



Suivi de l'enneigement des Pyrénées par satellite

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Universidad
Zaragoza

Interreg
POCTEFA

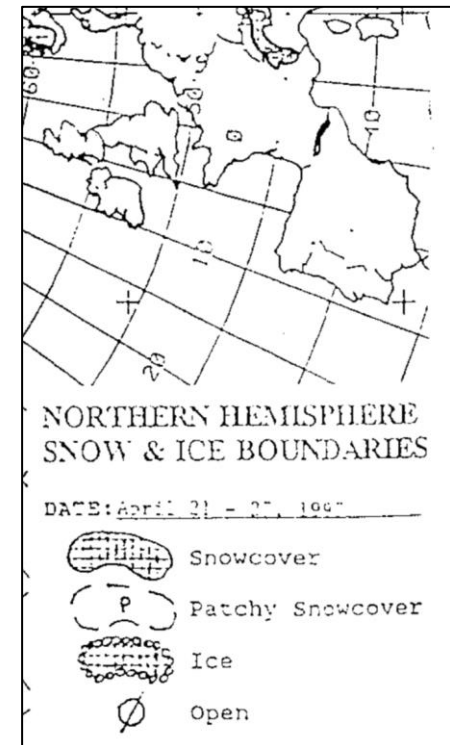
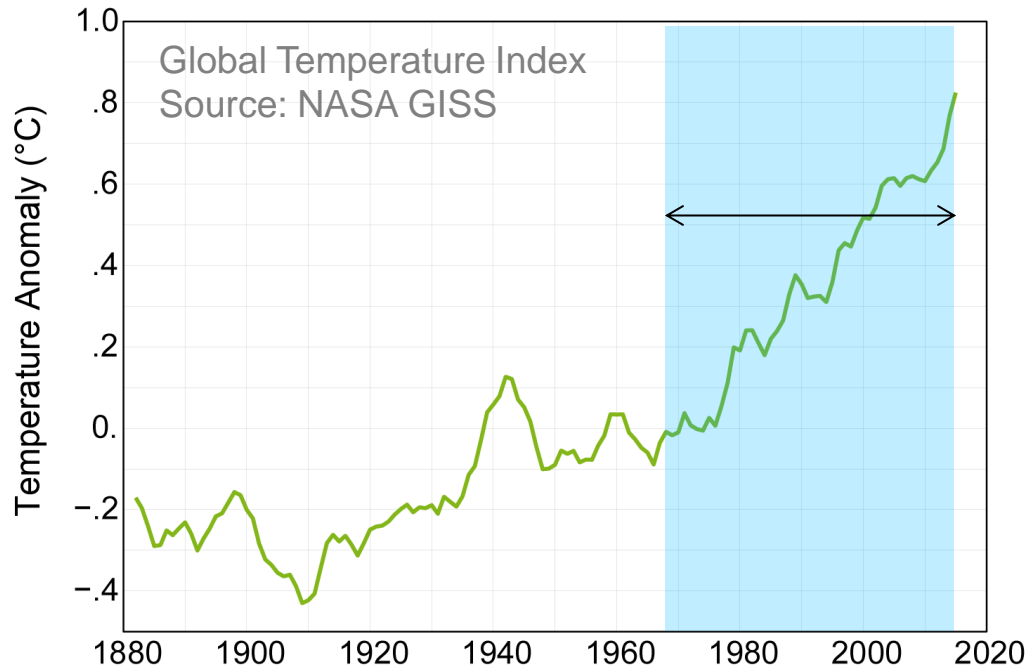


UNIÓN EUROPEA
UNION EUROPÉENNE

Fondo Europeo
de Desarrollo
Regional (FEDER)

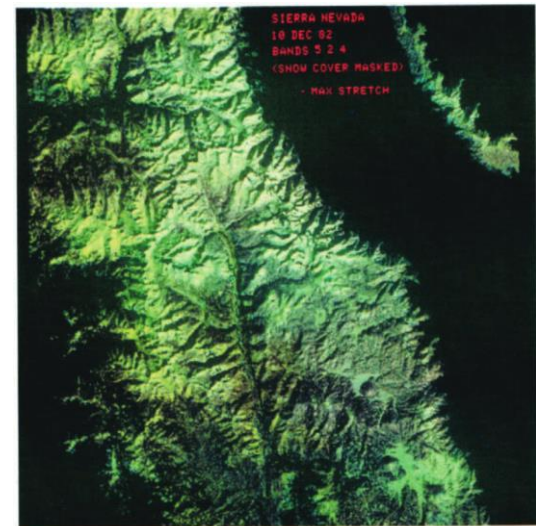
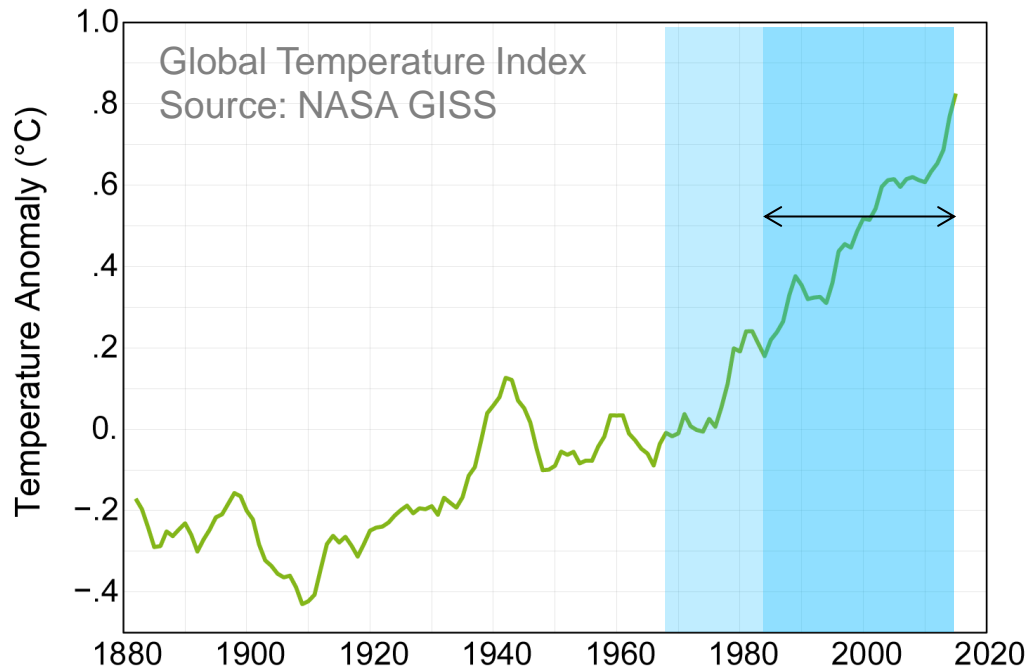
Example of the snow cover area

1966 first snow map of
North Hemisphere (NOAA)
190 km, 7 days



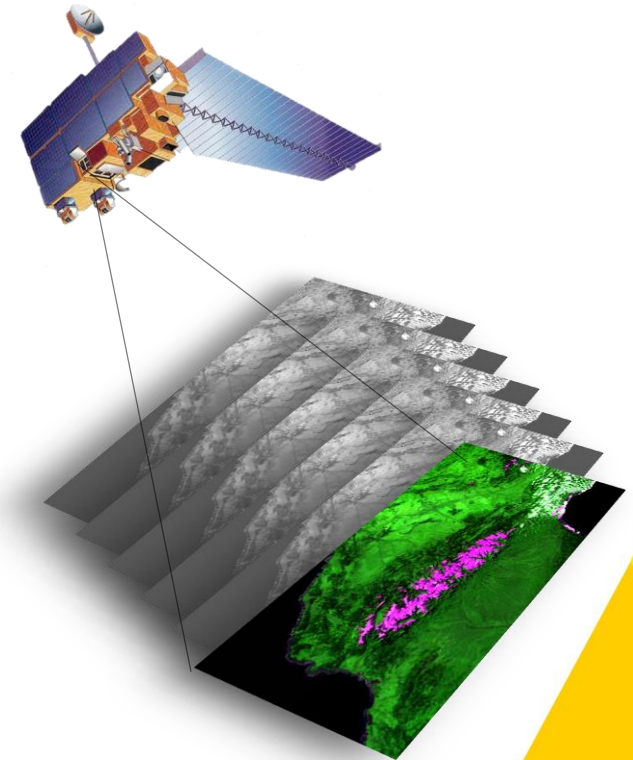
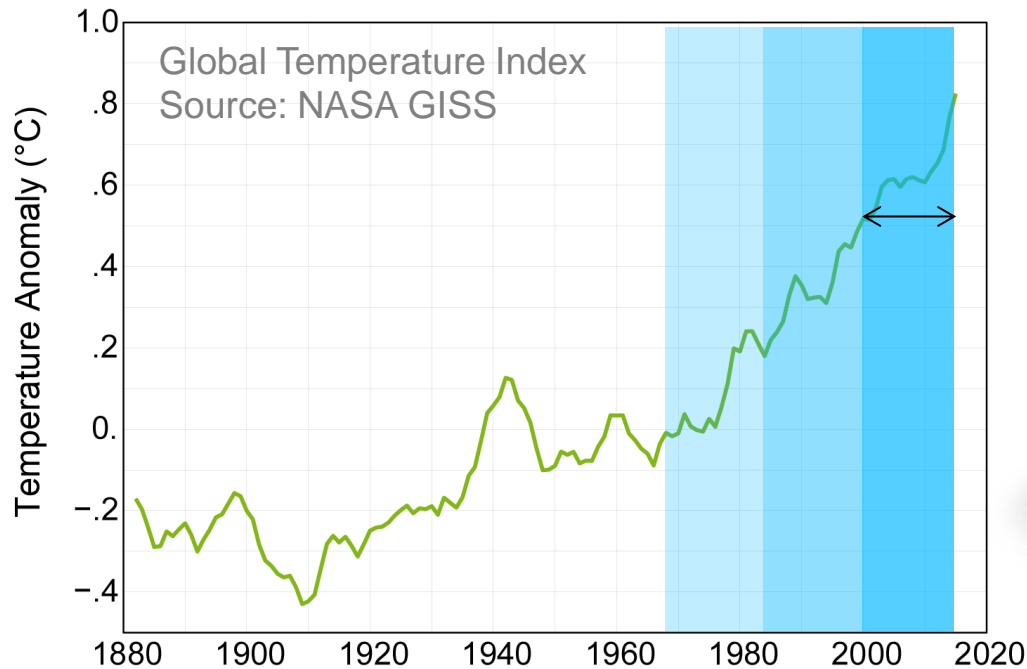
Example of the snow cover area

1980's: Landsat
30 m, 16 days (at best)

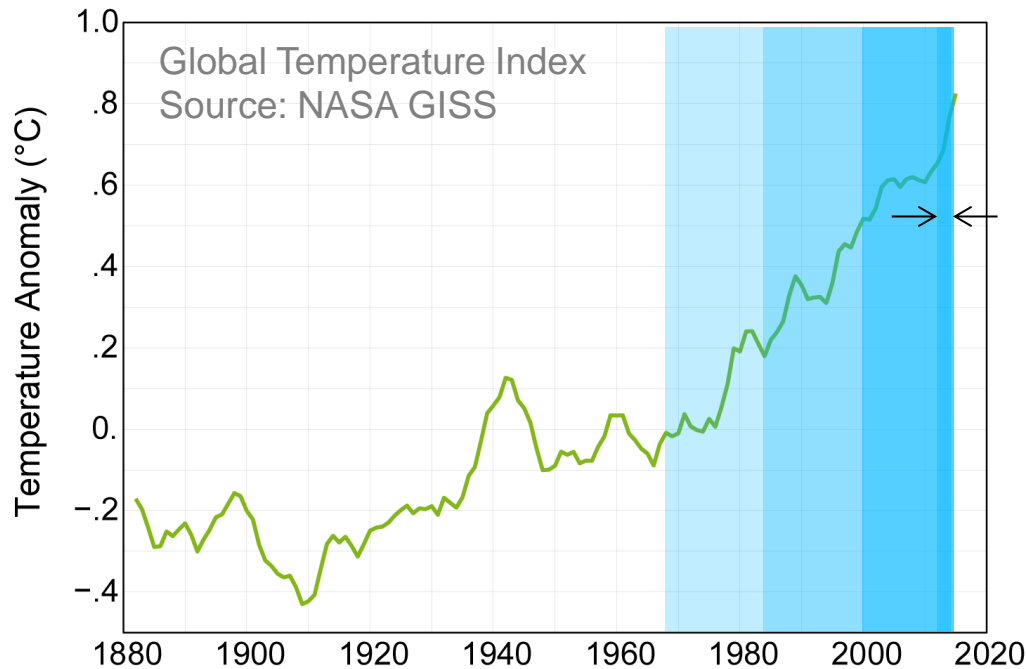


Example of the snow cover area

2000's: MODIS
500 m, 1 day



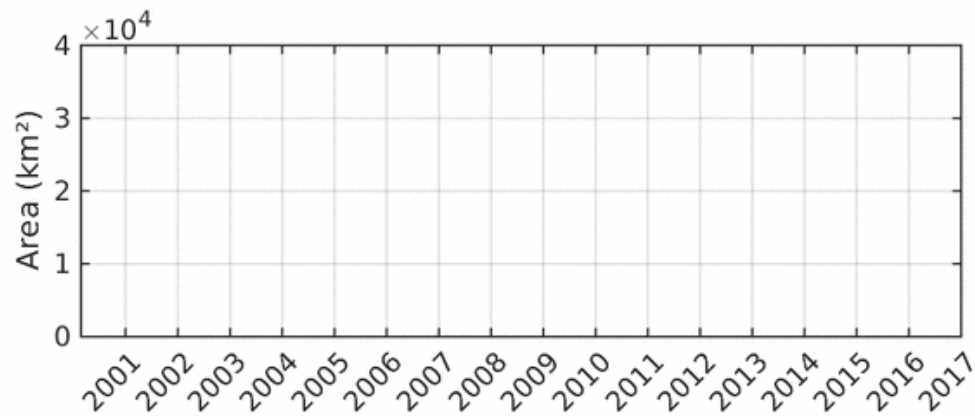
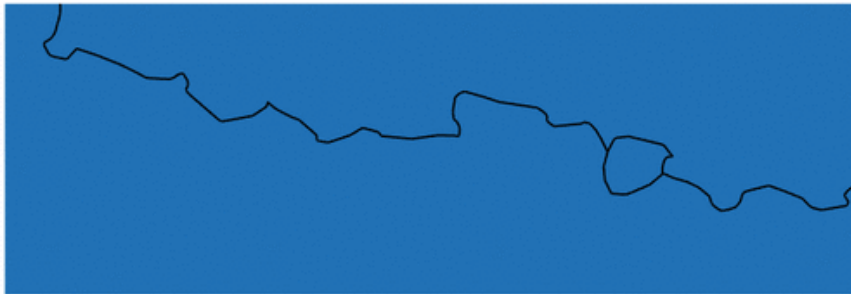
Example of the snow cover area



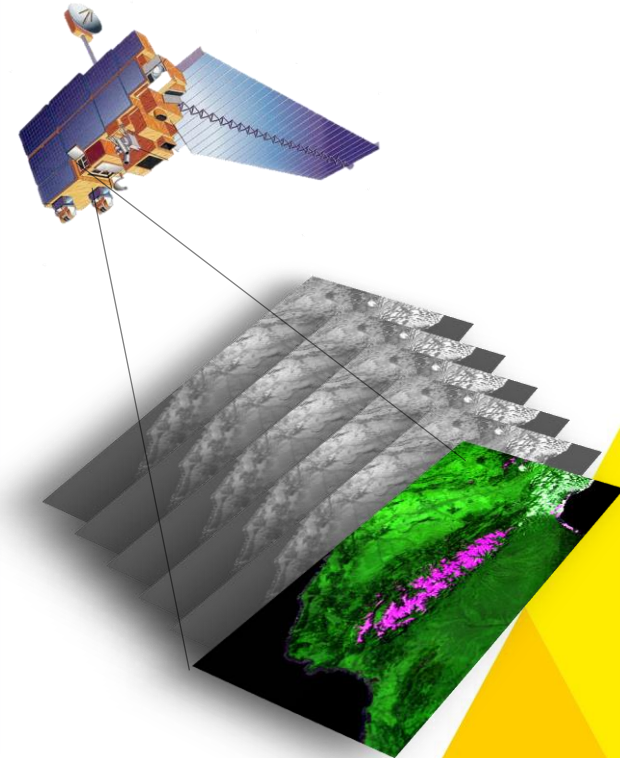
2015: Copernicus Sentinel-2
20 m, 5 days



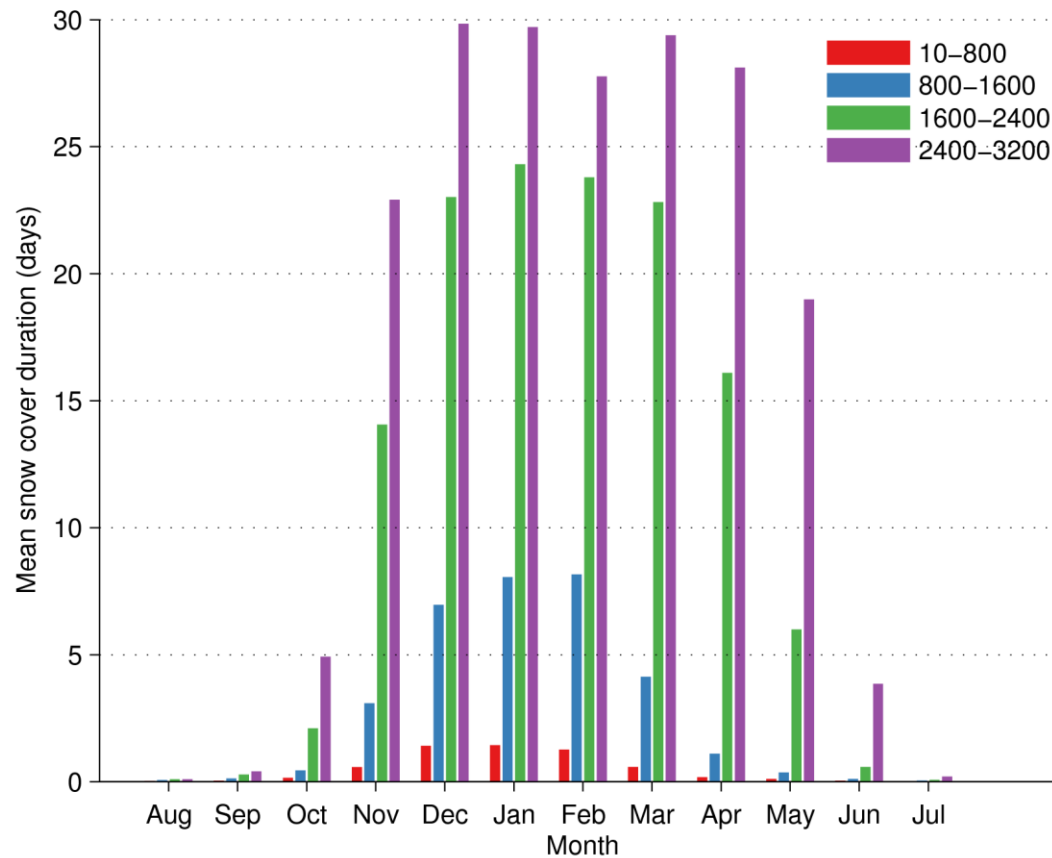
Feb-2000



2000's: MODIS
500 m, 1 day

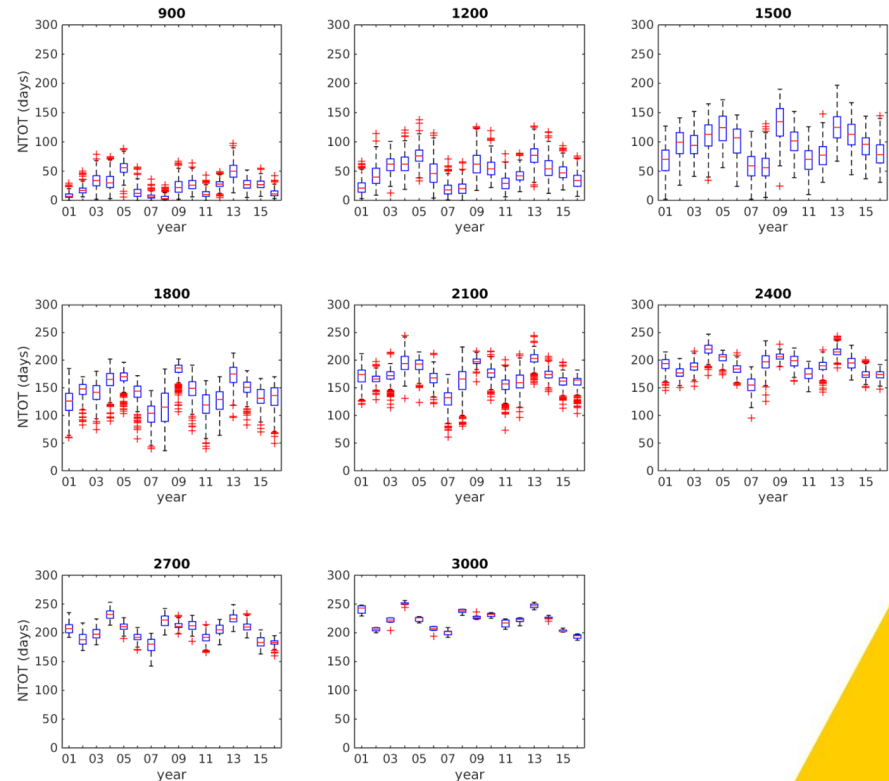
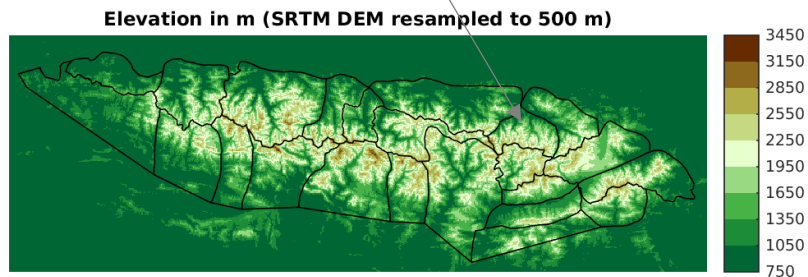


Mean snow cover duration by elevation



Ariège-Vicdessos

Number of days with snow between
01/08/N-1 and 31/07/N



Number of days with snow between
01/08/N-1 and 31/07/N

Number of days with snow between
01/12/N-1 and 31/03/N

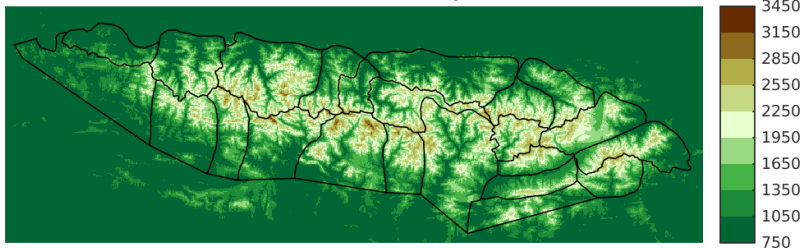
Date of the onset of the longest
snow period between 01/08/N-1
and 31/07/N

Meltout date of the longest snow
period between 01/08/N-1 and
31/07/N

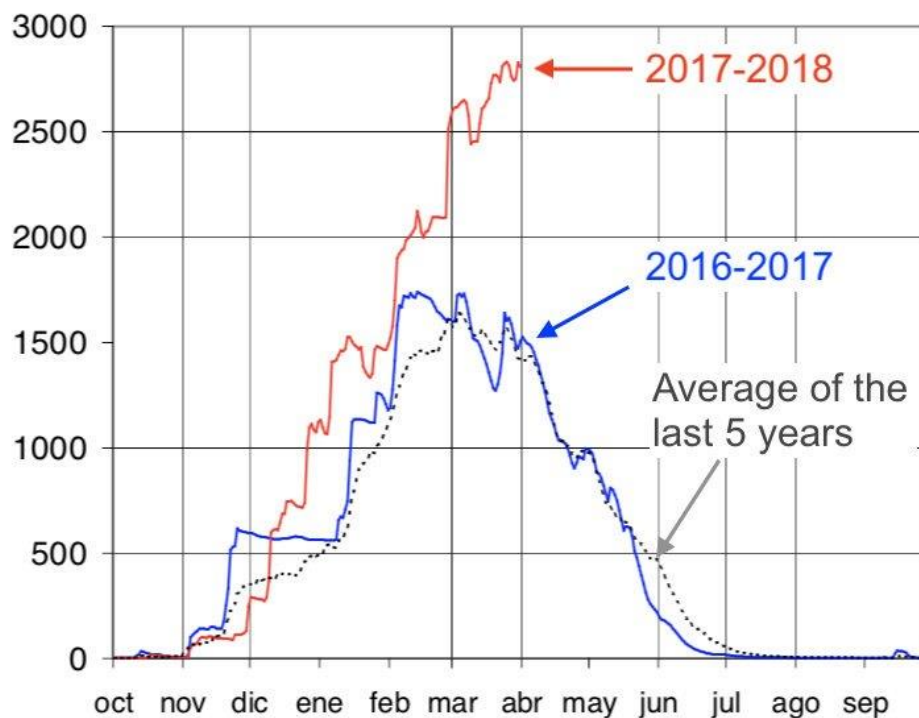
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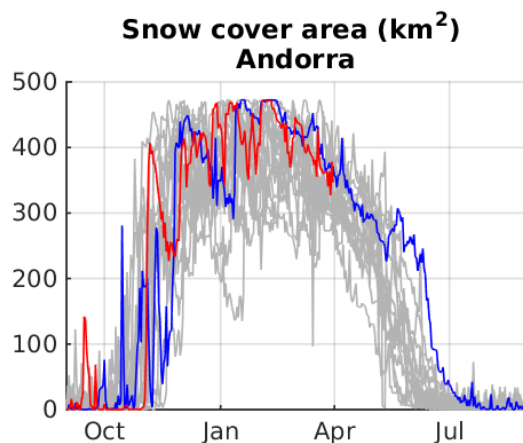
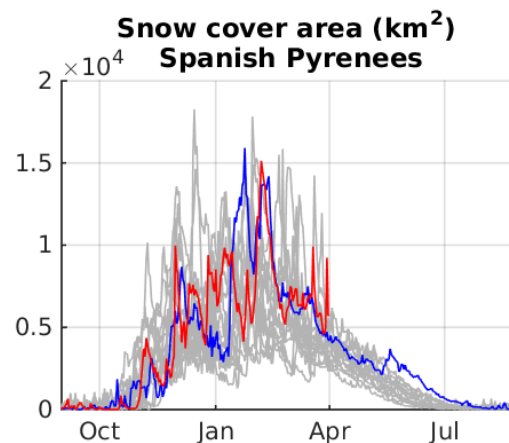
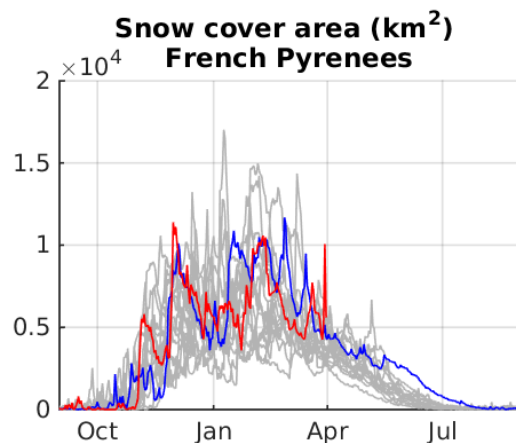
➔ No trend

Elevation in m (SRTM DEM resampled to 500 m)



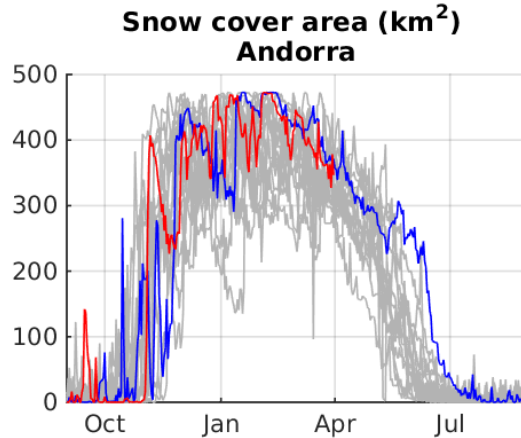
Snow water equivalent in millions of cubic meters
(source: CHEbro.es)



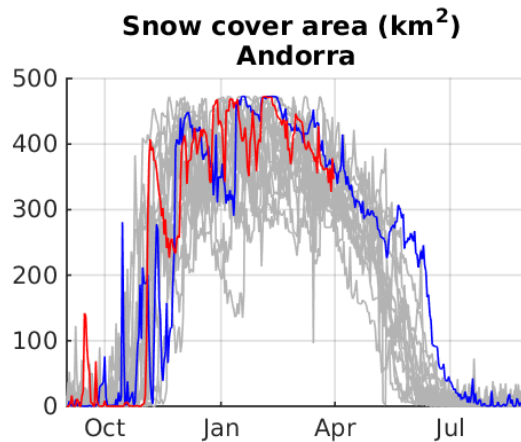


2017-2018
2016-2017

It's only 500 m resolution



It's only 500 m resolution



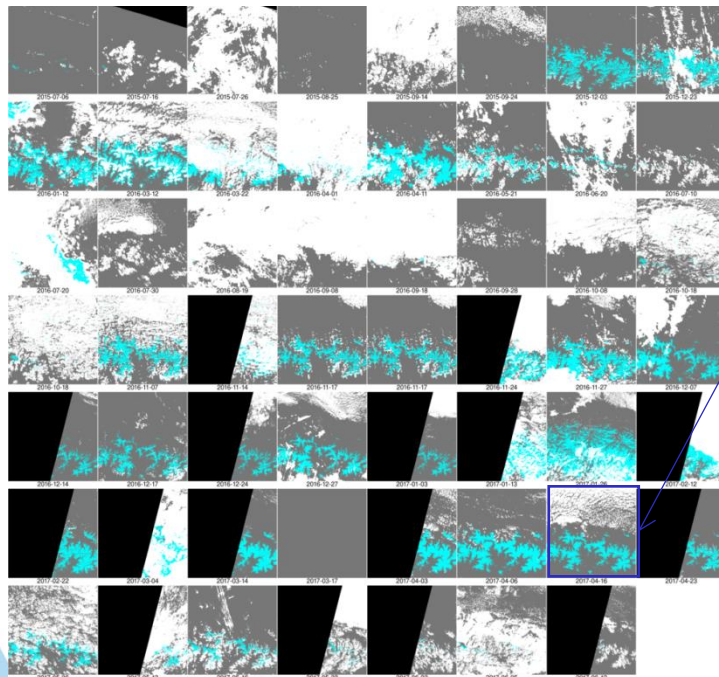
Sentinel-2 snow cover area

14

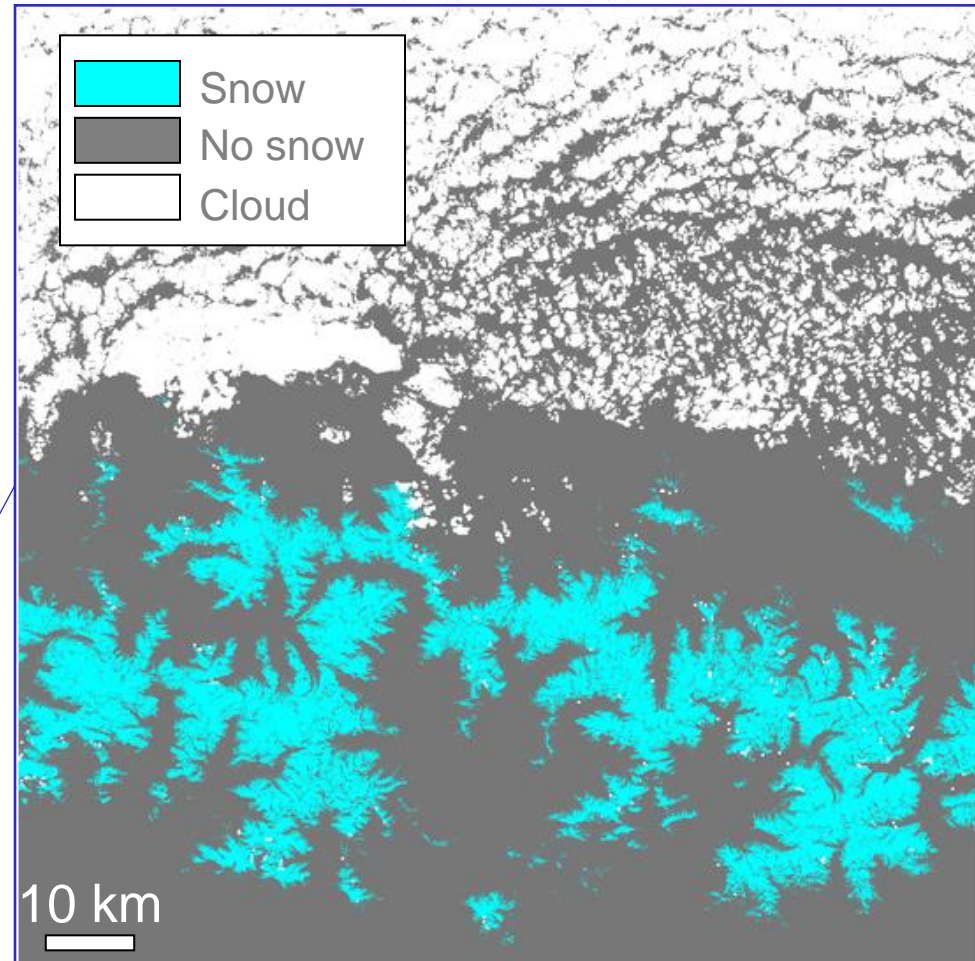
20 m every 5 days since 2015

Processor by Cesbio/Cnes

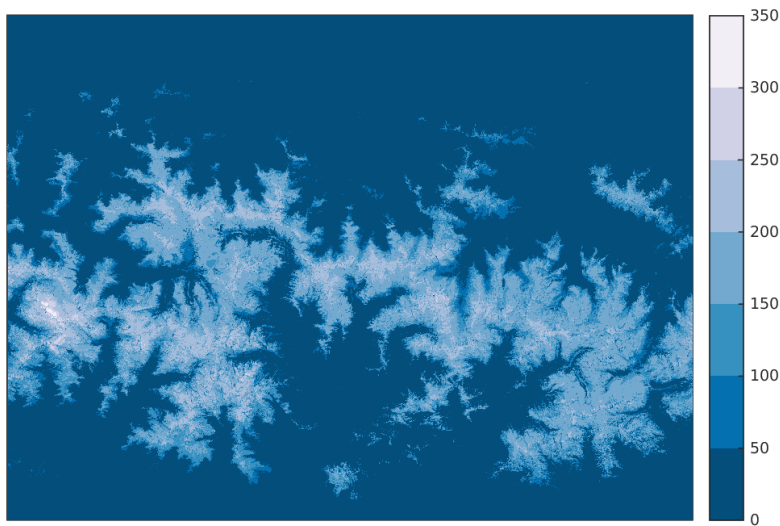
Distributed by <http://theia.cnes.fr>



2017-04-16

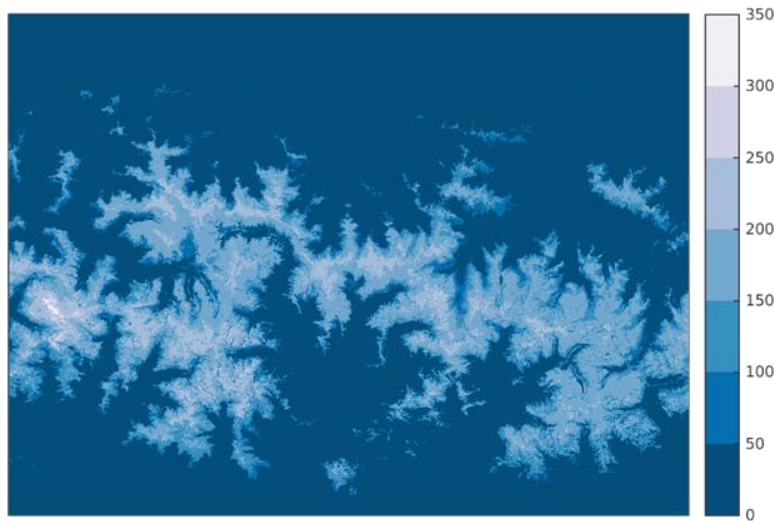


Snow duration map (days)
01-Sep-2015 to 31-Aug-2015

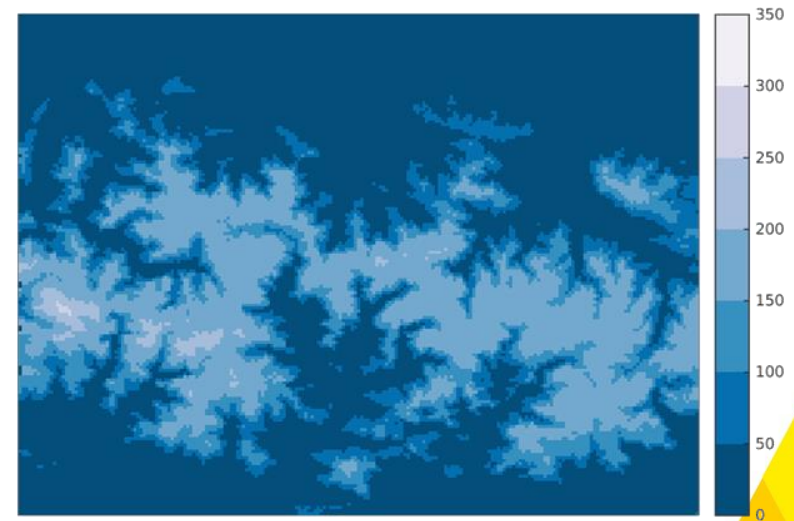


Snow duration map (days)
01-Sep-2015 to 31-Aug-2015

Sentinel-2

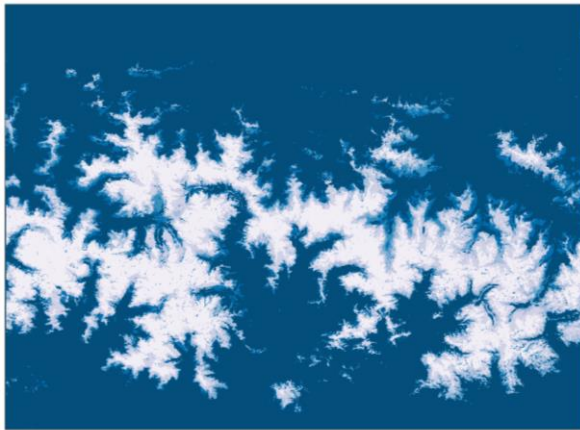


MODIS

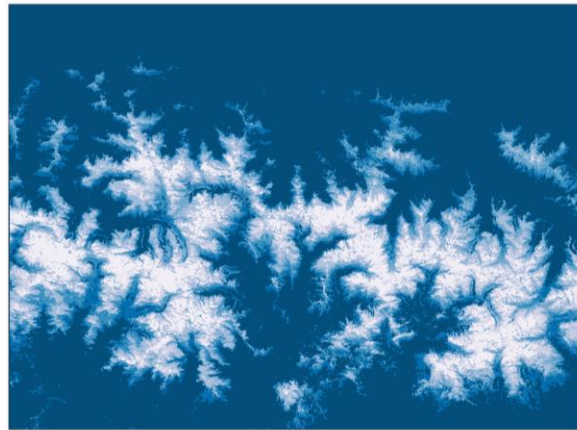


Snow duration map (days)
01 Jan to 01 Jun

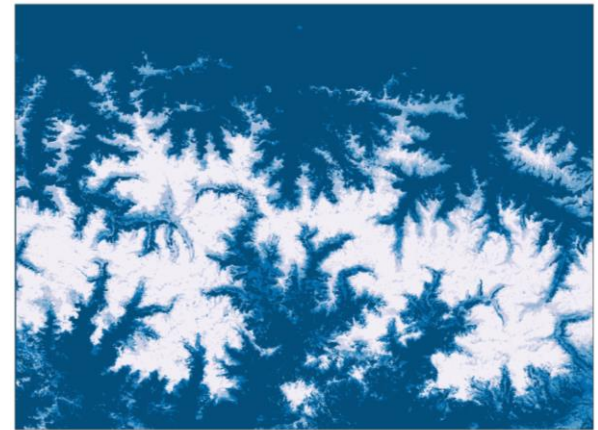
2016



2017



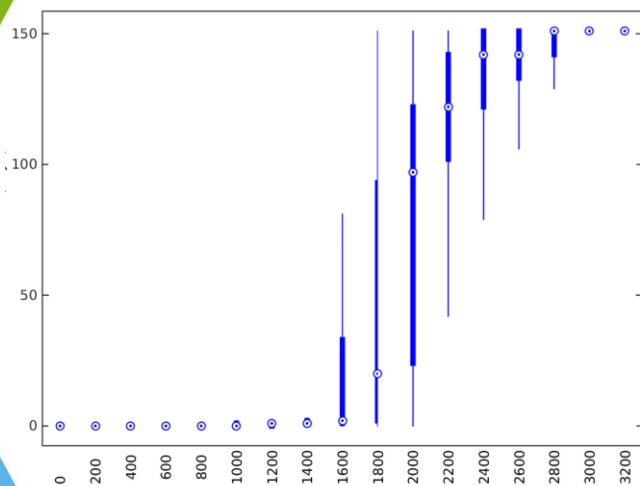
2018



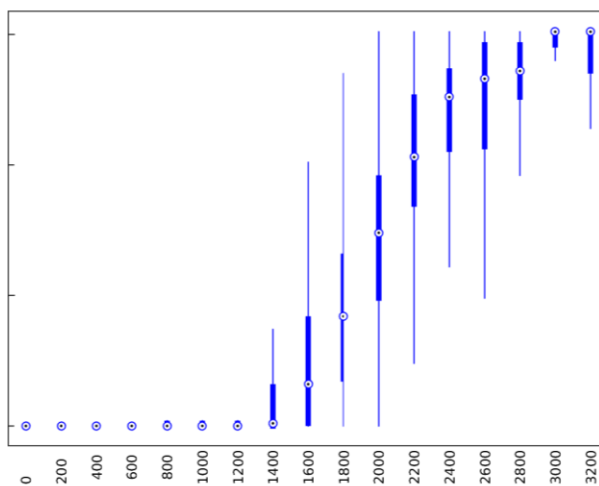
Snow duration by elevation (days)

01 Jan to 01 Jun

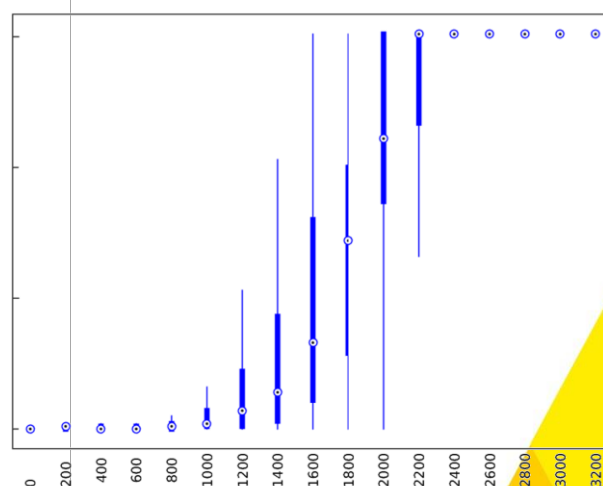
2016



2017



2018



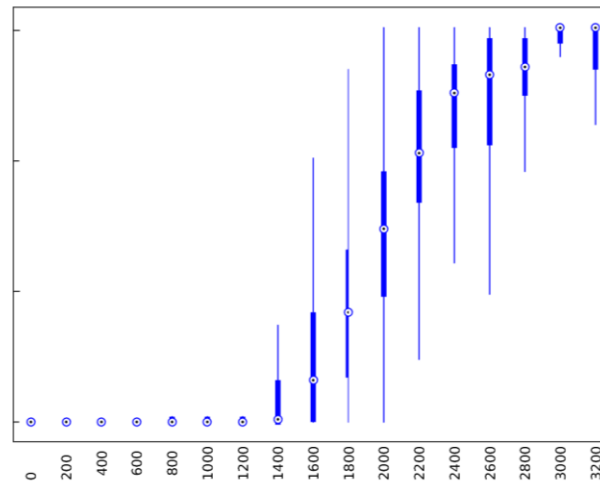
Elevation band (m)

Snow duration by elevation (days) 01 Jan to 01 Jun

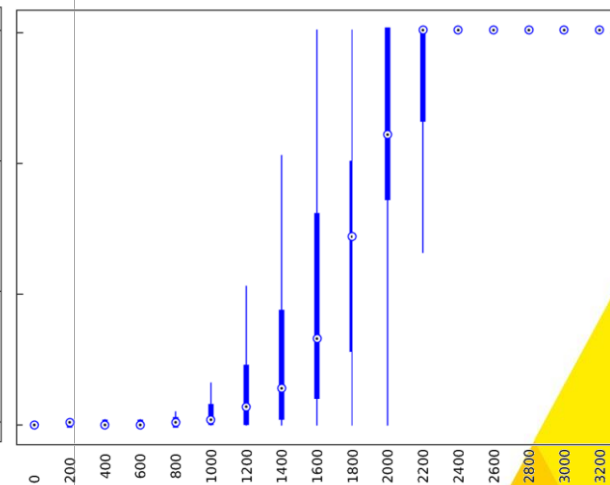
Aneto: 07 Jun 2018 vs. 01 Jun 2017



2017



2018



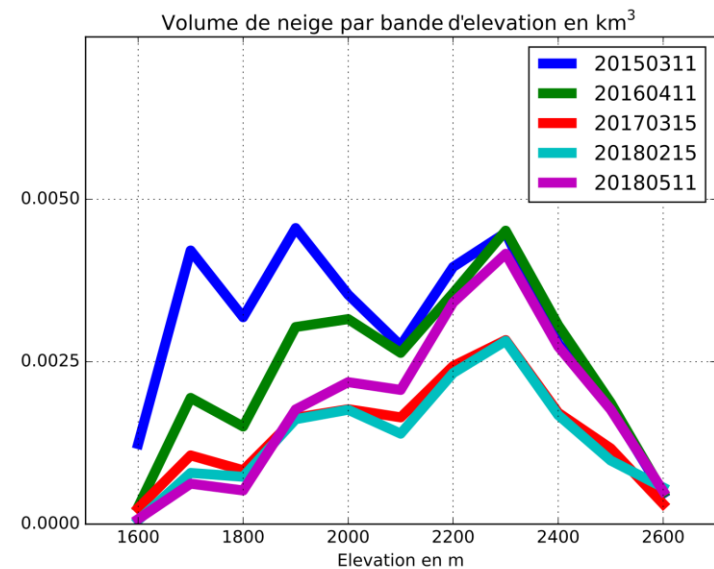
Elevation band (m)

- Two products
 - MODIS, Sentinel-2 snow cover area
- Common strengths
 - ☺ No issue with national borders (homogeneous data)
 - ☺ Near real time monitoring
- Common weaknesses
 - ☹ Short period of observation
 - ☹ Only the snow cover area NOT snow depth or snow water equivalent

- Two products
 - MODIS, Sentinel-2 snow cover area
- Common strengths
 - ☺ No issue with national borders (homogeneous data)
 - ☺ Near real time monitoring
- Common weaknesses
 - ☹ Short period of observation → useful for model validation in present climate
 - ☹ Only the snow cover area NOT snow depth or snow water equivalent → ongoing work to retrieve the snow depth from Pléiades stereo images

Four snow seasons of snow depth maps at 4m resolution

Bassiès déc. 2014



Pléaides snow depth

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Only 400 km² ☹️

