Google Earth Engine (GEE) – Theory and Application

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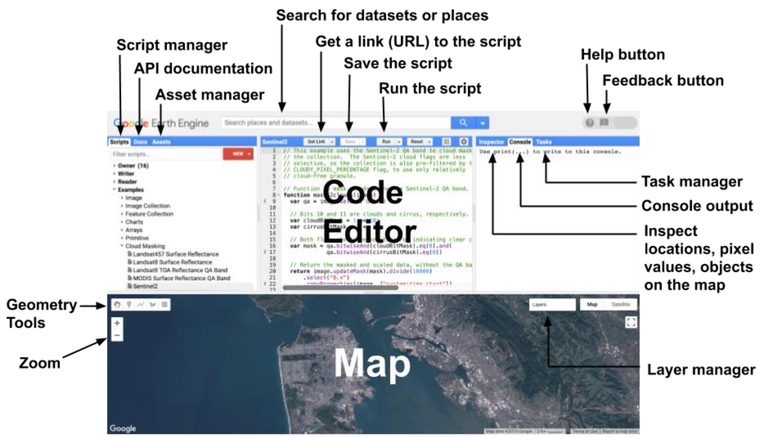
What is Google Earth Engine?

- GEE is a **cloud computing** platform with a **multi-petabyte catalog** of satellite imagery and geospatial datasets (Gorelick et al., 2017).
- GEE is a cloud-based platform that enables **large-scale processing** of satellite imagery to **detect changes**, **map trends**, and **quantify differences** on the Earth's surface. (Gandhi, 2021)



Earth Engine Code Editor

What are the GEE key components?

Data

An exhaustive catalog of remote sensing datasets, including multispectral, radar, aerial, climate, land cover, and vector.

Computation

Colocated data storage + computation

Browser-based IDE

No software to download or keep up to date. All you need is a modest internet connection.

Gandhi, 2021. End-to-End Google Earth Engine Course

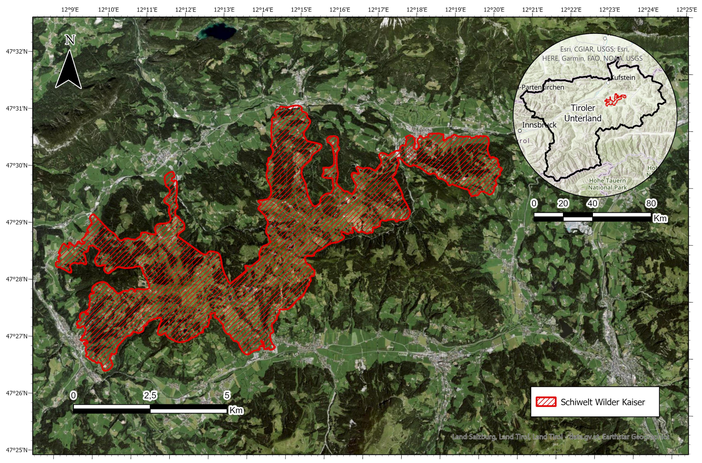
Study Case

SPATIOTEMPORAL ANALYSIS OF SNOW COVER AND LAND SURFACE TEMPERATURE IN AUSTRIA SKIING AREAS WITH GEE

Objectives

- Identify temporal variations of snow cover in Austrian Alps between 2018 and 2023, using Sentinel 2 Imagery.
- Identify temperature tendencies in Austrian Alps between 2018 and 2023, using Landsat 8 Imagery.
- Generate time series charts.

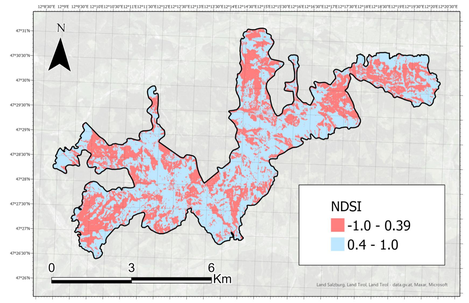
Study Area



Name: Schiwelt Wilder Kaiser - Brixental
Location: Tiroler Unterland
Area: 37,14 Km^2
Mean Elevation: 1202,96 m

Methodologies

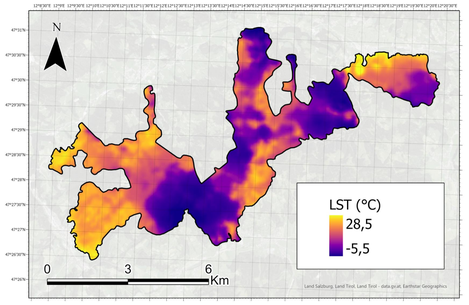
NDSI Index (Hall et al. (1995)).



NDSI Index - Schiwelt Wilder Kaiser (2020-02-28)

$$\mathbf{NDSI(Sentinel\ 2)} = \frac{B3\ - B11}{B3 + B11}$$

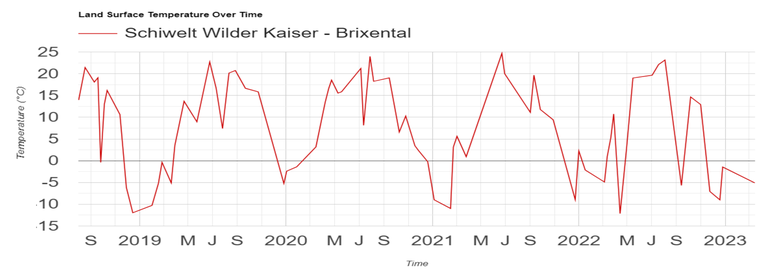
Land Surface Temperature (LST)



LST- Schiwelt Wilder Kaiser (2020-07-12)

$$T_S = \frac{T_B}{1 + \left(\lambda * \frac{T_B}{\rho}\right) ln\varepsilon}$$

Time Series



References

Gandhi, Ujaval, 2021. *End-to-End Google Earth Engine* Course. Spatial Thoughts. https://courses.spatialthoughts.com/end-to-end-gee.html

Gorelick, N., Hancher, M., Dixon, M., Ilyushchenko, S., Thau, D., & Moore, R. (2017). Google Earth Engine: Planetary-scale geospatial analysis for everyone. Remote sensing of Environment, 202, 18-27.

Hall, D. K., Riggs, G. A., & Salomonson, V. V. (1995). Development of methods for mapping global snow cover using moderate resolution imaging spectroradiometer data. Remote sensing of Environment, 54(2), 127-140.