Bridging the Gap: Exploring Synergies between the Land Cover Mapping and Atmospheric Science Communities.

From science to applications.

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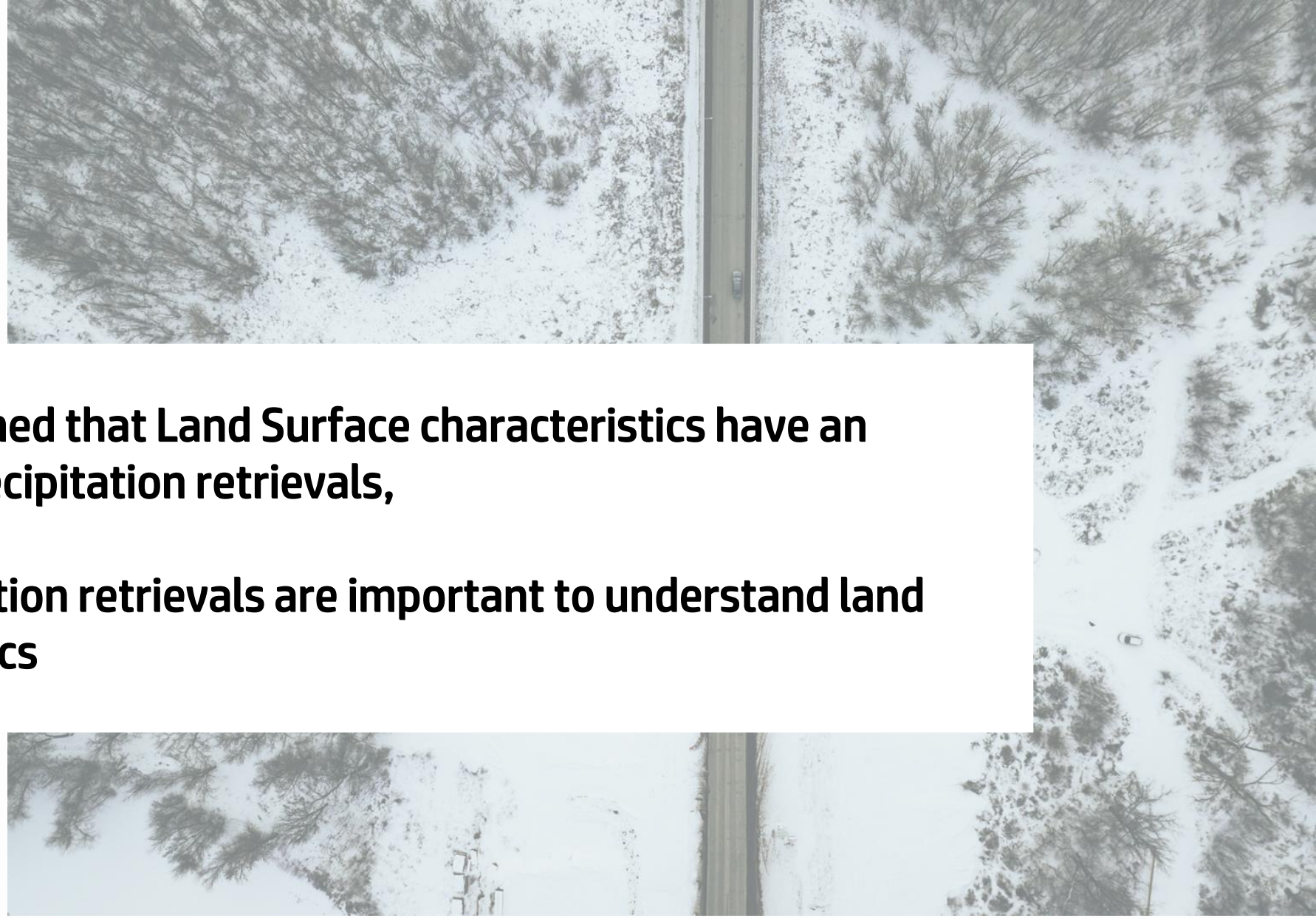
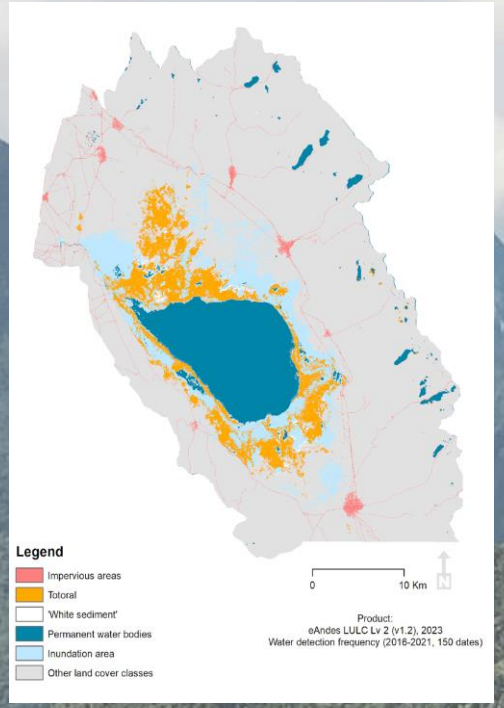
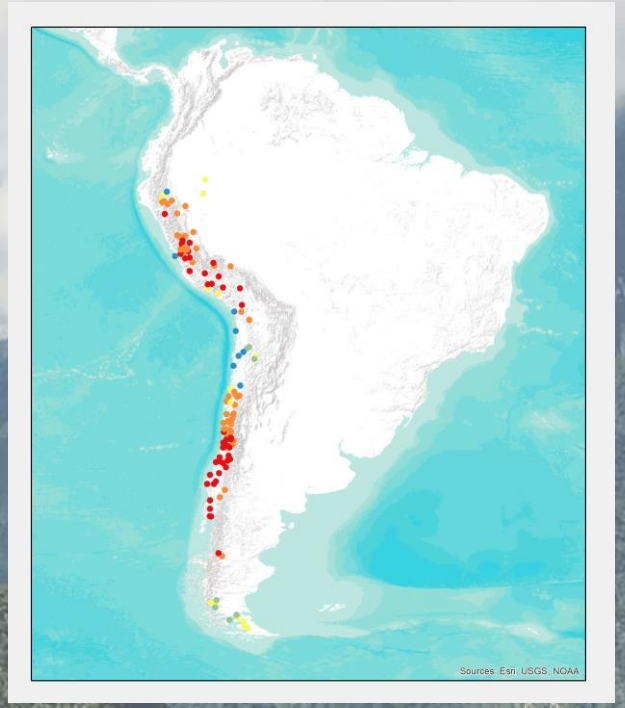


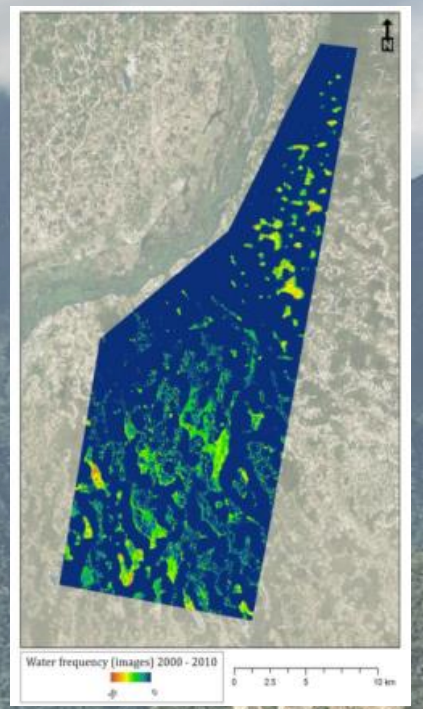
Well established that Land Surface characteristics have an impact on precipitation retrievals,

And precipitation retrievals are important to understand land cover dynamics

Projects usually involve ground validation of precipitation products prior to their use for ecosystem research and applications.



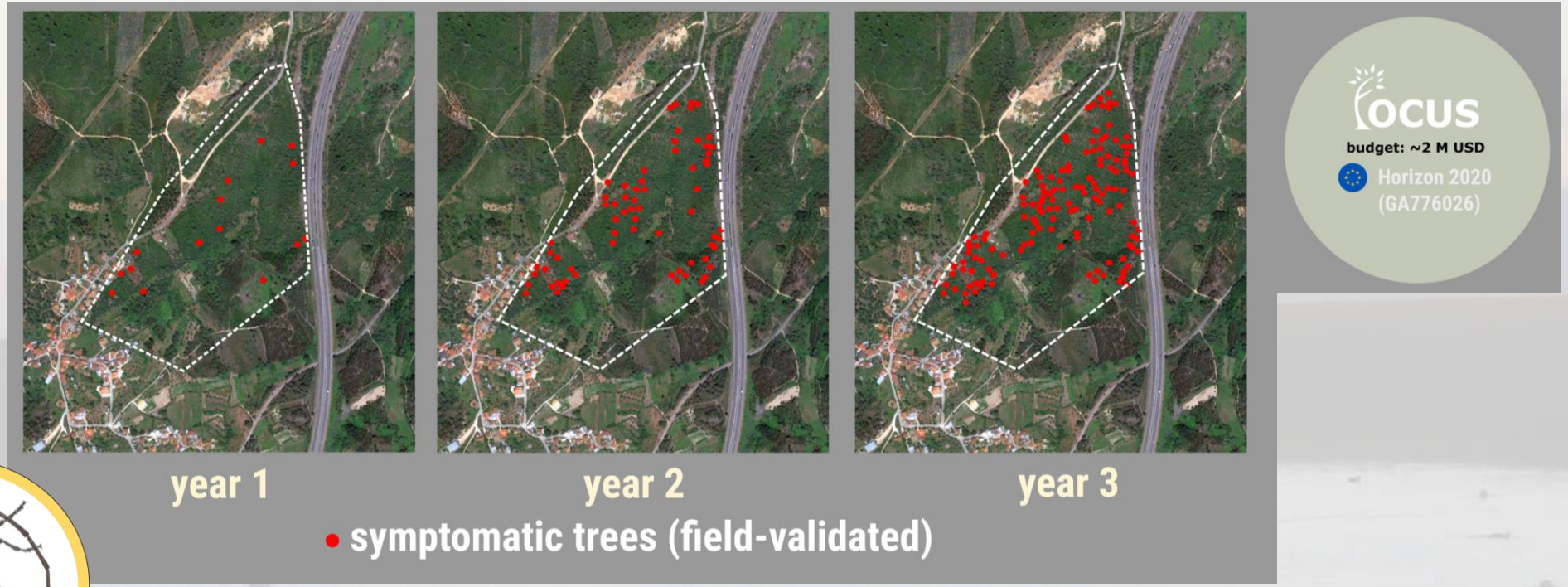




Portugal, Peru, Chile, Angola, Namibia, USA, Italy...

Some examples

Precipitation anomaly increases tree vulnerability to disease, near complete transition from forest to shrubland in < 3 years (extreme case).



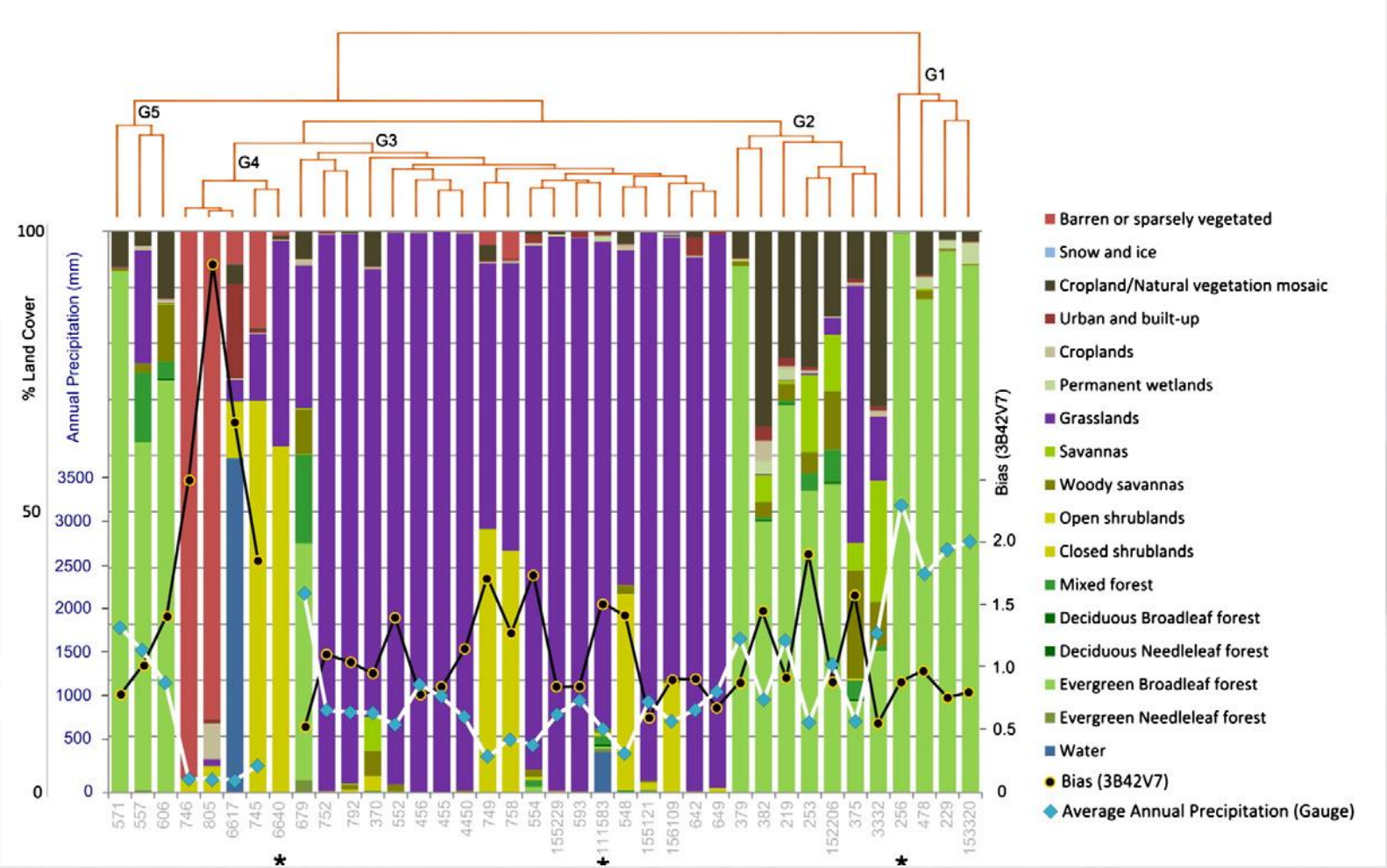
Significant changes to:

_ land cover class (and surface roughness)
_ surface fluxes
_ soil moisture
_ ET
_ Land surface temperature
_ Emissivity

Not all are in sync...

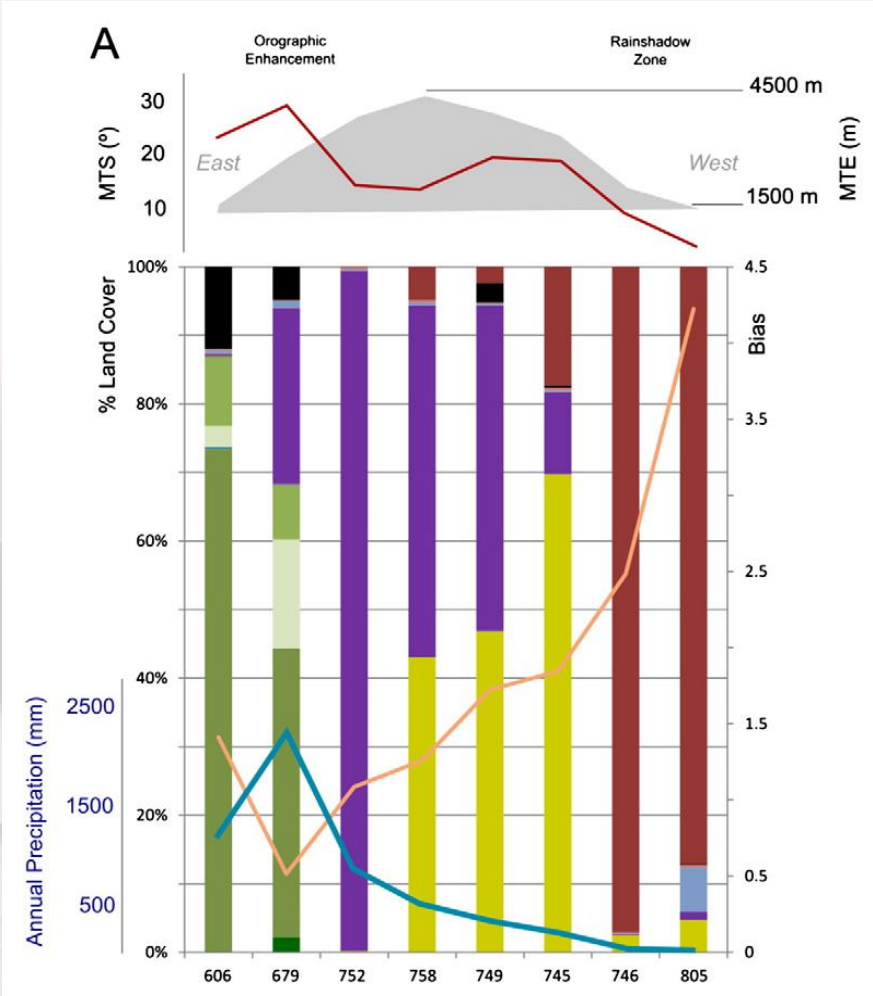
Different phenological patterns (further impacts emissivity and Tb)

A blast from the past (TRMM-era, 2015)

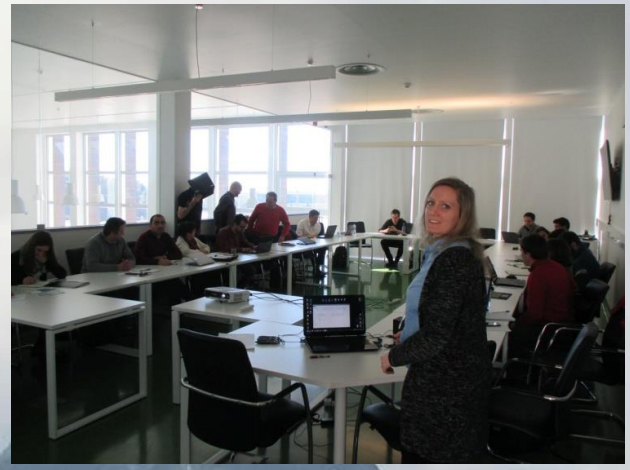


Peruvian Andes
TMPA, clustered (DTW)
MCD12Q1 product

A blast from the past (TRMM-era, 2015)



Peruvian Andes Transect
TMPA, MTS: Slope, MTE: Elevation
LULC: MCD12Q1 product



Land cover datasets...

Numerous programs: global, national, regional

Not quite application agnostic

User Needs and requirements: the usual community

Are existing land cover datasets adequately representing surface characteristics for precipitation and soil moisture retrievals?

And are available maps adequate for climate and weather models?

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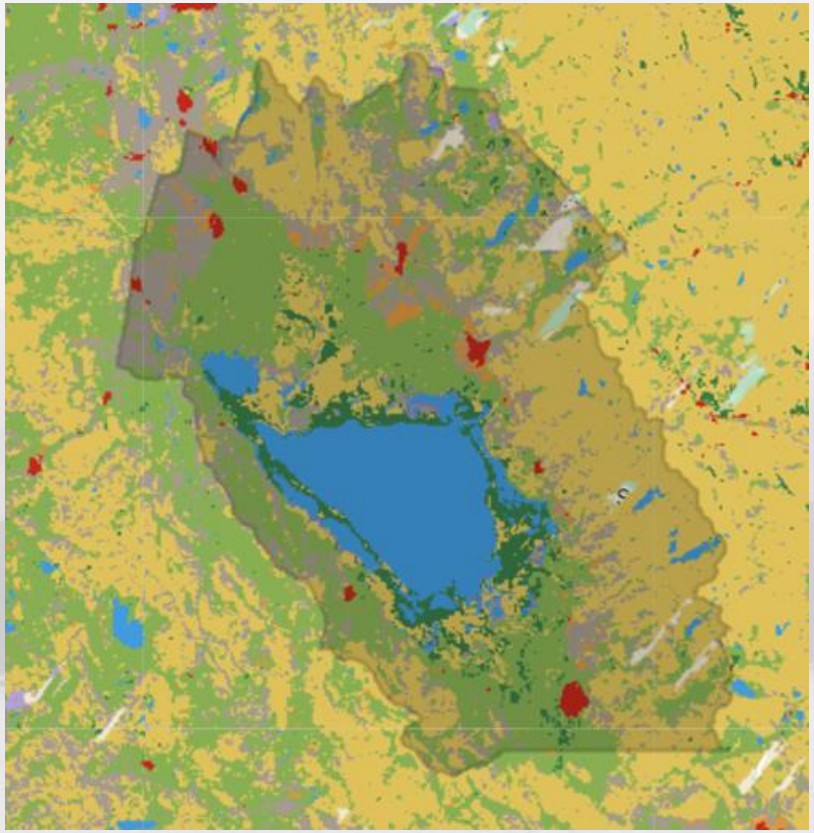
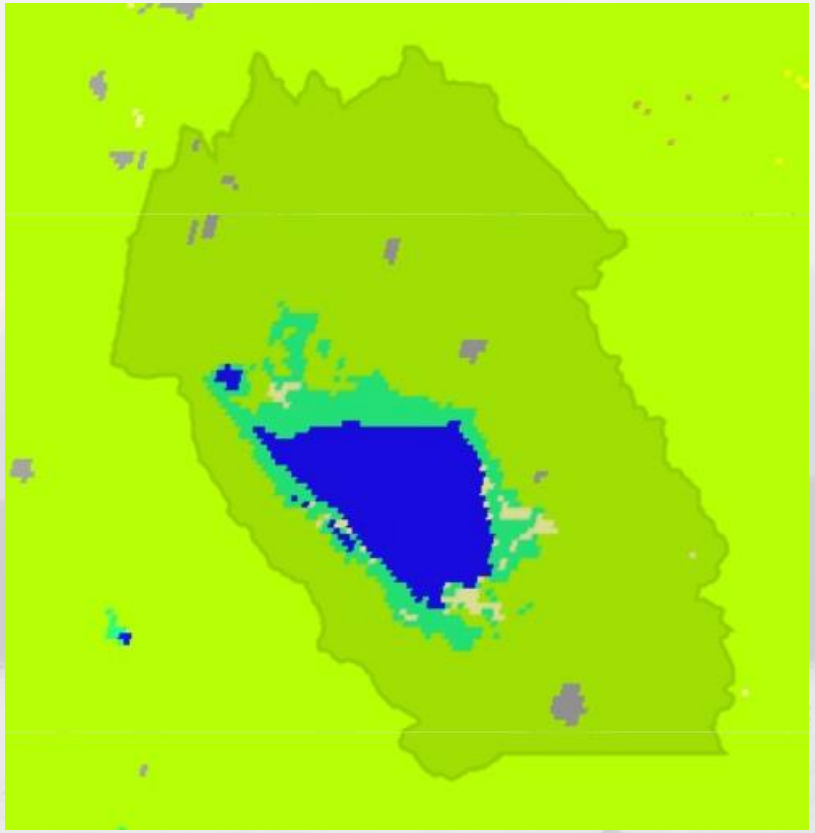
And are available maps adequate for climate and weather models?

Are the land cover and atmospheric sciences communities communicating effectively?

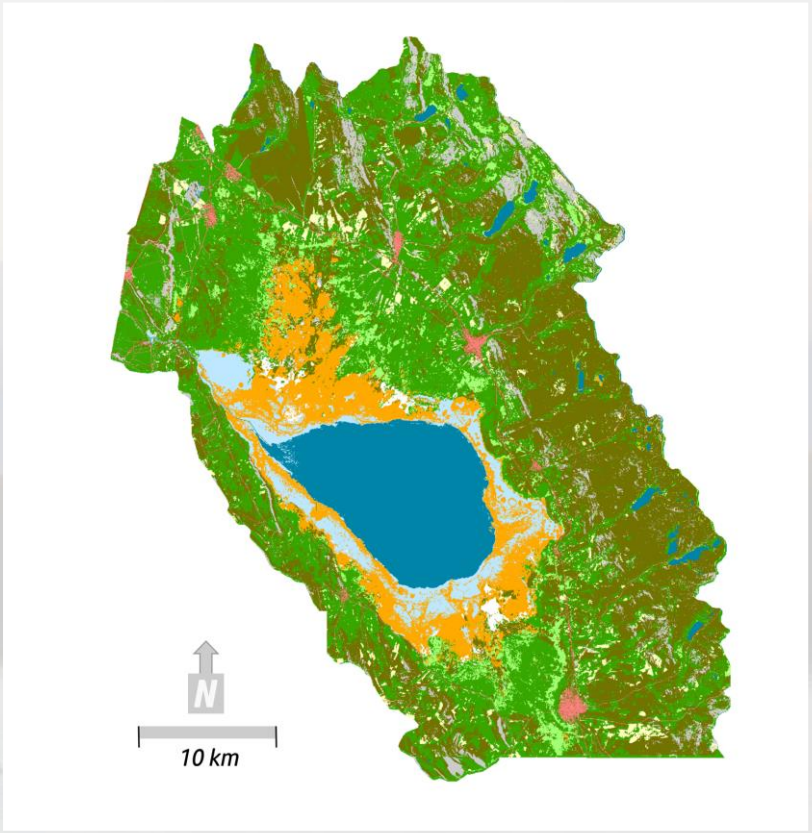
Challenge #1: Class selection and resolution



Google Dynamic World

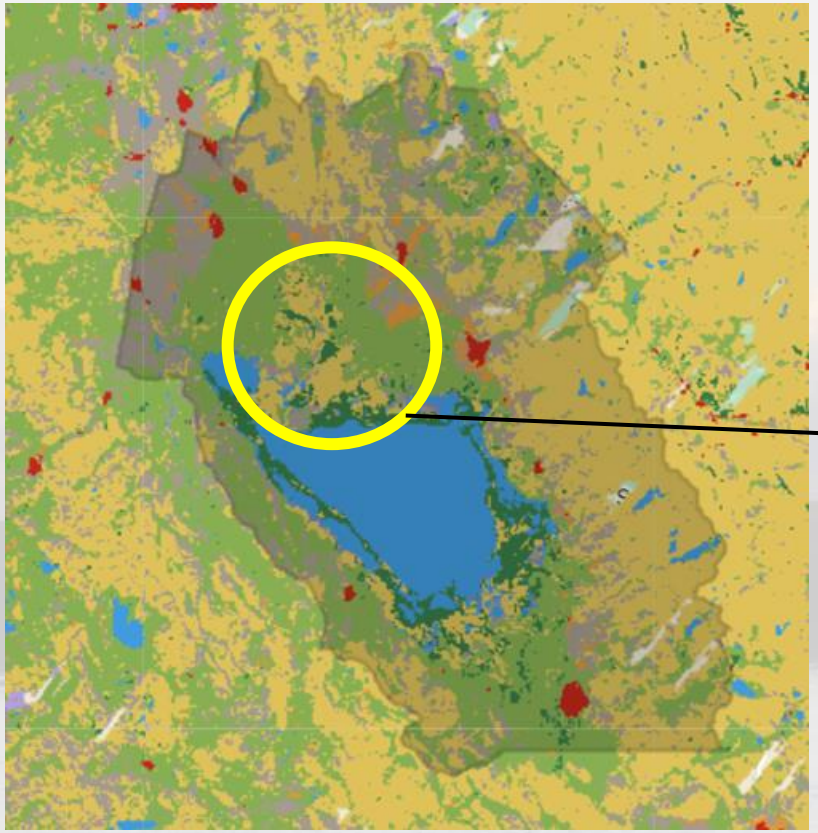


MODIS MCD12Q1



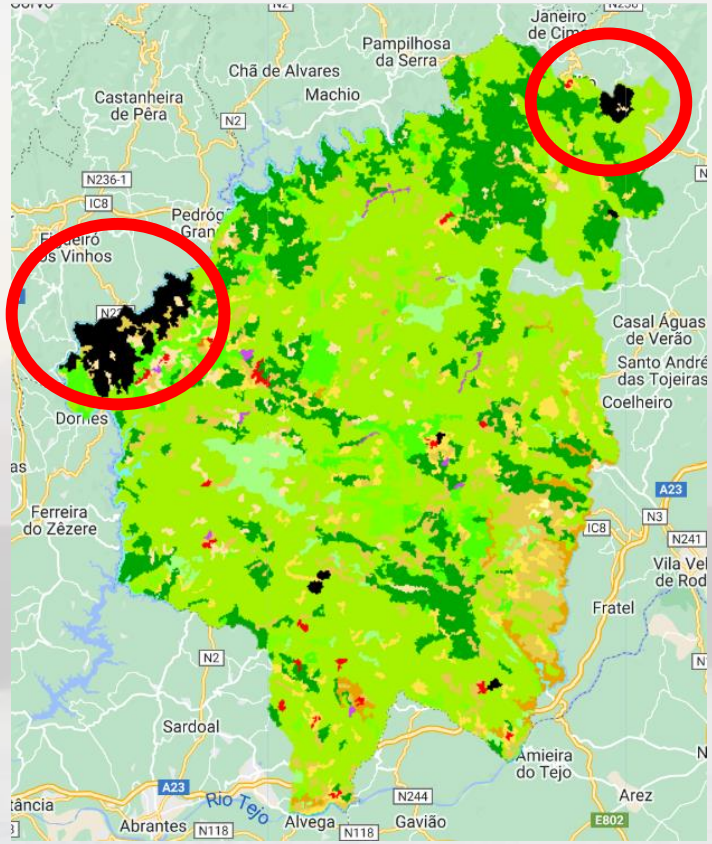
eoLab eAndes L2

Challenge #1: Class selection and resolution

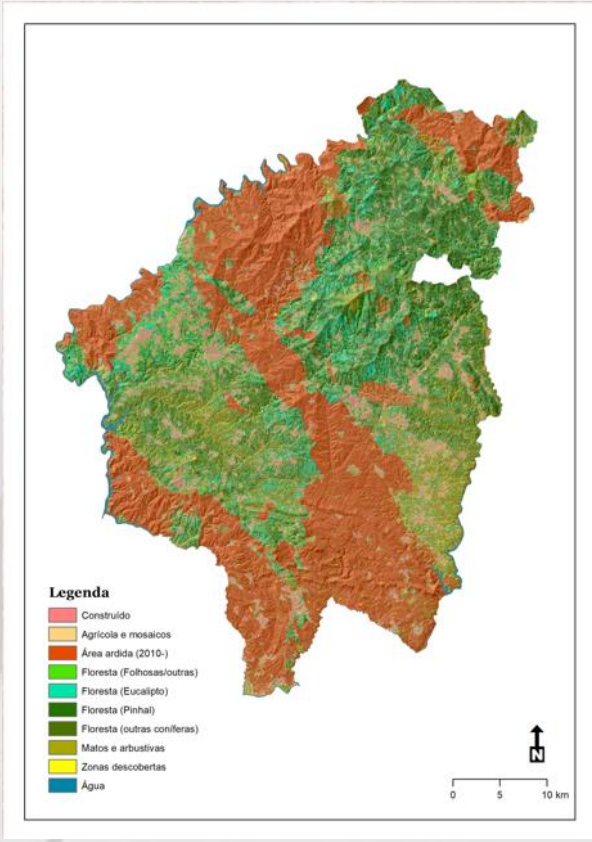


Google Dynamic World

Challenge #2: Timely depiction of change



CORINE 2018



eoLab L2 2018

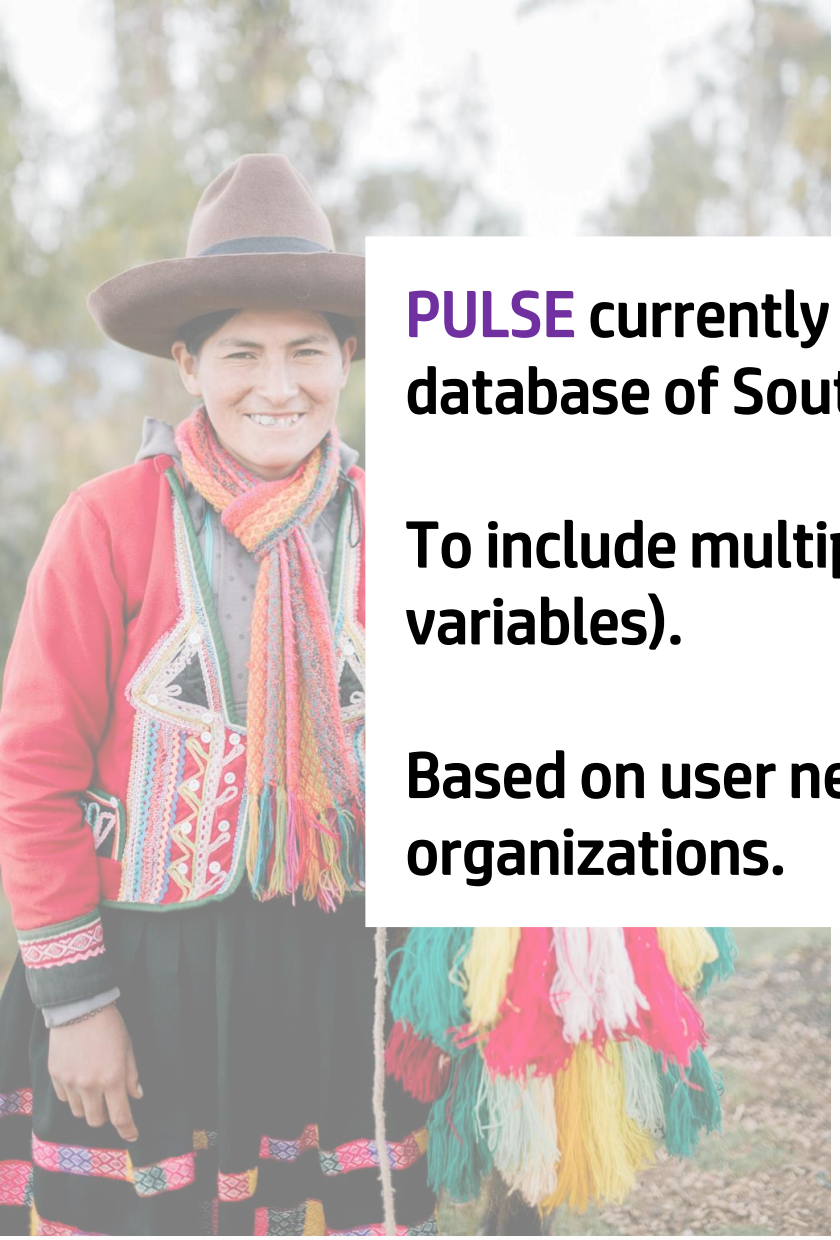
How can we streamline the development of an application-agnostic land cover dataset valuable for atmospheric and water resource applications?

PULSE

Precipitation + Uncertainties +
Land Surface + Ecosystems

Integrated approach leveraging multiple projects and organizations

New products or harmonization / repackaging of existing ones?



PULSE currently working on a comprehensive land cover database of South American mountainous ecosystems.

To include multiple data layers (thematic and continuous variables).

Based on user needs and requirements and involving multiple organizations.

Proyecto e-Andes

watersheds .online

SERNANP PERÚ

Reserva Nacional Junín

Ministerio del Ambiente

CONCYTEC

CONSEJO NACIONAL DE CIENCIA, TECNOLOGÍA E INNOVACIÓN TECNOLÓGICA

COLE + HOMINEM CUDIO ET AGRUM

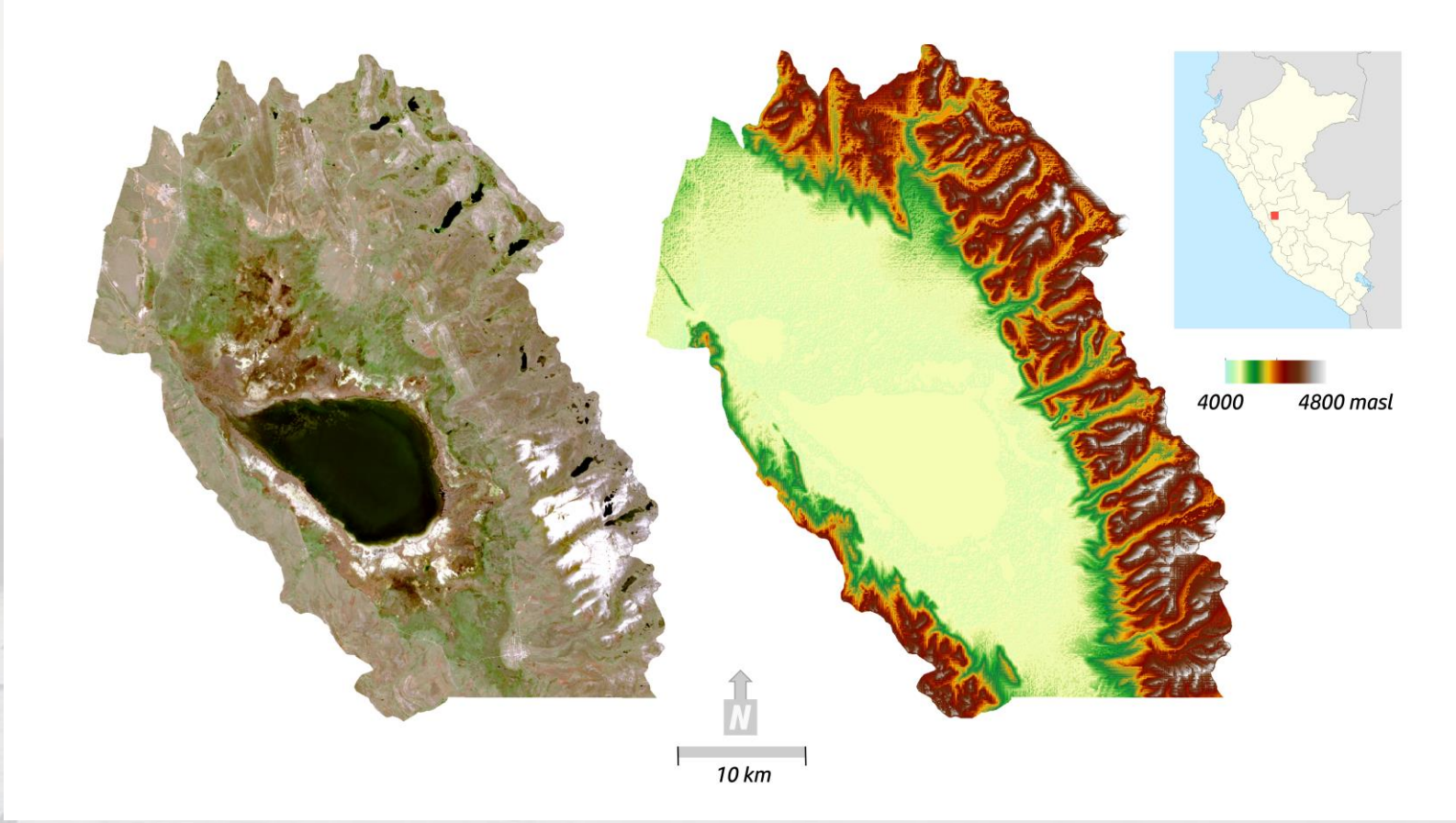
Step #1 : Prototype dataset on flagship site

Junin National Reserve

Representative of Andean ecosystems

Strong user engagement

10-m resolution



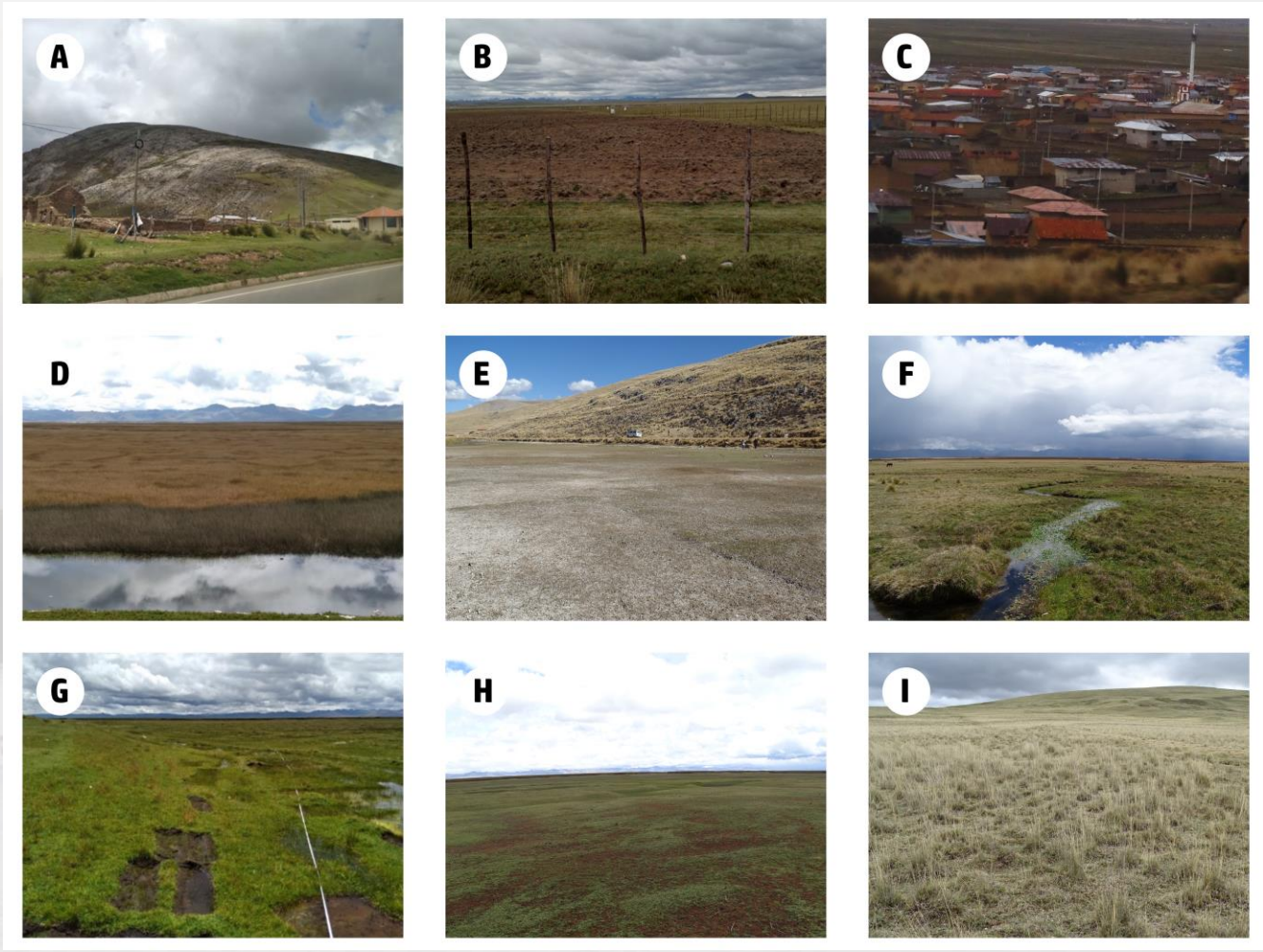
Step #2 : Training data acquisition / class definition

Visually similar, functionally different

Flooded / dry

Mixed and dynamic classes

? Question: Which classes are relevant for atmospheric/hydrologic applications?



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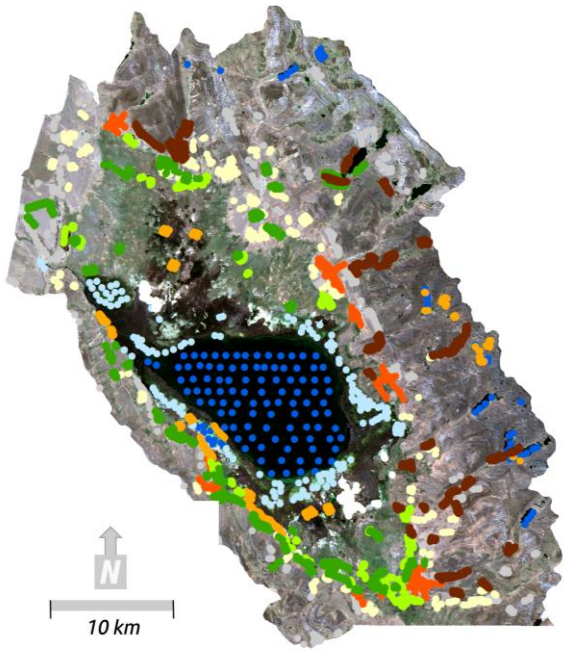
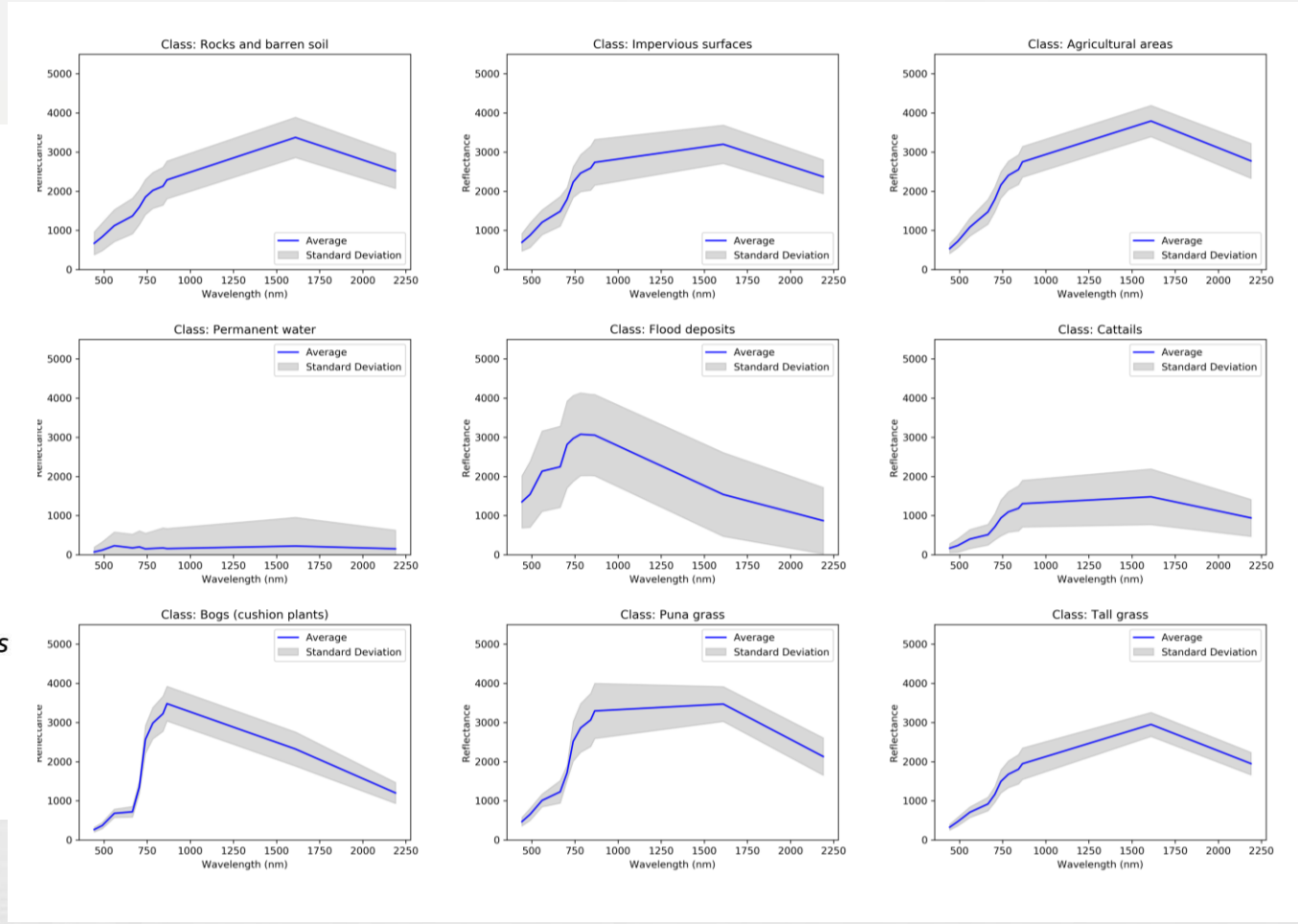
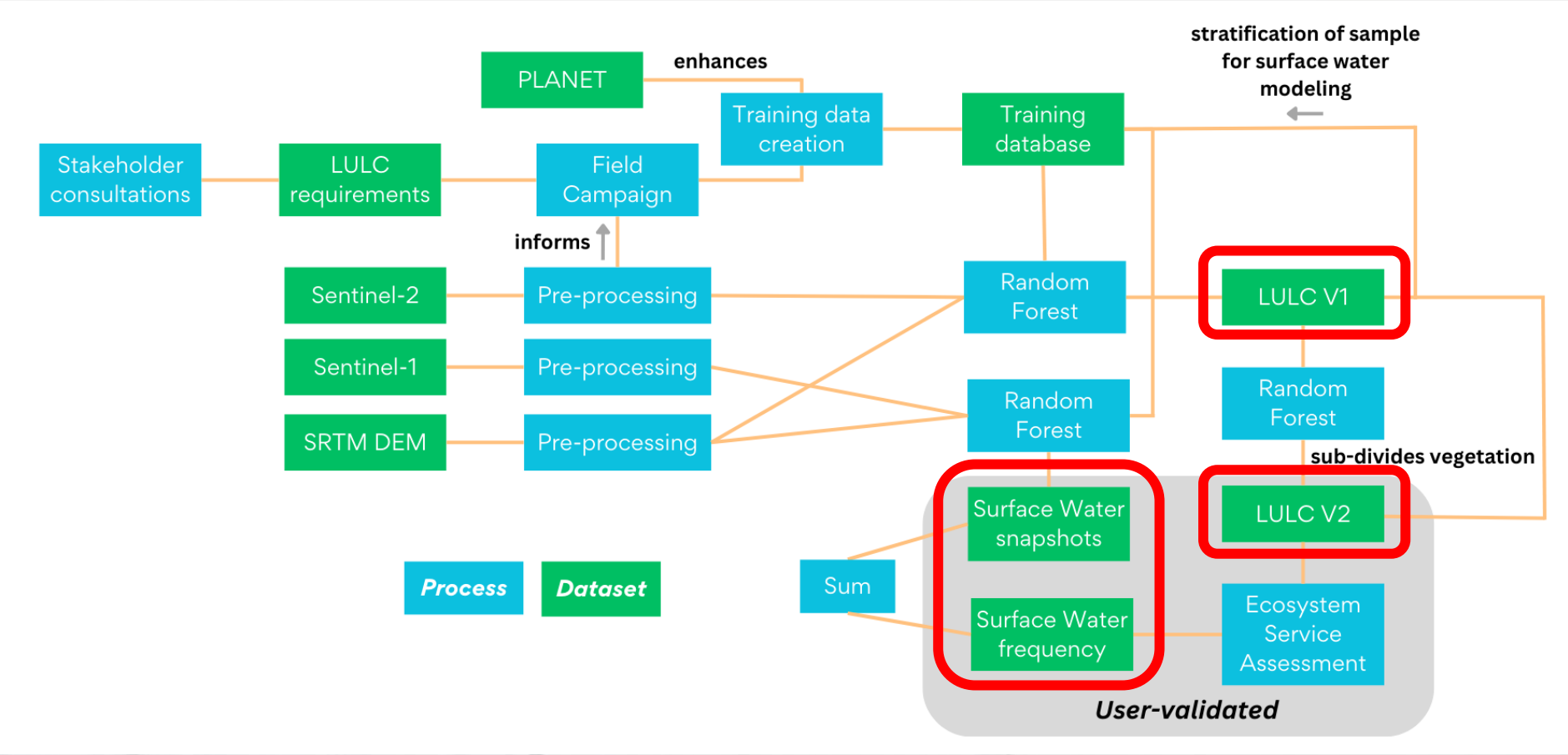


LULC V2

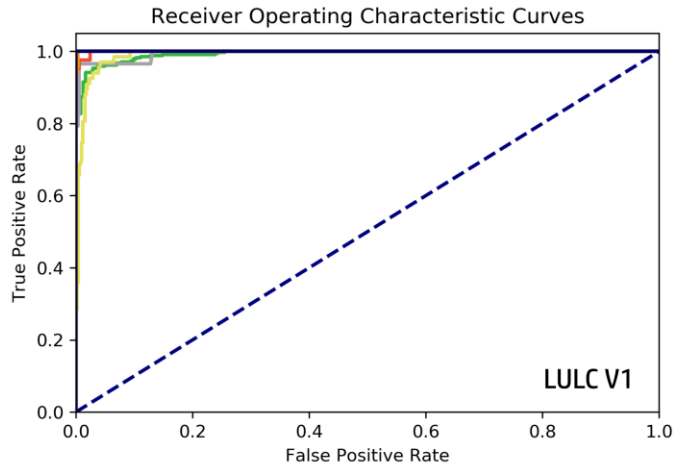
- *Barren soil and outcrops*
- *Agricultural areas*
- *Impervious surfaces*
- *Cattails*
- *Flood deposits*
- *Permanent water bodies*
- *Frequently inundated areas*
- *Bogs (cushion plants)*
- *Puna grass*
- *Tall grass*



Step #3 : One dataset is not enough



Step #4 : Model development

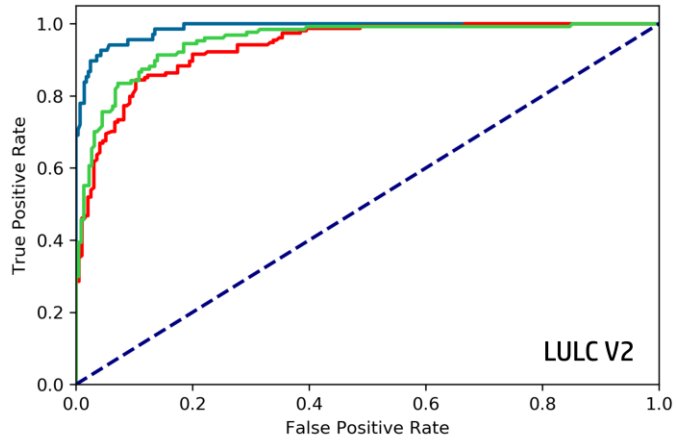


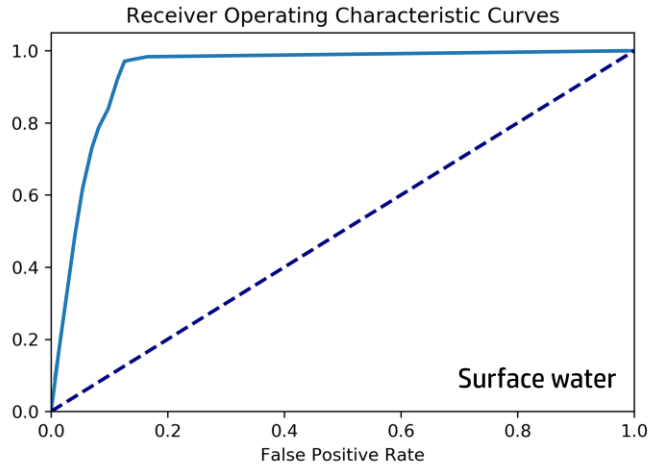
LULC V1:

Barren soil:
Agricultural areas:
Impervious:
Vegetation:
Water:
Flood deposits:
Cattails:

LULC V2:

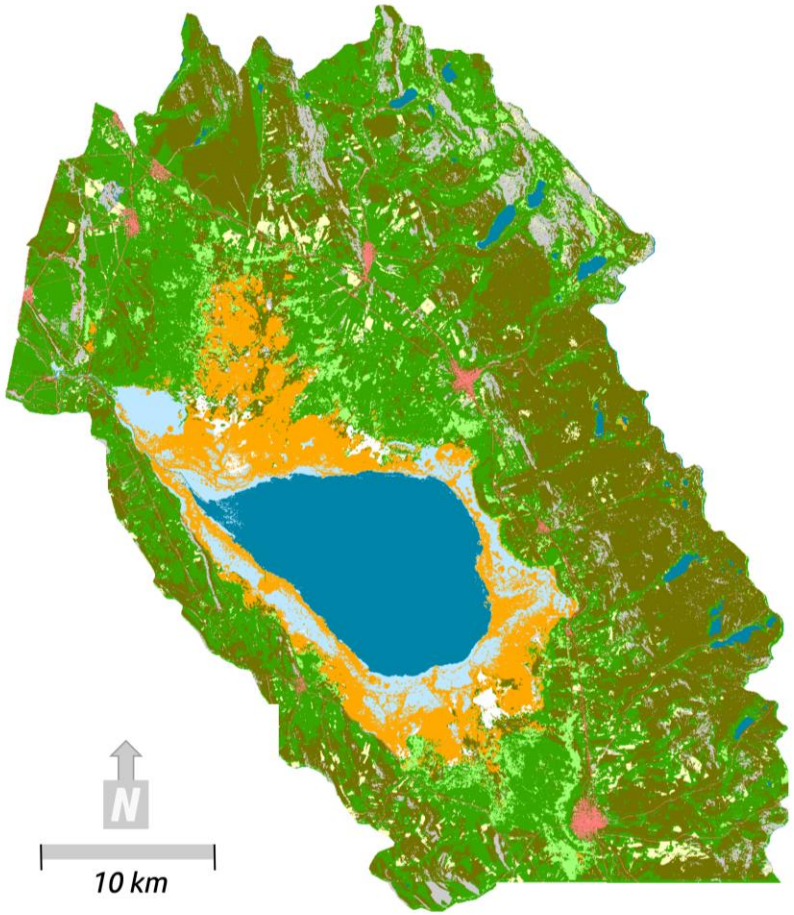
Cushion plants:
Puna grass:
Tall grass:

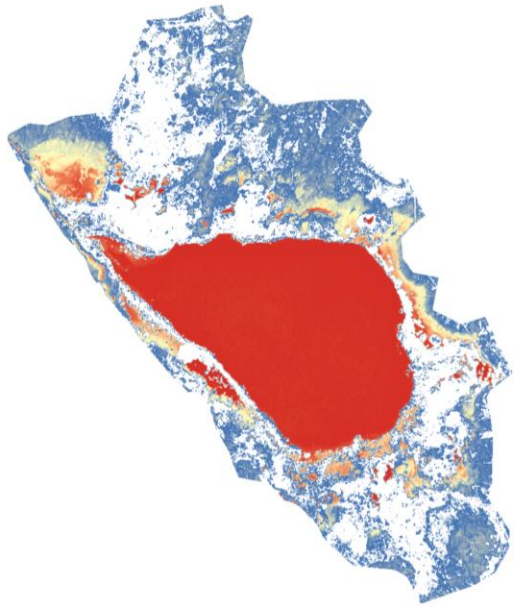




LULC OA: 90% (Lv1) / 85% (Lv2)
Surface Water OA: 91%

Cattails almost double the flooded surface area.





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Surface Water Frequency (%)

100 %

0

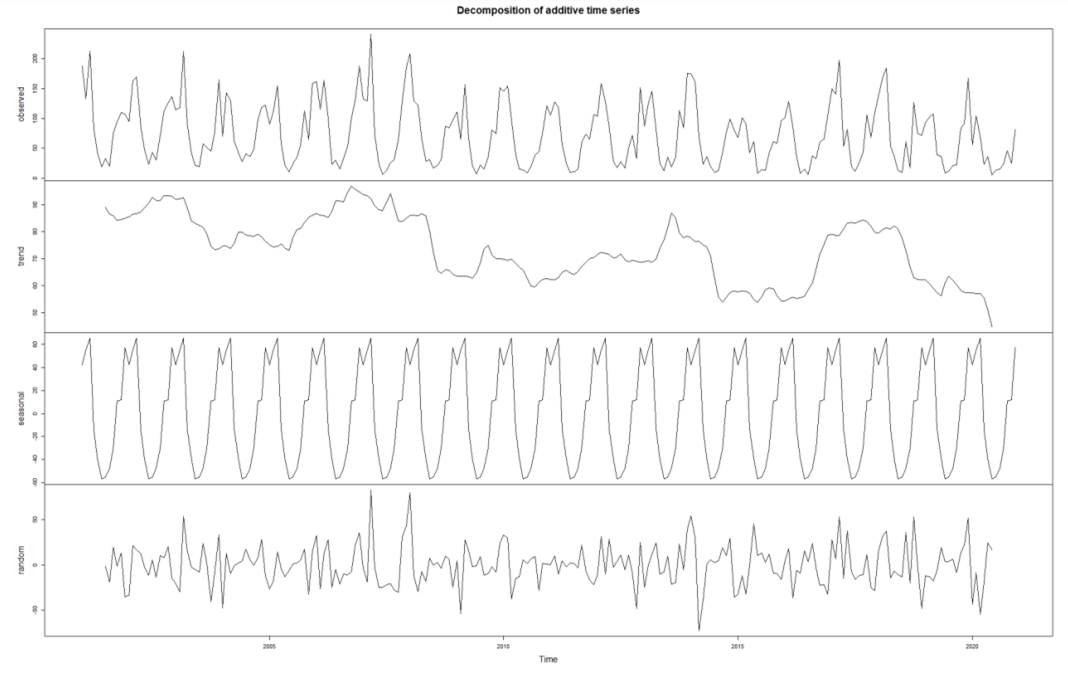
First datasets of the PULSE initiative.

Next: land surface temperature, soil moisture, plant phenology

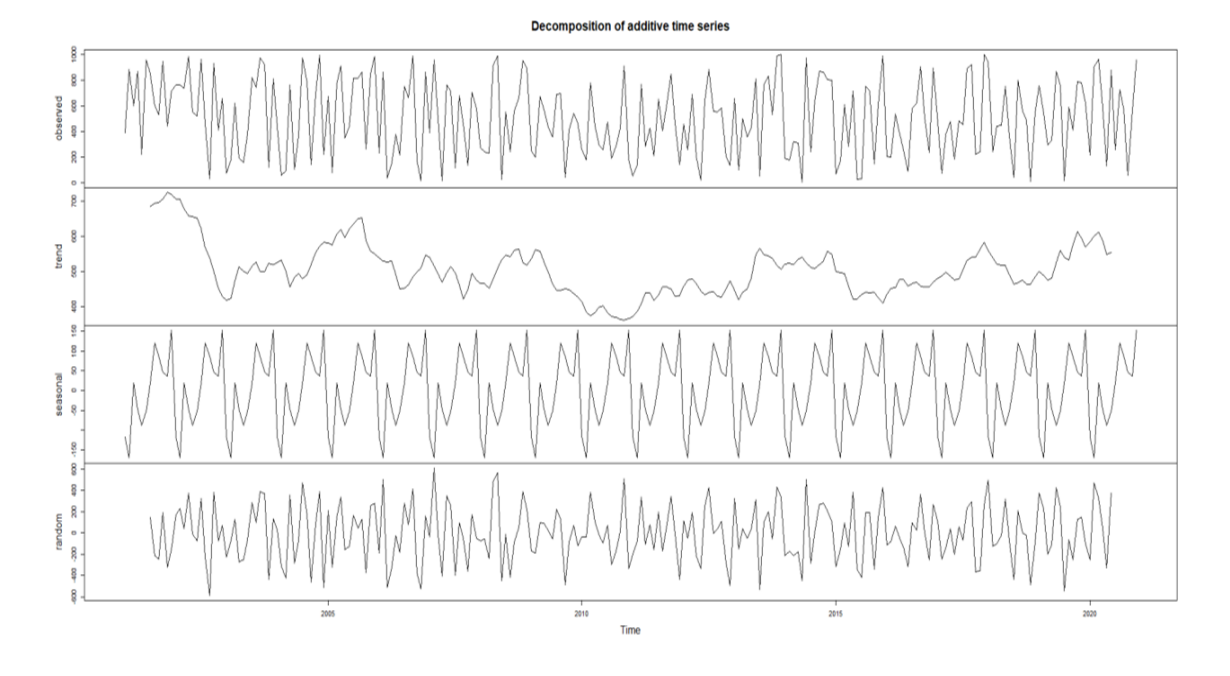
?

Question: How to create an FAIR suite valuable for the atmos. sciences?

Classes are not telling the whole story

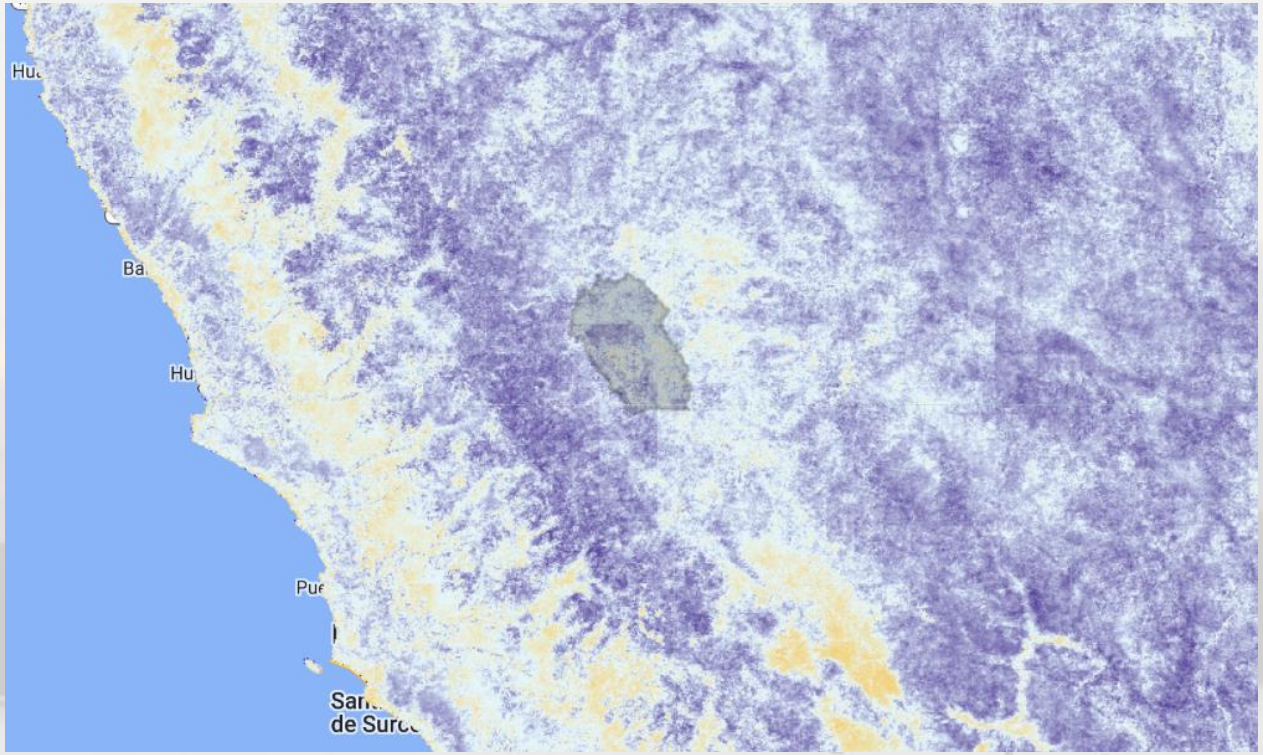


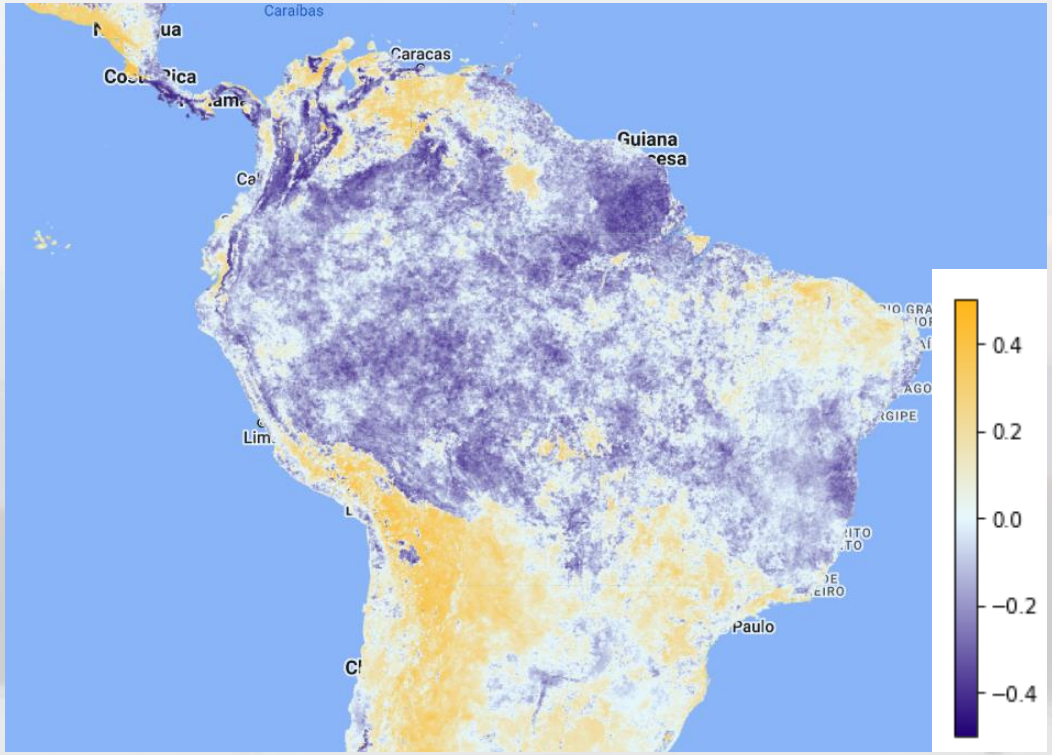
IMERG V06 Final Time Series Decomposition



NDVI Time Series Decomposition (Puna grass)

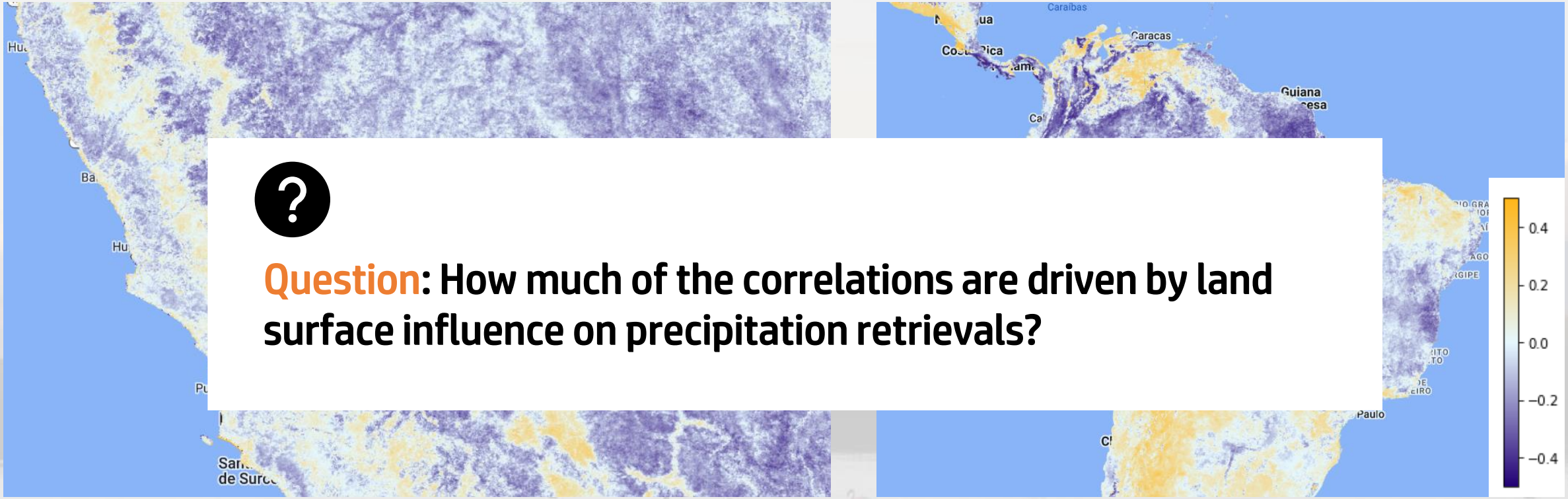
Classes are not telling the whole story





Correlation of monthly IMERG and NDVI (MODIS) time series

Classes are not telling the whole story



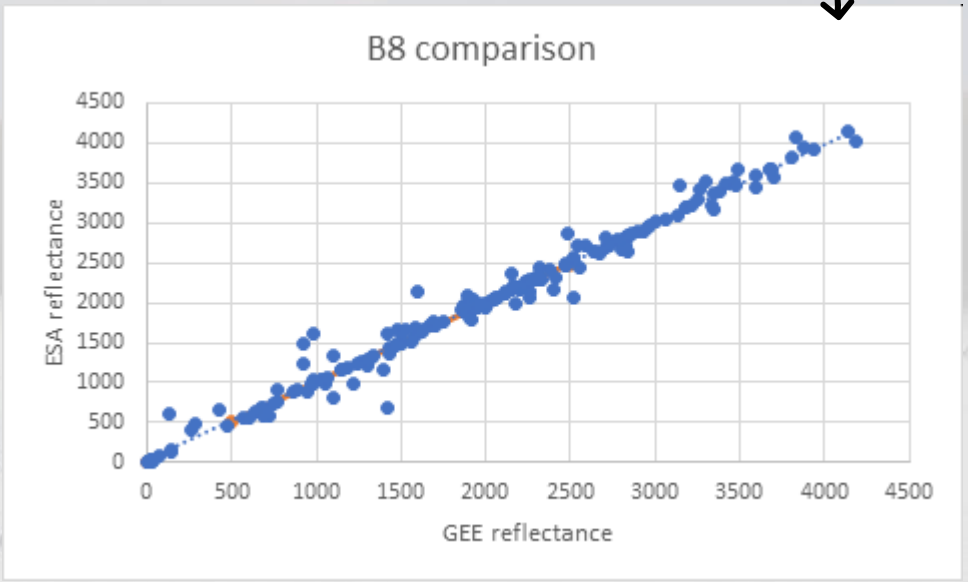
Question: How much of the correlations are driven by land surface influence on precipitation retrievals?

Correlation of monthly IMERG and NDVI (MODIS) time series

Scaling up, next steps

Moving to the cloud may be required to extend mapping to the whole Andes and automate updates.

Original Sentinel-2 data and cloud datasets are not exactly alike. What is the impact of the differences?



and... change of terms/processing chains...
NWS twitter example

Is Near Real Time land cover necessary?

Summary

1. Co-designing land surface characteristics datasets with users streamlines the development process.

2. PULSE is testing the implementation of a suite of application-agnostic products, but guidance on potential uses / requirements are still needed.

3. What are the obstacles to incorporating land cover products to enhance soil moisture and precipitation retrievals?

4. It is necessarily a collaborative effort, but incentives needed.

Funding:

Collaborations are welcome!

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