ITS_LIVE QGIS user guide

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Table of Contents

OVERVIEW	. 2
TECHNICAL DESCRIPTION	. 2
GETTING STARTED	. 3
PROFILE ANALYSIS OF A TIME SERIES	. 5
RASTER DIFFERENCING	.9
3D VIEW OF ICE FLOW - BERING/BAGLEY	11

Overview

This guide describes how to display and analyze ITS_LIVE data in QGIS. The tutorial below focuses primarily on how to work with ITS_LIVE .qgz files, which allow fast access to ITS_LIVE ice speed mosaics without the need to download any data. The .qgz files enable an intuitive way to explore data and perform simple numerical analysis of the scalar ice speed data for any given year; however, access to x and y velocity components, uncertainties, masks, etc., requires downloading the netCDF data files.

Technical description

Each QGIS project file (extension .qgz) contains layers that point to the ice speed data and a basemap. The ice speed values files exactly match the 'v' variable in the netCDF files, but are presented as cloud-optimized geoTIFF files (https://www.cogeo.org) accessed through a GDAL (https://gdal.org) virtual raster (.vrt) format xml file. The VRT file allows us to include overview images for the larger regions, and also allows QGIS to use the GDAL visicurl driver to open the COGeoTiff files using simple byte-addressable http requests, allowing us to serve large geospatial datasets from a simple web object server platform.

Getting Started

After installing QGIS on your computer (https://qgis.org), simply go to

<u>http://nsidc.org/apps/itslive/</u>, click on your region of interest, and download the QGIS project file (.qgz), and open it in QGIS:



If you are using version of QGIS < 3.0 you will need to unzip the file before loading into QGIS. The example below shows ITS_LIVE-PAT.qgz, which contains the full record of Patagonia's ice speed mosaics from 1985 to present:



Now zoom to an area of interest, change the colormap or transparency if you'd like, and click View -> Identify Features, which will allow you to click on the map to query ice speed at any location. Below, the Band 1 value indicates that we've clicked somewhere with an ice speed of 1194 m/yr.



Profile analysis of a time series

This example explores the flow evolution of Alaska's Bering Glacier. Begin by opening the ITS_LIVE-ALA.qgz project file and zoom to Bering Glacier, indicated by a blue box in the screenshot below:



Choose "Terrain profile" plugin icon. If you don't see the icon, simply install the "Profile tool" from the Plugins menu:





Trace a profile up the centerline of Bering Glacier (double click last point to finish):

In the Layers menu on the left side of the screen, expand the Annual Speed layer and select 2018 (the year is selected when it is grey, not when it is checked), After selecting the 2018 annual velocity layer, click "Add Layer" button:



Add the 2015 annual velocity layer, then click on the color box to format the 2015 line in the plot:



Follow the same procedure for 2014 and 2013:



The resulting plot shows a multi-year slowdown of Bering Glacier following a surge. Units of speed for ITS_LIVE are in meters per year; x-axis units are meters along chosen line:



Raster Differencing

QGIS includes a raster calculator tool, which allows you to perform simple mathematical operations on raster layers. For example, to find out how glaciers in High Mountain Asia changed from 2014 to 2018, load the ITS_LIVE-HMA.qgz file and click Raster -> Raster Calculator. Click on the Raster Bands for the years of interest, or manually enter the expression "2018@1" - "2014@1" into the Raster Calculator Expression box. Enter a filename such as raster_difference Output layer menu and click OK to perform the raster calculation. Note that this will take a minute and will save the ~1.5 GB difference file to your local machine.

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After calculating the ice speed difference, make the new raster_difference layer visible and double-click on it to format it. Below we've chosen the divergent RdBu color ramp, set the axis values from -75 to 75 m/yr, and set the Transparency to 75%.

Information	Render type Singl	eband pseudo	color 👻	
Source	Band	Band 1	(Gray)	-
Symbology	Min	-75	Max	75
Transparency	▶ Min / Max Valu	e Settings		
Histogram	Interpolation		Linear	•
	Color ramp			-
Rendering	Label unit		Invert Color Ramp	
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Metadata	-75	-75	Greens	
Legend	-37.5	-37.5	Magma	
QGIS Server	57.0		RdGy	
	0	0	Reds	
	37.5	37.5	Spectral	
	75	75	All Color Pamps	
			Create New Color Ramp	
			Edit Color Ramp	

Now different regions of glacier speedup or slowdown are visible in the raster difference:



3D view of ice flow - Bering/Bagley

Use qgis2threejs plugin (now a default included with QGIS 3.4+) to drape speed+basemap over a (local) DEM. (DEM data not available from ITS_LIVE). The end product will look something like the video of the 3D model seen here:

http://its-live-data.jpl.nasa.gov.s3.amazonaws.com/documentation/ITS_LIVE_BeringGlacier.mov



To begin, load ITS_LIVE-ALA.qgz, and zoom to the Bering Glacier area:

Add a local DEM for the area. In this case the file we use is Alaska_albers_V3_90m from C. Keinholz. Place it at the bottom of the layer stack, and/or turn it off - it does not need to be displayed.



Choose the QGIS2threejs tool:



In the QGIS2threejs Exporter pop up window, choose the DEM layer, and you will get:



In the menu bar at the top of the screen, choose Scene \rightarrow Scene Settings... \rightarrow set Vertical Exaggeration to 4.0:



zoom by dragging, type "r" to start rotation. It should look something like the movie.

All of the data in this visualization is pulled at the needed resolution from ITS_LIVE, except for the DEM, which you will need to find on your own.