Annual development of subalpine grassland observed with UAV: how NDVI evolution is controlled by snow melting

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Session CR: 2.1 Geophysical and in situ methods for snow and ice studies

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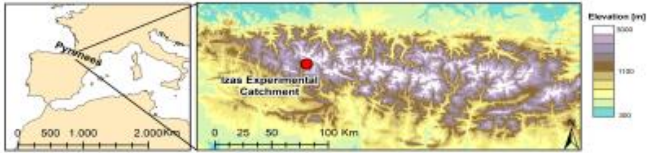
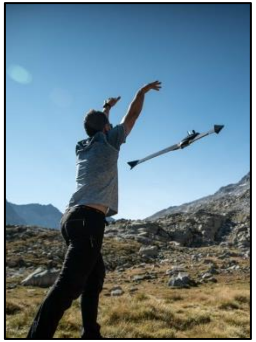
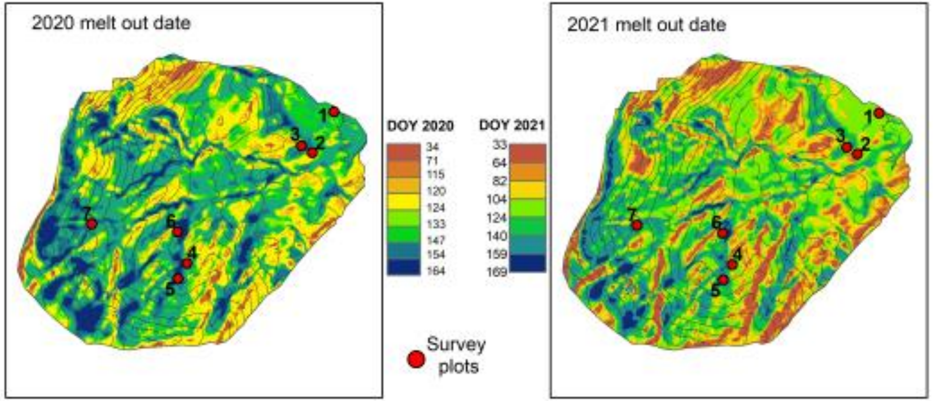
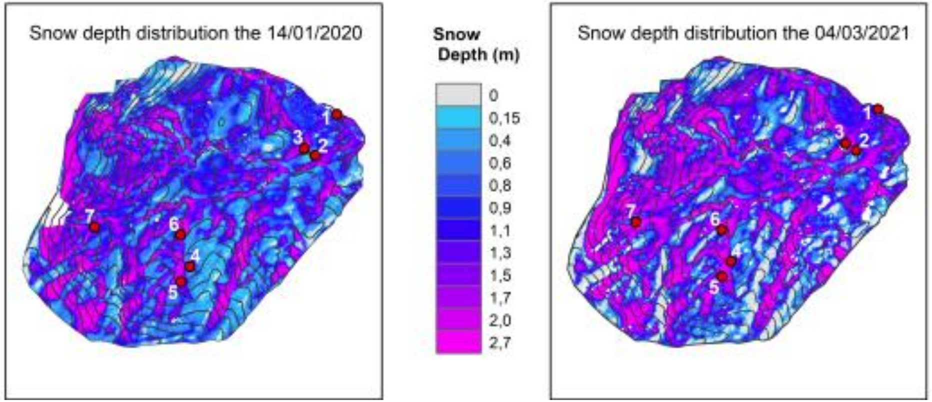
Study area and materials

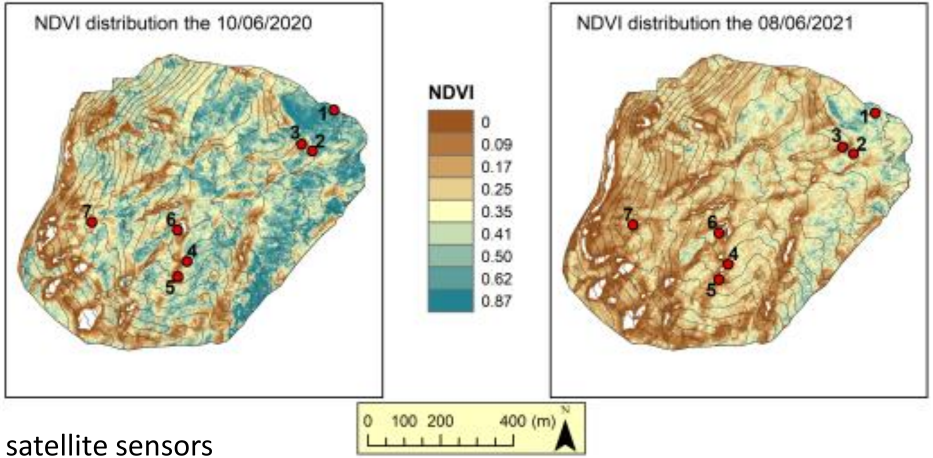
- **Study Area: Izas Experimental Catchment** (central Pyrenees)
    - ~45 ha, Elevation: 2000 to 2300 m (a.s.l.)
- **2 years with observations (**2020 and 2021)
- **Snow depth:** 18 *UAV* flights (SfM software)
- **Melt out date** derived from snow depth maps
- 7 plant comunity survey plots.
- **NDVI** : 14 UAV flights (with multiscpectral camera)





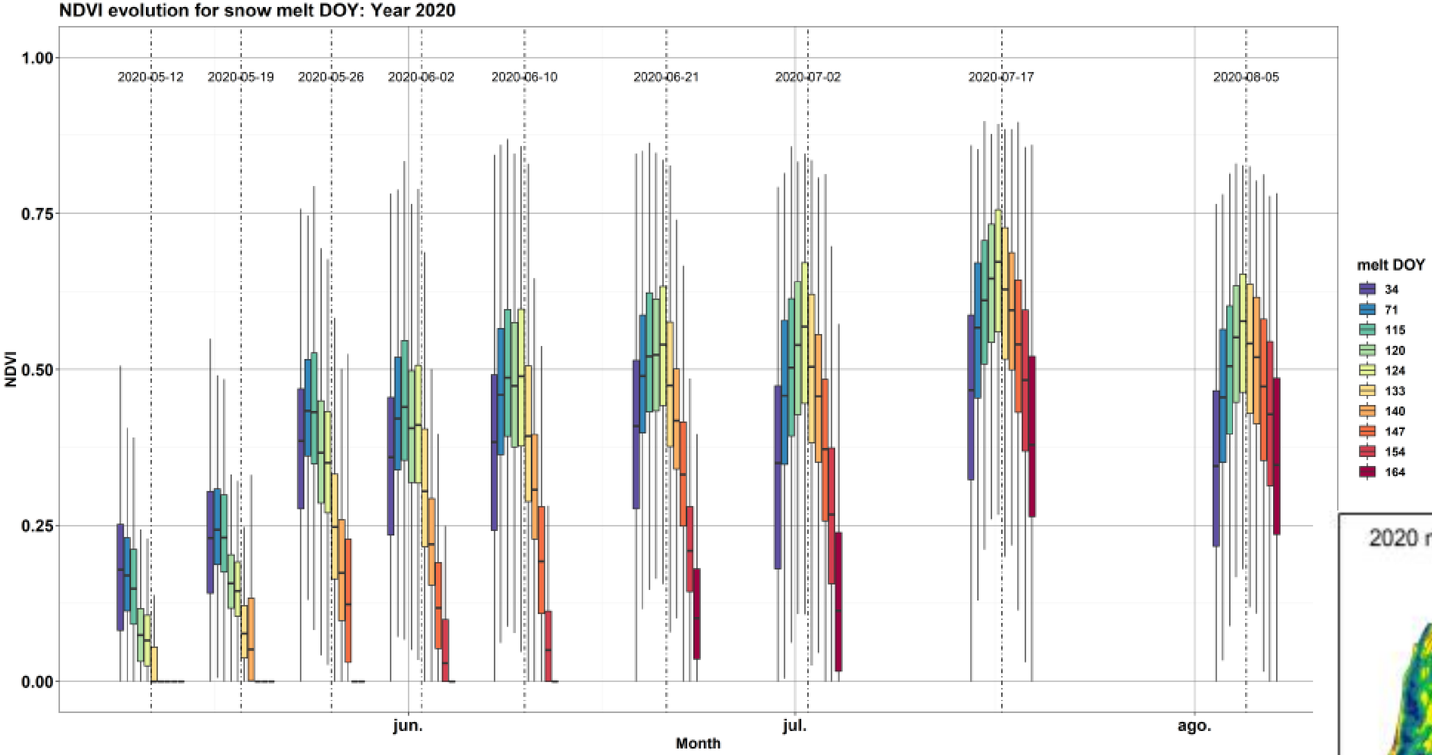


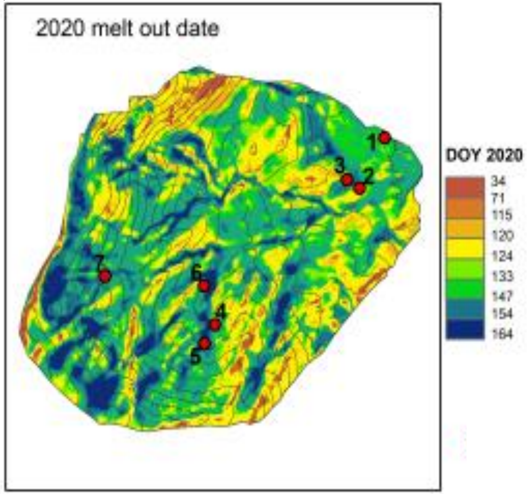




High spatial resolution observations not affordable with satellite sensors

Results



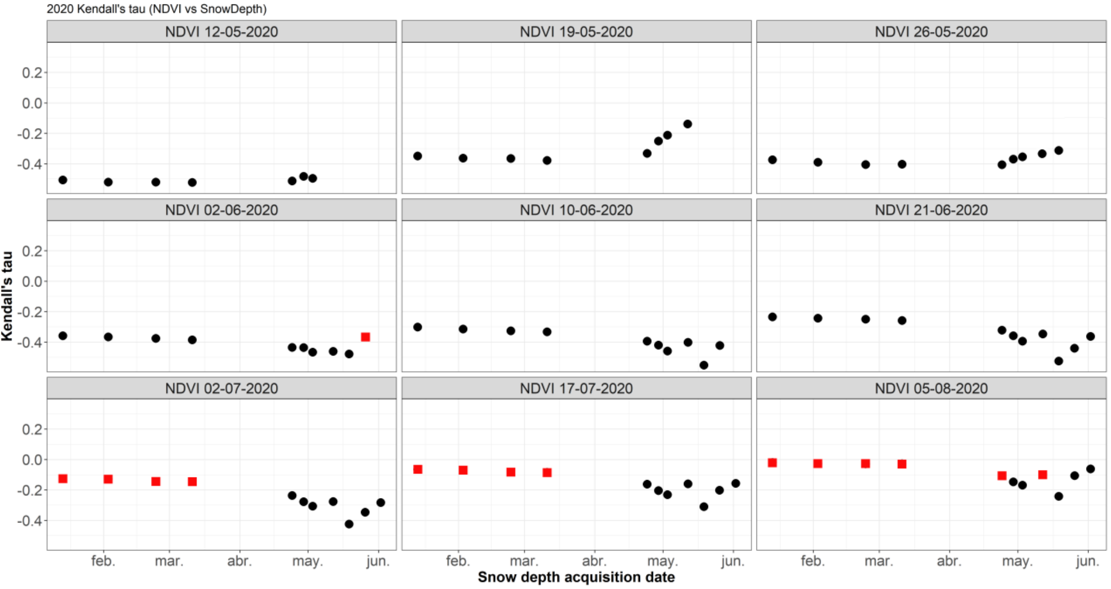


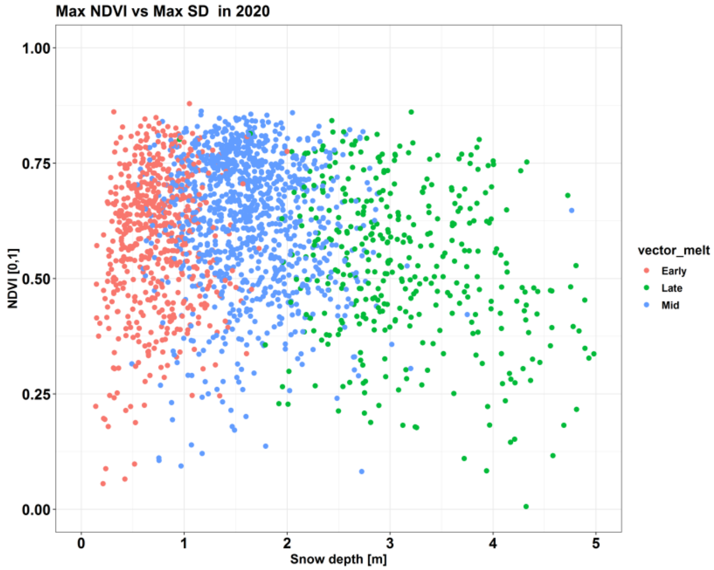
- The NDVI evolution observed in zones with distinct melt out dates shows three behaviors:
  - Early melt
  - Mid melt(optimum melt with max NDVI)
  - Late melt

Results

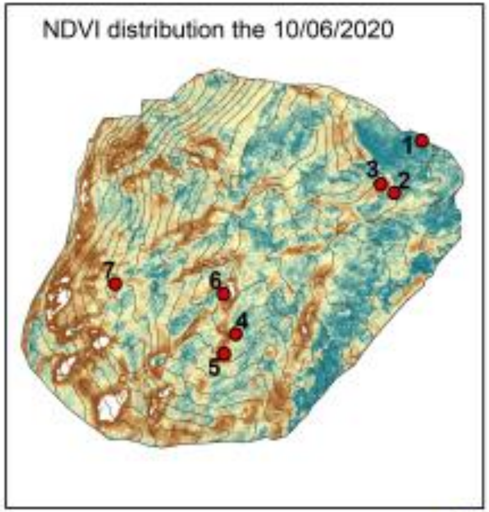
NDVI vs Snow depth: Kendall's correlation➔Little correlation with snow depth 3-4 weeks before NDVI observation probably due to anticipation of snow melt

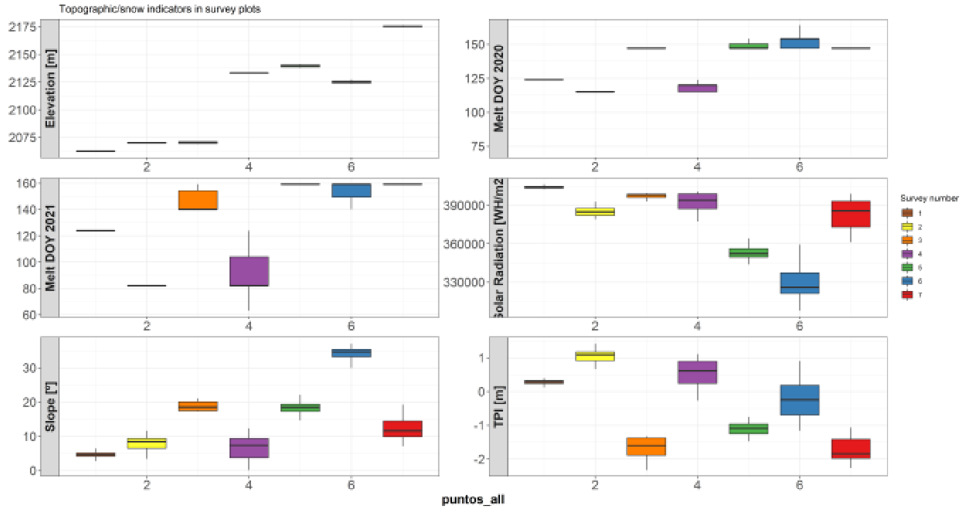
No correlation between maximum snow depth and maximum NDVI➔ snow depth is not required to understand NDVI evolution

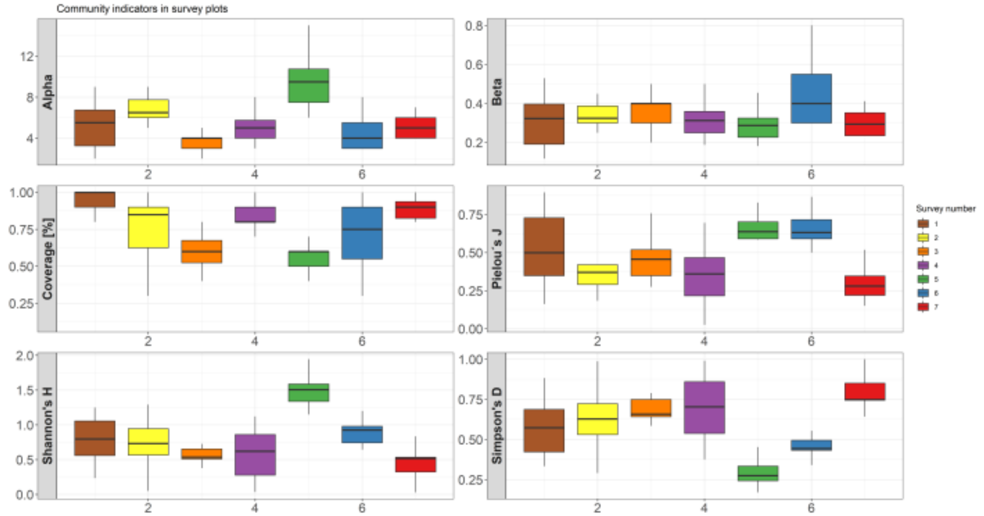




Results



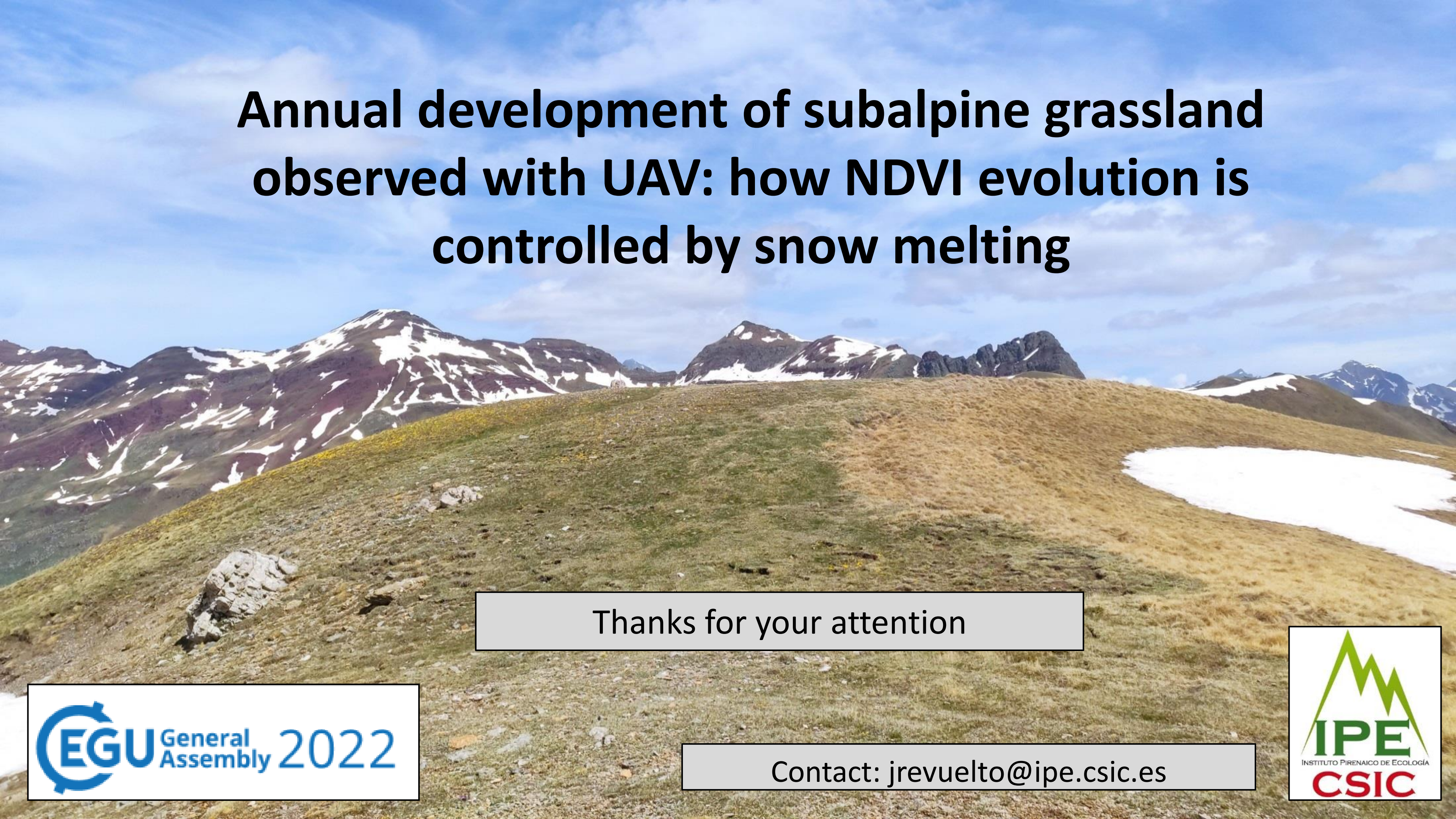




- Plant diversity indicators did no show remarkable relations with snow melt/topographic features
- One specie is dominant in Izas catchment: *Festuka skiea*

Conclusions

- **High spatial resolution observations of UAV** highly valuable to analyze **grassland** and **snow** dynamics.
- The **snow melt out date** controls **grassland greening**.
- **Early snow melting** hampers reaching maximum NDVI values.
- **Late snow melting** does not allow grassland to reach maximum NDVI values.
- There is an **optimum melt out date** (20 April -10 May) to reach **maximum grassland greening**.
- **Similar results in two seasons** with different snow and meteorological conditions.
- There has not been observed any impact of maximum snow depth and maximum NDVI➔ **Snow depth is not needed to analyze grassland greening**.
- Despite many authors have observed differences in plant communities in view to snow dynamics, this is not observed at Izas (probably due to *Festuka eskia* abundance)



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Thanks for your attention

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