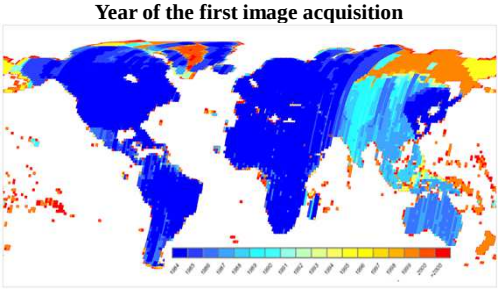
Geographic and temporal unevenness of the archive

European Commission

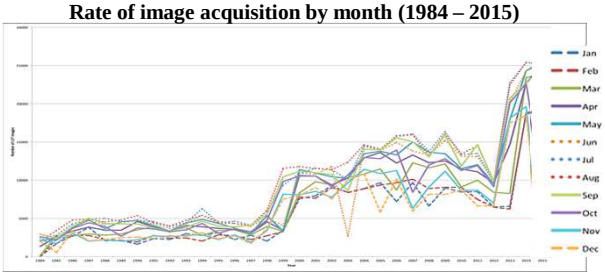
Number of L1T



Year of the first image acquisition



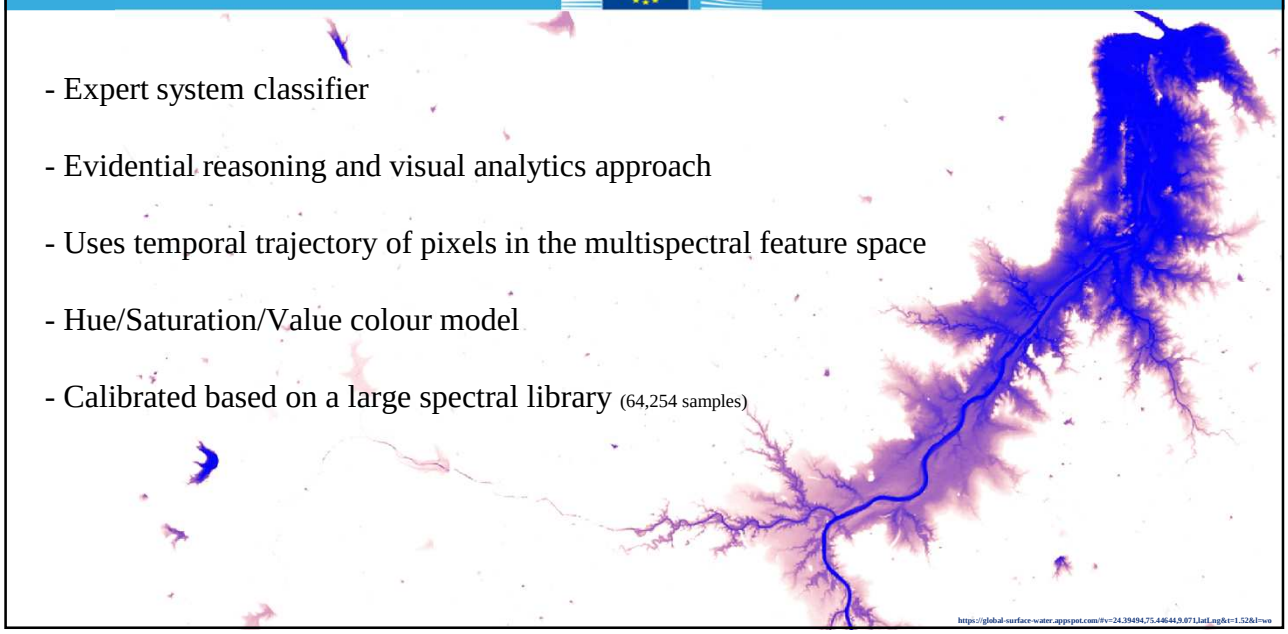
Rate of image acquisition by month (1984 – 2015)

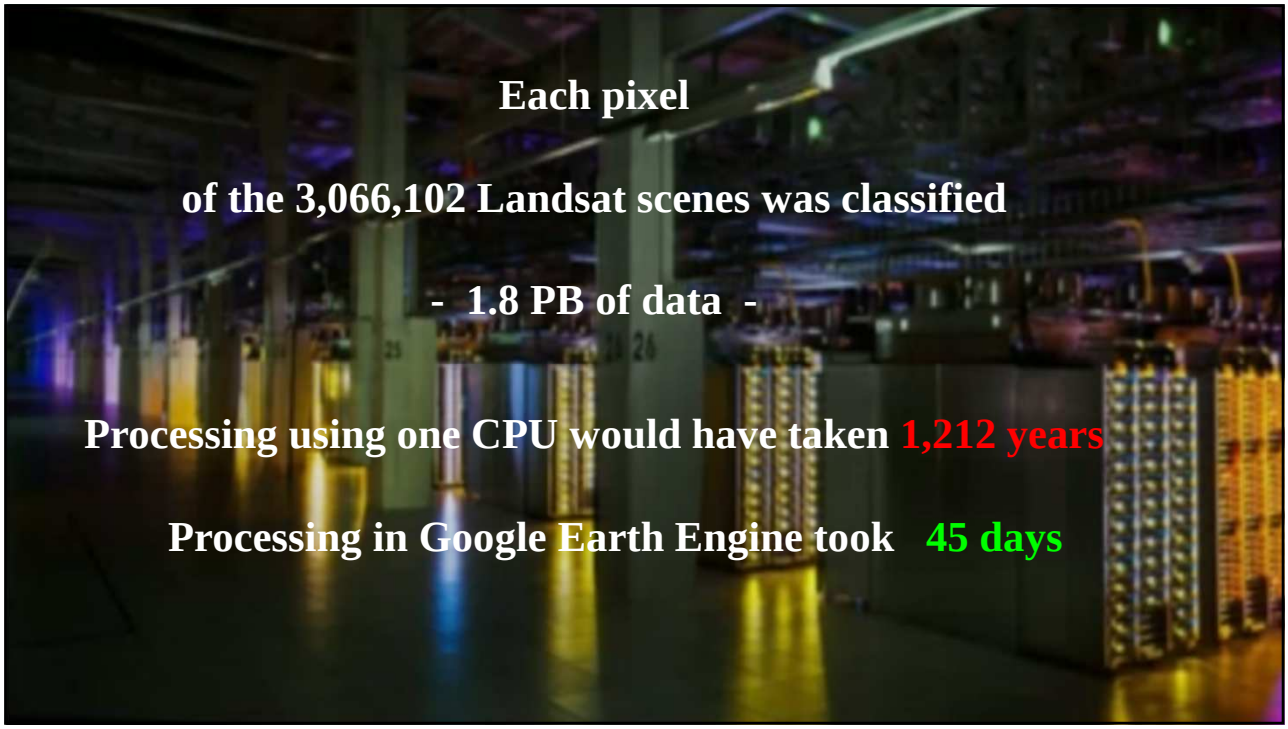


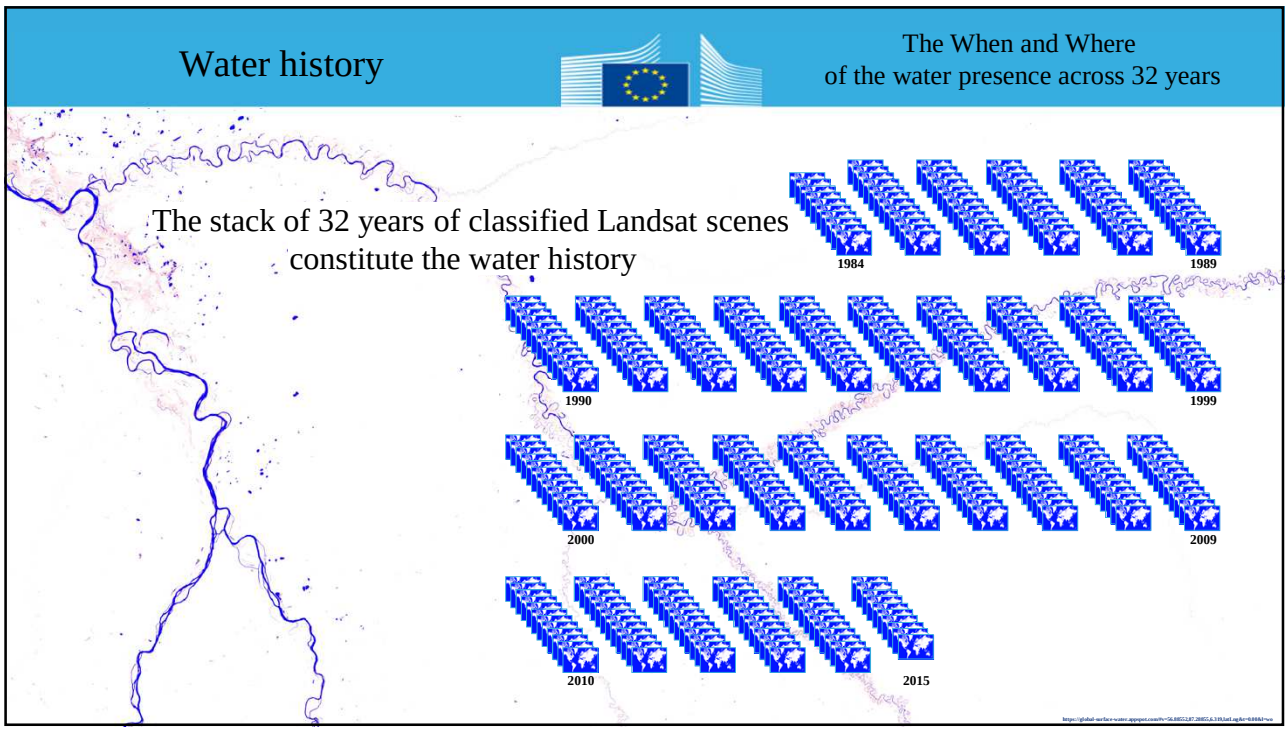
Pixel based classifier

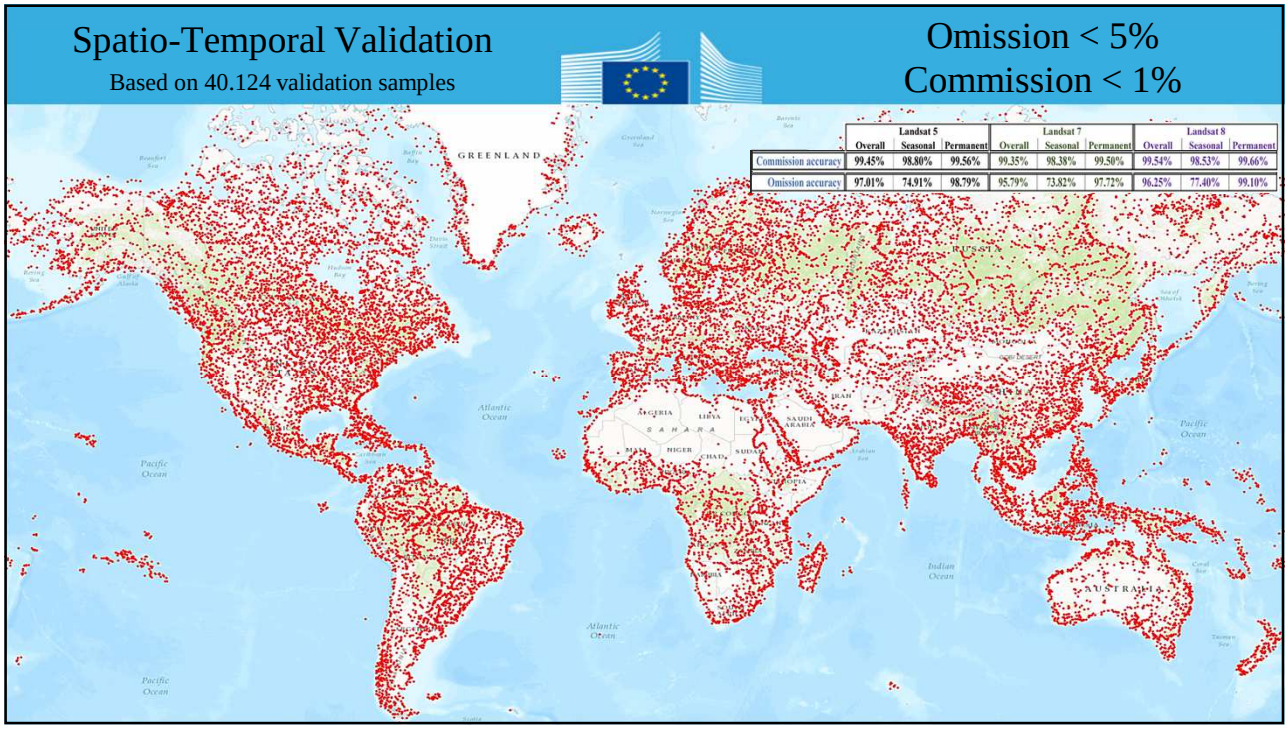
Each pixel of the 3,066,102 Landsat scenes was classified as water, land or non-valid observation

- Expert system classifier
- Evidential reasoning and visual analytics approach
- Uses temporal trajectory of pixels in the multispectral feature space
- Hue/Saturation/Value colour model
- Calibrated based on a large spectral library (64,254 samples)









	Landsat 5			Landsat 7			Landsat 8		
	Overall	Seasonal	Permaneent	Overall	Seasonal	Permanent	Overall	Seasonal	Permanent
Commission accuracy	99.45%	98.80%	99.56%	99.35%	98.38%	99.50%	99.54%	98.53%	99.66%
Omission accuracy	97.01%	74.91%	98.79%	95.79%	73.82%	97.72%	96.25%	77.40%	99.10%

Thematic Products

The validated water history was used to produce thematic products that document different facets of the surface water dynamics

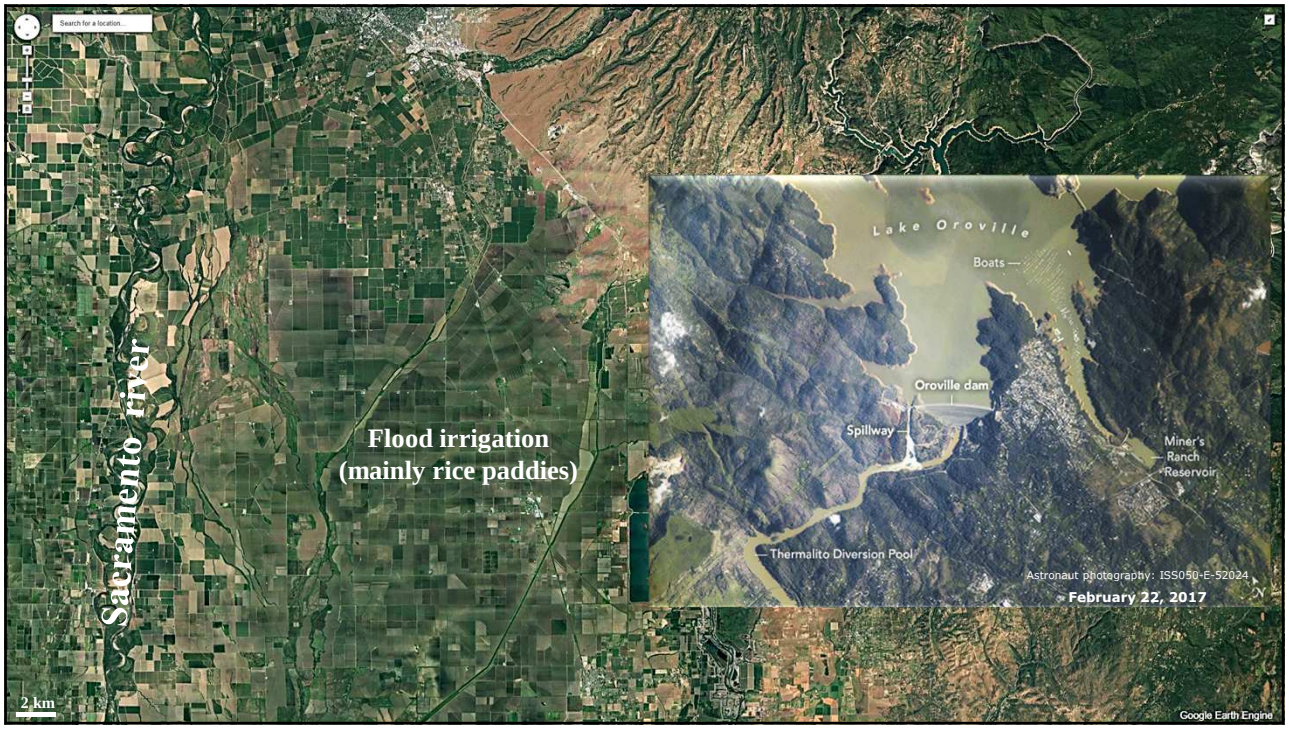
Maps & Temporal Profiles

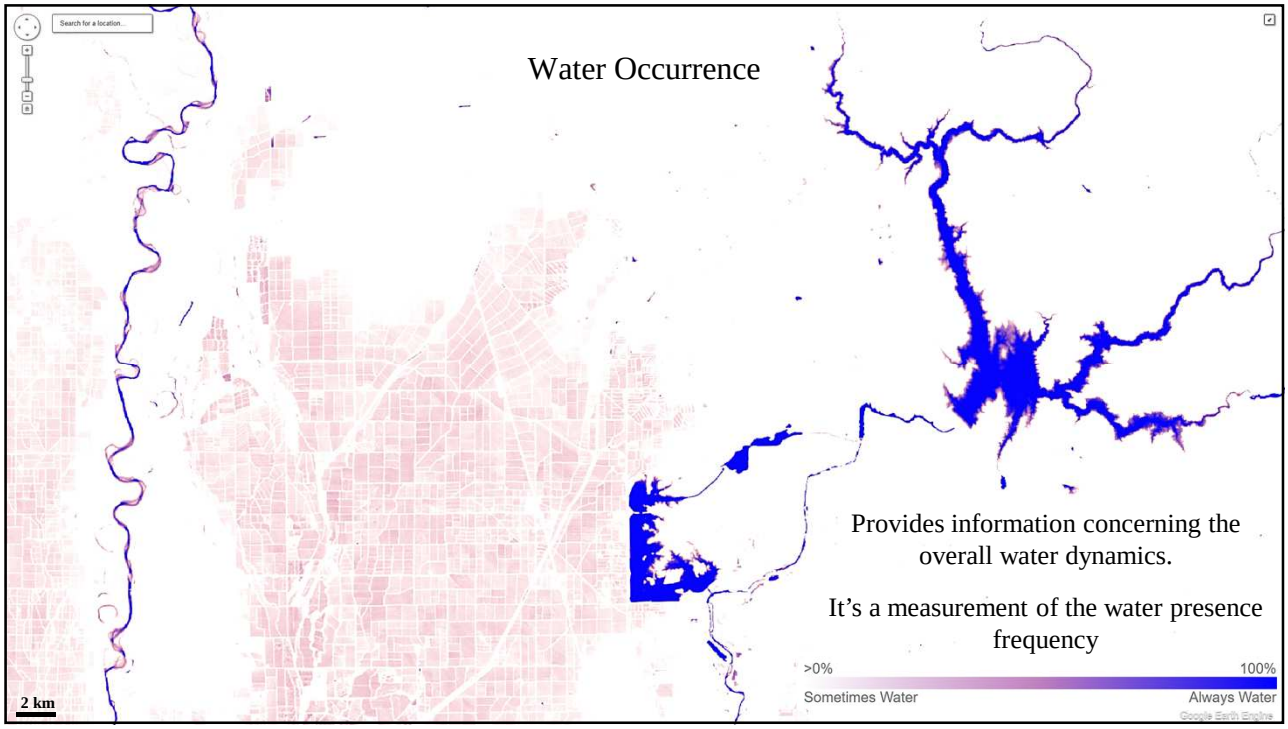
- Occurrence
- Occurrence Change Intensity
- Seasonality
- Recurrence
- Water Transition
- Max Water Extent

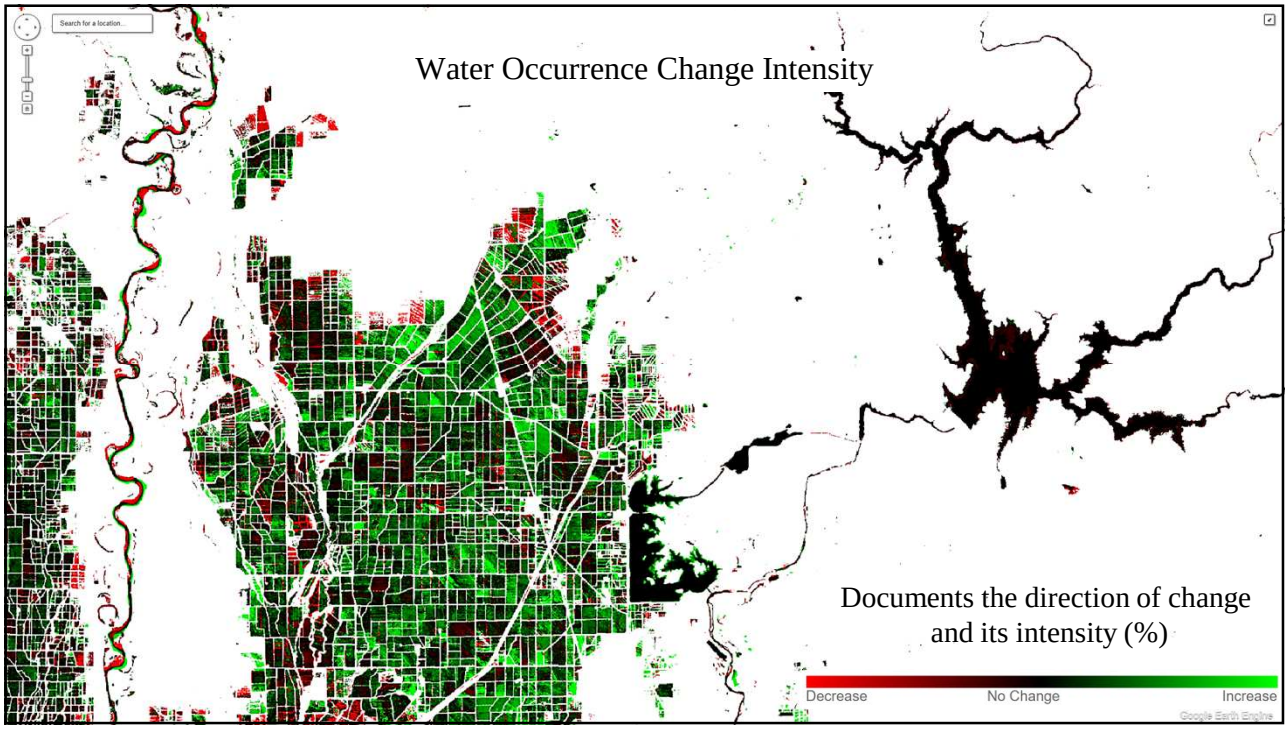
Full monthly water history

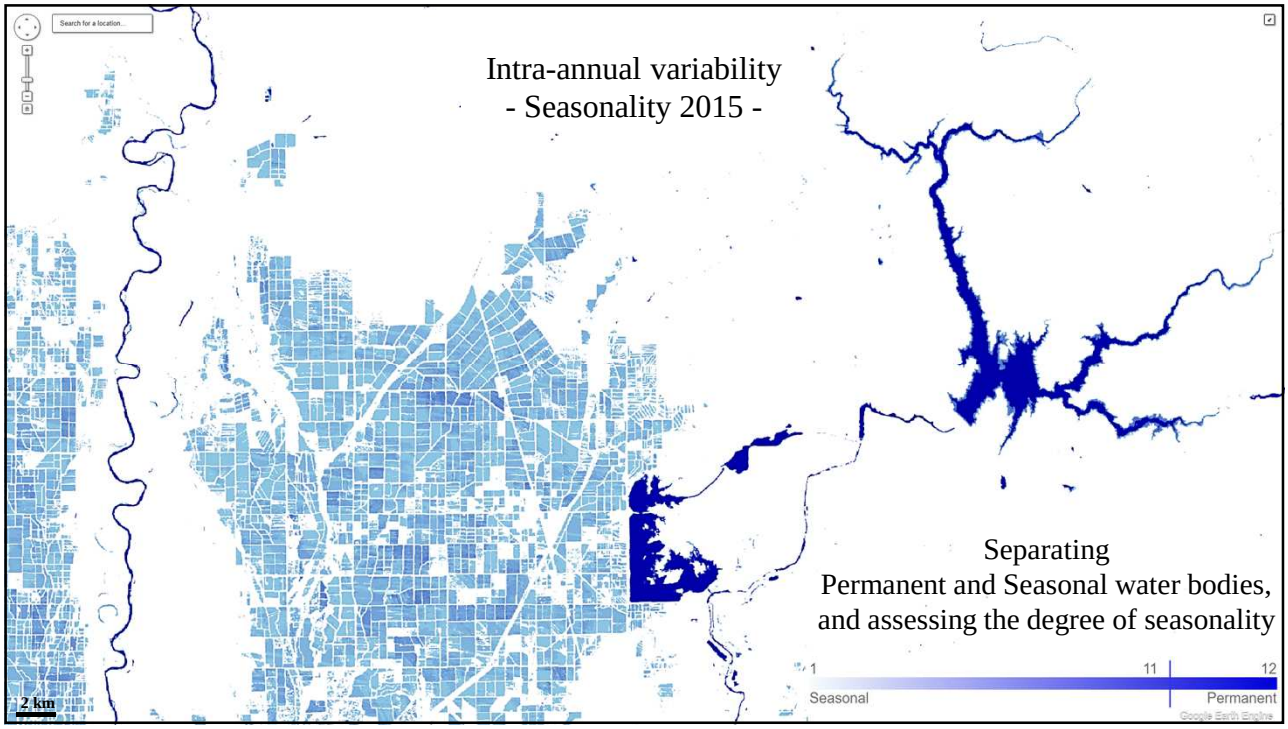
(+Metadata layers)

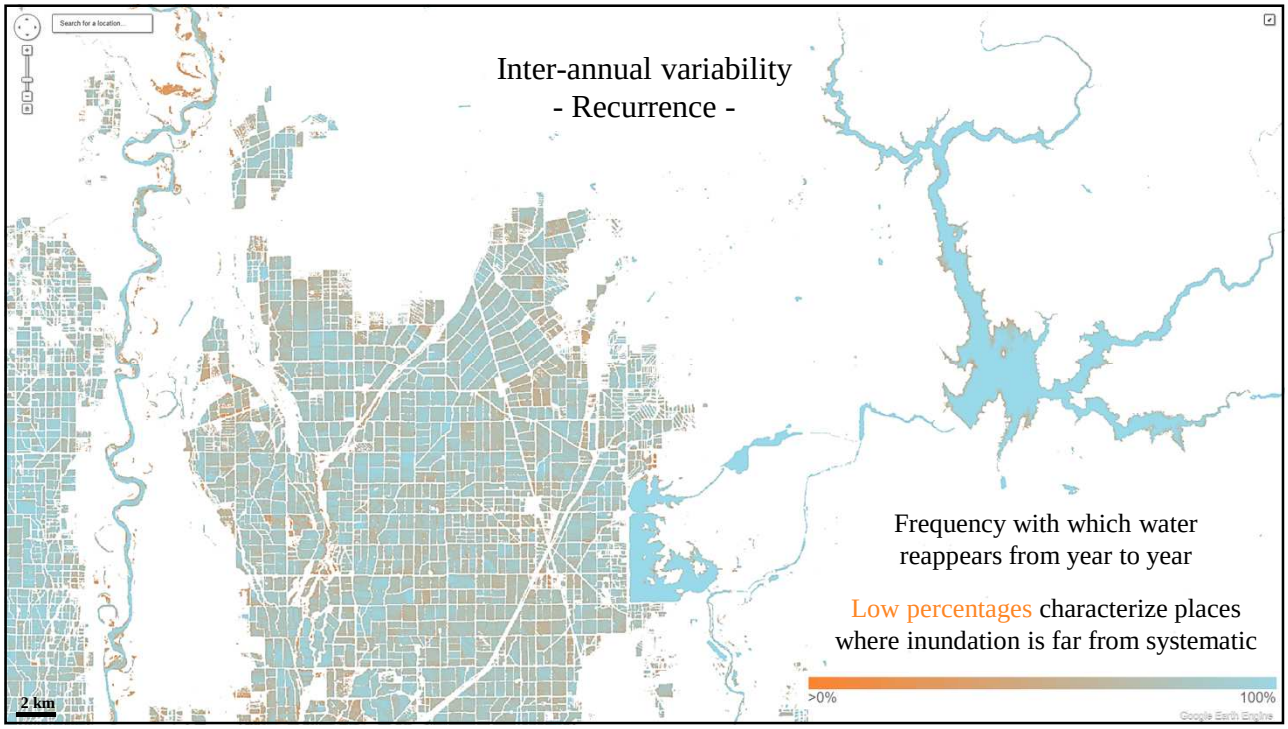
https://global-surface-water.appspot.com/

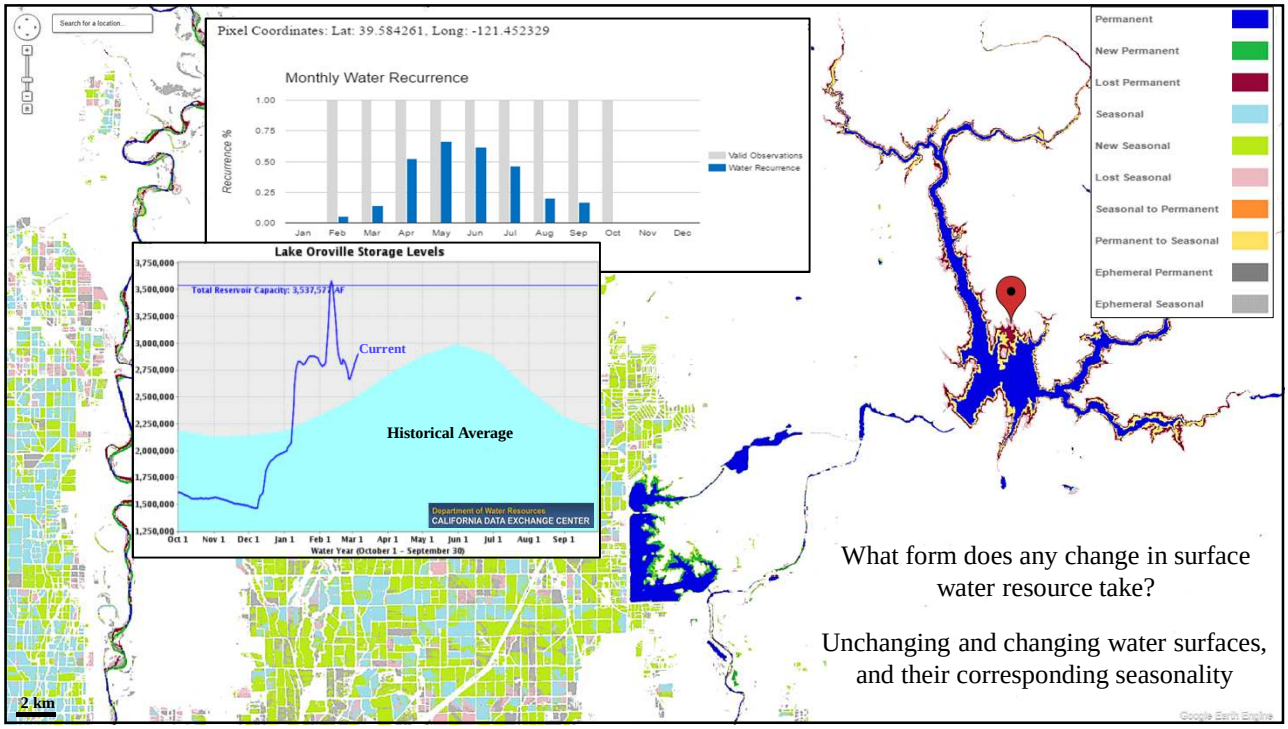


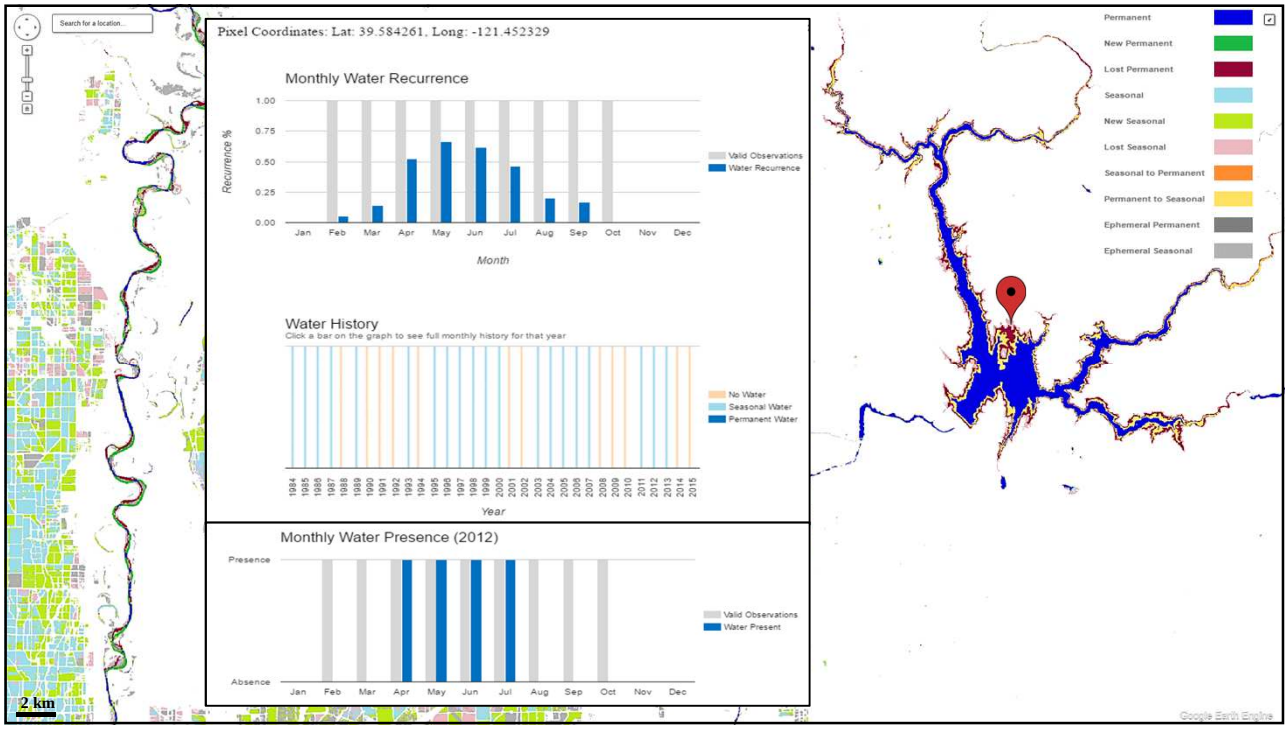

Search for a location...
Water Occurrence
Provides information concerning the overall water dynamics.
It's a measurement of the water presence frequency
>0%
100%
Sometimes Water
Always Water
2 km
Google Earth Engine


Search for a location...
Water Occurrence Change Intensity
Documents the direction of change and its intensity (%)
Decrease
No Change
Increase
Google Earth Engine

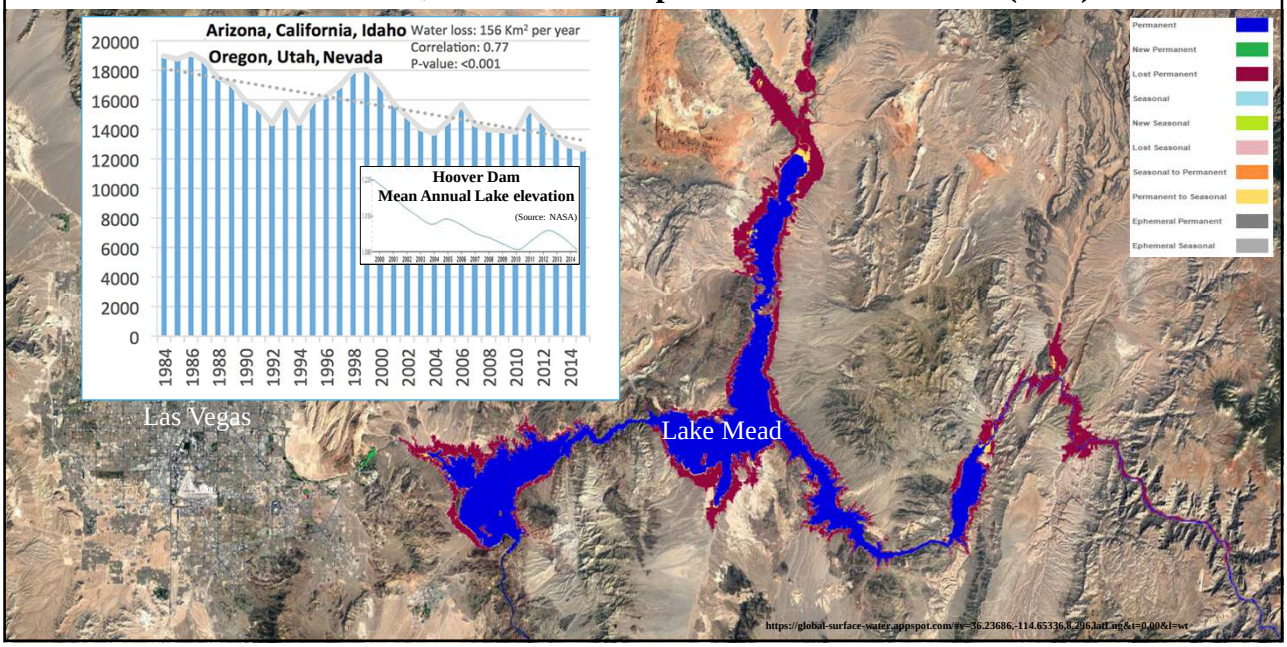

Search for a location...
Intra-annual variability
- Seasonality 2015 -
Separating
Permanent and Seasonal water bodies,
and assessing the degree of seasonality
1
11
12
Seasonal
Permanent
2 km
Google Earth Engine


Search for a location...
Inter-annual variability
- Recurrence -
Frequency with which water
reappears from year to year
Low percentages characterize places
where inundation is far from systematic
>0%
100%
2 km
Google Earth Engine

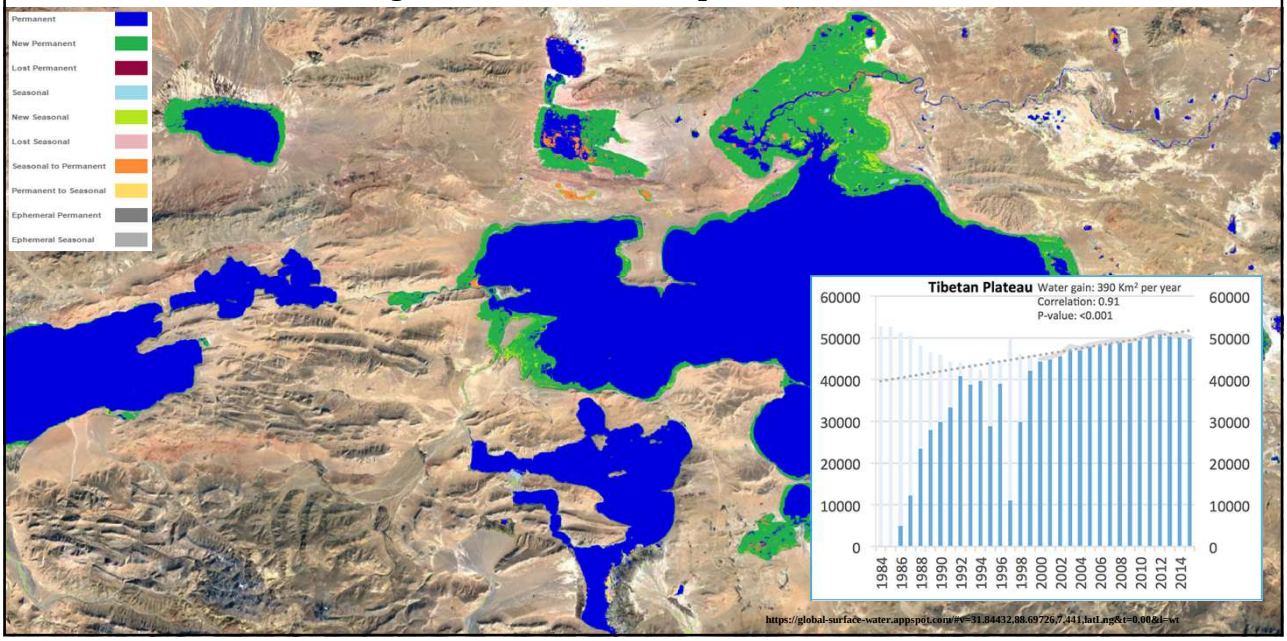

Pixel Coordinates: Lat: 39.584261, Long: -121.452329
Monthly Water Recurrence
Recurrence %
Valid Observations
Water Recurrence
Lake Oroville Storage Levels
Total Reservoir Capacity: 3,537,577 AF
Current
Historical Average
Department of Water Resources
CALIFORNIA DATA EXCHANGE CENTER
Water Year (October 1 – September 30)
Permanent
New Permanent
Lost Permanent
Seasonal
New Seasonal
Lost Seasonal
Seasonal to Permanent
Permanent to Seasonal
Ephemeral Permanent
Ephemeral Seasonal
2 km
What form does any change in surface water resource take?
Unchanging and changing water surfaces, and their corresponding seasonality


Pixel Coordinates: Lat: 39.584261, Long: -121.452329
Monthly Water Recurrence
Recurrence %
Valid Observations
Water Recurrence
Month
Water History
Click a bar on the graph to see full monthly history for that year
No Water
Seasonal Water
Permanent Water
Year
Monthly Water Presence (2012)
Presence
Absence
Valid Observations
Water Present
Permanent
New Permanent
Lost Permanent
Seasonal
New Seasonal
Lost Seasonal
Seasonal to Permanent
Permanent to Seasonal
Ephemeral Permanent
Ephemeral Seasonal
2 km

Drought and sustained demands for water have seen six western states lose more than 6,000 km^2 of their permanent surface water (33%)



Lakes on the Tibetan Plateau have increased in area by 20% with respect to the 1980s: Grazing land is lost and transport links threatened



The Aral Sea has lost around 1200 km^2 per year since 1986
Some recovery is apparent after 2015