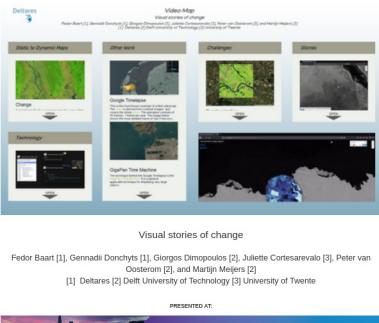
Video Map



Visual stories of change

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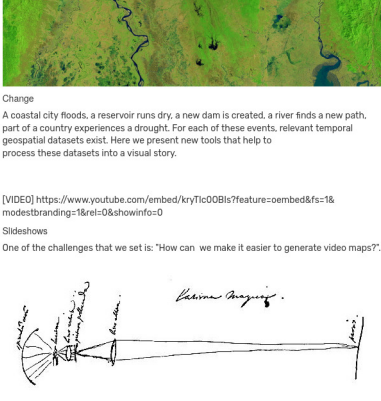
PRESENTED AT:

STATIC TO DYNAMIC MAPS



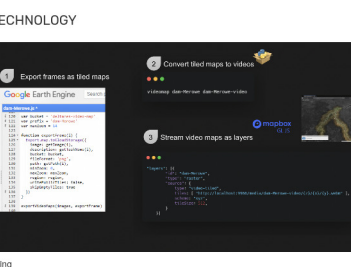
Change

A coastal city floods, a reservoir runs dry, a new dam is created, a river finds a new path, part of a country experiences a drought. For each of these events, relevant temporal geospatial datasets exist. Here we present new tools that help to
process these datasets into a visual story.

[VIDEO] https://www.youtube.com/embed/kryTlc00BIs?feature=oembed&fs=1&modestbranding=1&rel=0&showinfo=0

Slideshows

One of the challenges that we set is: "How can we make it easier to generate video maps?".

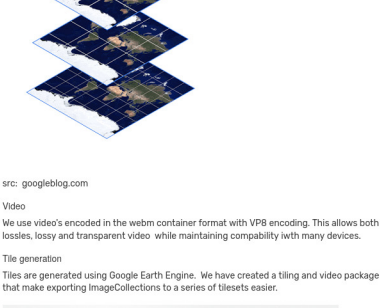


We want to go from static maps and slideshow maps (maps with low framerate animation) to video maps. A static map does not change in time. A slideshow map shows only a few frames with a framerate lower than what is perceived as a video (<13fps).

Interactive

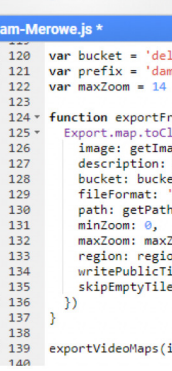
Interactive functionality helps to explore data. A common map allows several interactions. Navigational in space is done using zooming, panning and sometimes with tilting and rotating. Inspecting changes over time also require interactions: playing, pausing, stepping, seeking, rewinding and looping. One can also imagine that it would be worthwile to be able to zoom out in time, from days, to seasons, to years to decades.

TECHNOLOGY



Tiling

We use the TMS tiling scheme to show video's at the relevant scale. At scale 0 the world is 512x512 pixels. At level 7 there are 16384 tiles to create a 4GigaPixel video.



src: googleblog.com

Video

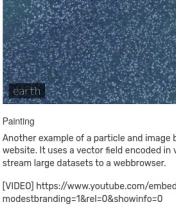
We use video's encoded in the webm container format with VP8 encoding. This allows both lossles, lossy and transparent video while maintaining compability iwth many devices.

Tile generation

Tiles are generated using Google Earth Engine. We have created a tiling and video package that make exporting ImageCollections to a series of tilesets easier.

Frames to videos

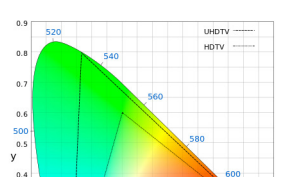
We created a python package to transform a series images per tile to a video per tile. This is done by creating an ffmpeg pipeline using the python-ffmpeg package.



Map component

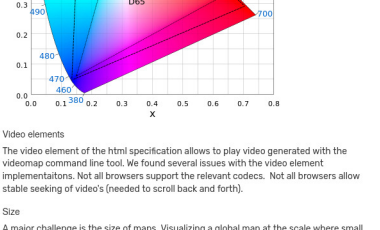
Architecture

OTHER WORK



Google Timelapse

This is the most known example of a tiled videomap. The video is derived from Landsat images and covers the whole globe. The animation consists of 35 frames, 1 frame per year. The image below shows the most detailed frame of San Francisco.

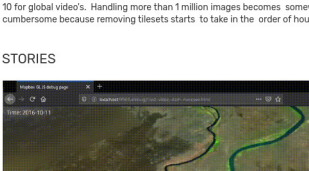


GigaPan Time Machine

The technique behind the Google Timelapse is the GigaPan Time Machine. It is a general applicable technique for displaying very large video's.

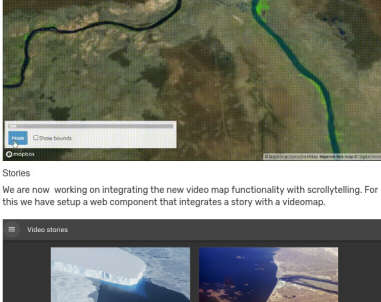
Leaflet

The leaflet map component includes the option to load arbitrary html elements on the map. This can also be used to display video elements on the map.



Earth Nullschool

Another noteworthy example that appears to show a video are the weather maps of nullschool and hint.fm. These are not true video's but a particle model running running in an html canvas. This technique was picked up by several researchers and websites such as windy.com.

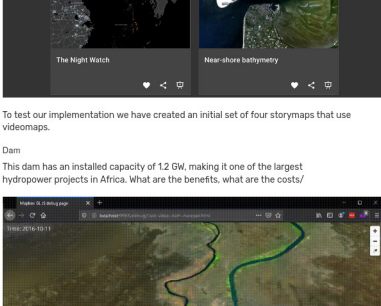


Painting

Another example of a particle and image based advection model is the openearth/painting website. It uses a vector field encoded in video. This is an example where a video is used to stream large datasets to a webbrowser.

[VIDEO] https://www.youtube.com/embed/2jt8KJwsXkA?feature=oembed&fs=1&modestbranding=1&rel=0&showinfo=0

CHALLENGES



Synchronization

It is challenging to play multiple video's in sync. When you start two video's at the same time they are not in sync because they have to load data from the internet.

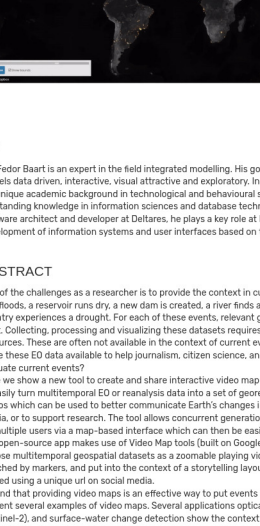
There are several approaches to syncing video's. The web timing group is working on a shared timing object that you can use to keep several media sources in sync. This works good for playing long video's that are continuously playing.

[VIDEO] https://www.youtube.com/embed/UI9otGX1zuM?feature=oembed&fs=1&modestbranding=1&rel=0&showinfo=0
The advantage of this approach is that it also allows to play a video in sync accross devices. This allows for cooperative mapping activities.

[VIDEO] https://www.youtube.com/embed/TPqeODGRPsM?feature=oembed&fs=1&modestbranding=1&rel=0&showinfo=0
One disadvantage is that this implementation is not optimized for seeking and stepping in time. Sometimes it is necessary that video's are shown at exactly the same frame. This is not ensured using the timing object approach. For this use case we created an extra mediaplayer.

Codecs

When you want to share a video map, it needs to show up in a browser. Ideally you want a video that contains all the color information (lossless, bytes per pixel) and works on all browsers. A channel for transparency is also nice because it allows to show a video on a background map. Unfortunately not all combinations work. Finding an optimal codec and quality setting combination can take quite some effort.



Video elements

The video element of the html specification allows to play video generated with the videomap command line tool. We found several issues with the video element implementaitons. Not all browsers support the relevant codecs. Not all browsers allow stable seeking of video's (needed to scroll back and forth).

Size

A major challenge is the size of maps. Visualizing a global map at the scale where small roads are visible (level 15 at 5m per pixel) requires 6.7TB per frame. This is the resolution of modern optical satellites.

We handle this large amount of data by providing the possibility to select geometries for which to generate videio's. We store video's in the google cloud. This works fine up to level 10 for global video's. Handling more than 1 million images becomes somewhat cumbersome because removing tilesets starts to take in the order of hours.

STORIES

Stories

We are now working on integrating the new video map functionality with scrollytelling. For this we have setup a web component that integrates a story with a videomap.

To test our implementation we have created an initial set of four storymaps that use videomaps.

Dam

This dam has an installed capacity of 1.2 GW, making it one of the largest hydropower projects in Africa. What are the benefits, what are the costs/

Ice

This is the Thwaites glacier with next to it the iceberg B22A. This remote location is the major source for future sea-level rise in many projections.

Night

As the earth turns dark we can zoom into human activity. What are we upto?

CV

Dr. Fedor Baart is an expert in the field integrated modelling. His goal is to make computer models data driven, interactive, visual attractive and exploratory. In his work he combines his unique academic background in technological and behavioural sciences, with his outstanding knowledge in information sciences and database technology. In his role as software architect and developer at Deltares, he plays a key role at Deltares in the development of information systems and user interfaces based on the latest technology.

ABSTRACT

One of the challenges as a researcher is to provide the context in current events. A coastal city floods, a reservoir runs dry, a new dam is created, a river finds a new path, part of a country experiences a drought. For each of these events, relevant geospatial datasets exist. Collecting, processing and visualizing these datasets requires experience, time and resources. These are often not available in the context of current events. What if we could make these EO data available to help journalism, citizen science, and researchers to quickly evaluate current events?
Here we show a new tool to create and share interactive video map stories. The tool allows to easily turn multitemporal EO or reanalysis data into a set of georeferenced and tiled videos which can be used to better communicate Earth's changes in journalism, social media, or to support research. The tool allows concurrent generation of video map stories by multiple users via a map-based interface which can then be easily shared.
The open-source app makes use of Video Map tools (built on Google Earth Engine API) to expose multitemporal geospatial datasets as a zoomable playing video story, which can be enriched by markers, and put into the context of a storytelling layout. The story can be shared using a unique url on social media.
We find that providing video maps is an effective way to put events into context. We will present several examples of video maps. Several applications optical images (Landsat and Sentinel-2), and surface-water change detection show the context of a day zero event in South Africa. Moving populations based on the night lights of the VIIRS show challenges in the Ethiopian, Sudanese, Eritrean border after the dam was constructed. Ocean and coastal currents derived from the Global Tide and Surge Model and HYCOM reanalysis allow to reconstruct the currents and reconstruct the final days of a ship lost at sea. Video maps based on the TROPOMI mission allow to zoom in and look at the sources of atmospheric pollution (NO2).
By making these stories available at the fingertips of journalists, citizens and scientists we hope to help provide more detailed and accurate context for the many challenges that our world is currently facing.

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