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Session HS3.1

Remote Sensing and Clustering Applications in Landscape Hydrology: Characterizing a Subarctic Watershed in Nunavik (Canada)

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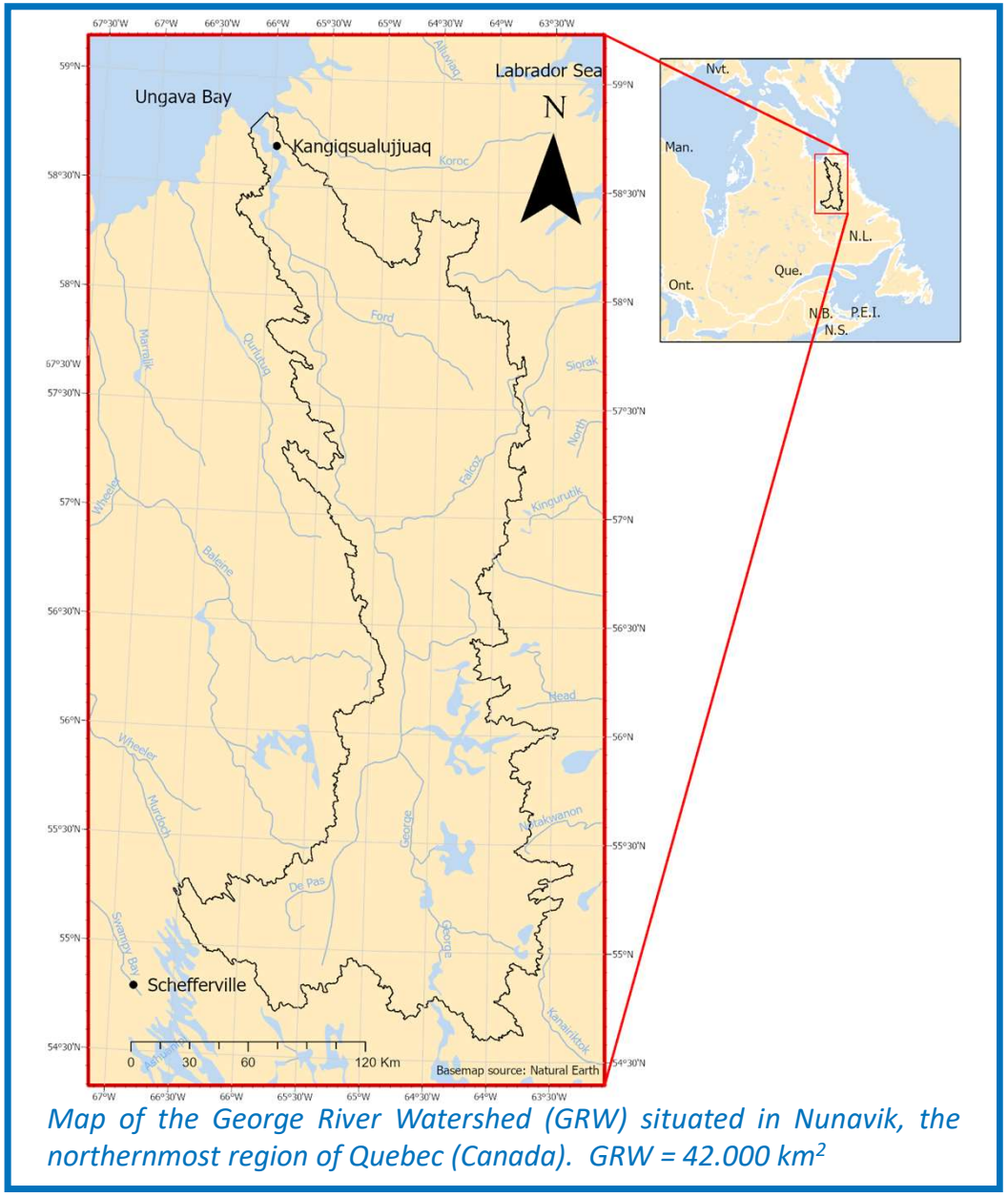
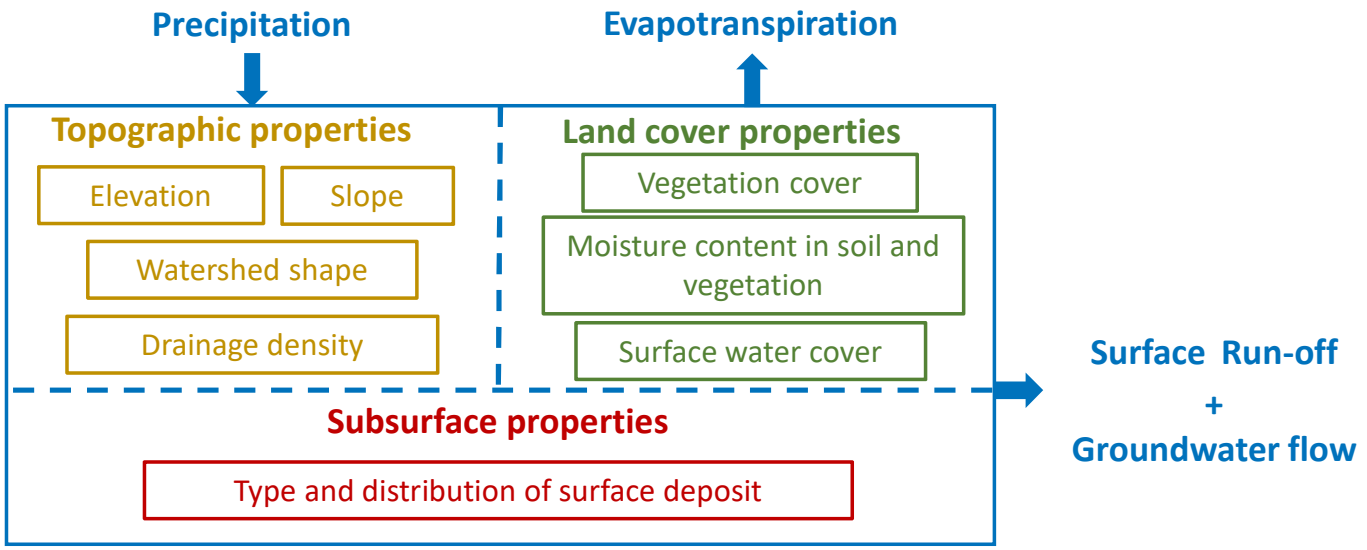


Map of the George River Watershed (GRW) situated in Nunavik, the northernmost region of Quebec (Canada). GRW = 42.000 km²

Conceptual framework and dataset:

Landsat images collection 1985-2019 from Google Earth Engine catalog

NDVI: Norm. Diff. Vegetation Index
NDMI: Norm. Diff. Moisture Index
NDWI: Norm. Diff. Water Index



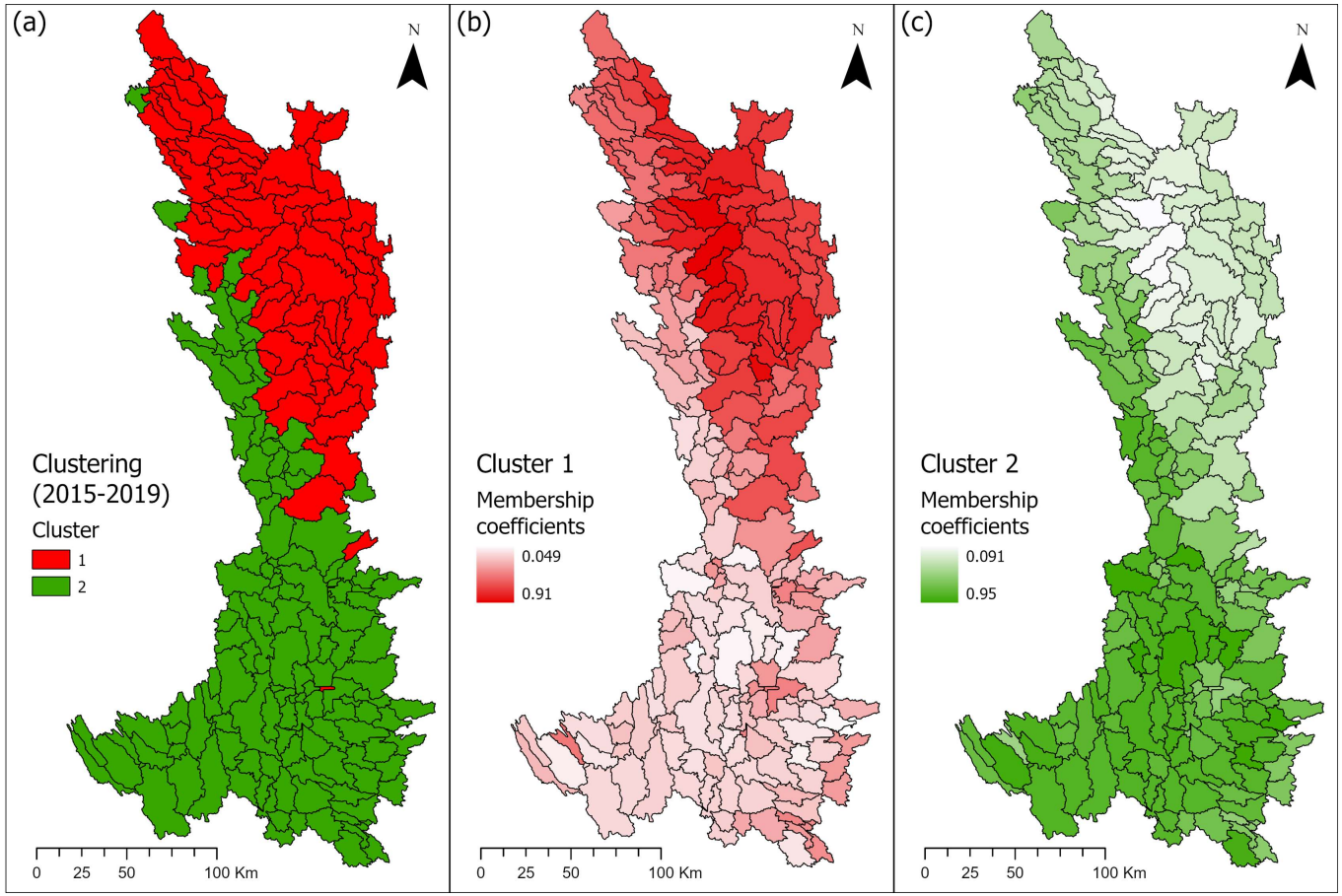
Methodology:

Watershed segmentation into 218 subwatersheds

Topographic, Land cover and Subsurface metrics extraction for each subwatershed

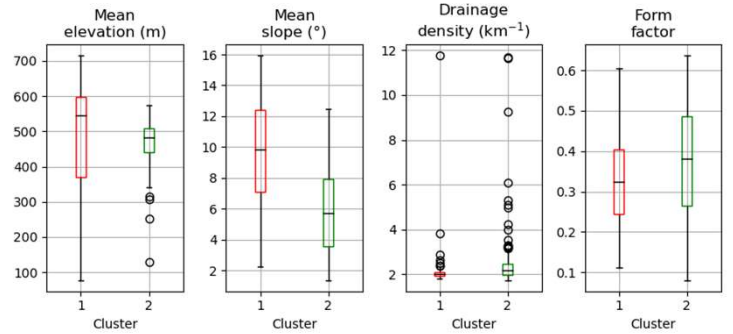
Fuzzy C-Means Clustering

Clustering results (2015-2019)

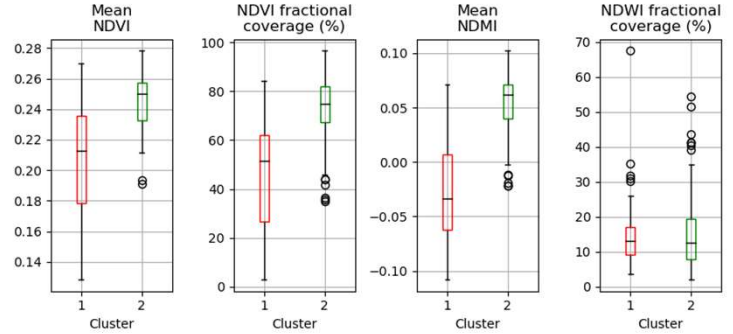


Clustering results for the 2015-2019 classification reveal a clear partitioning of the GRW with two clusters of subwatersheds distributed latitudinally: (a) "hard" clustering results, (b) fuzzy clustering results for Cluster 1 (C1) and (c) fuzzy clustering results for Cluster 2 (C2).

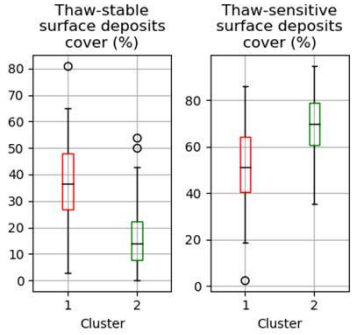
Topographic metrics :



Land cover metrics :

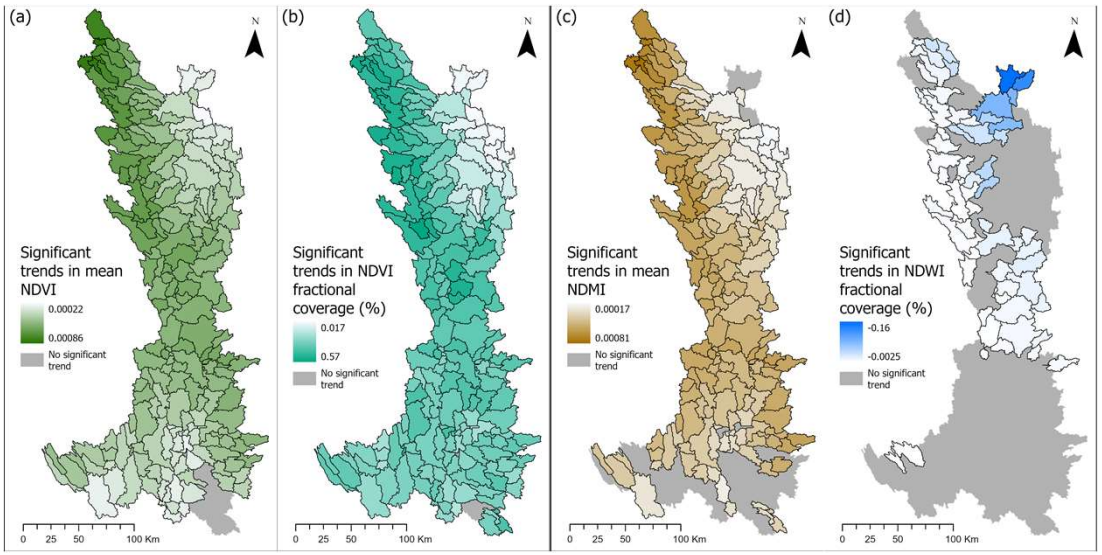


Subsurface metrics :



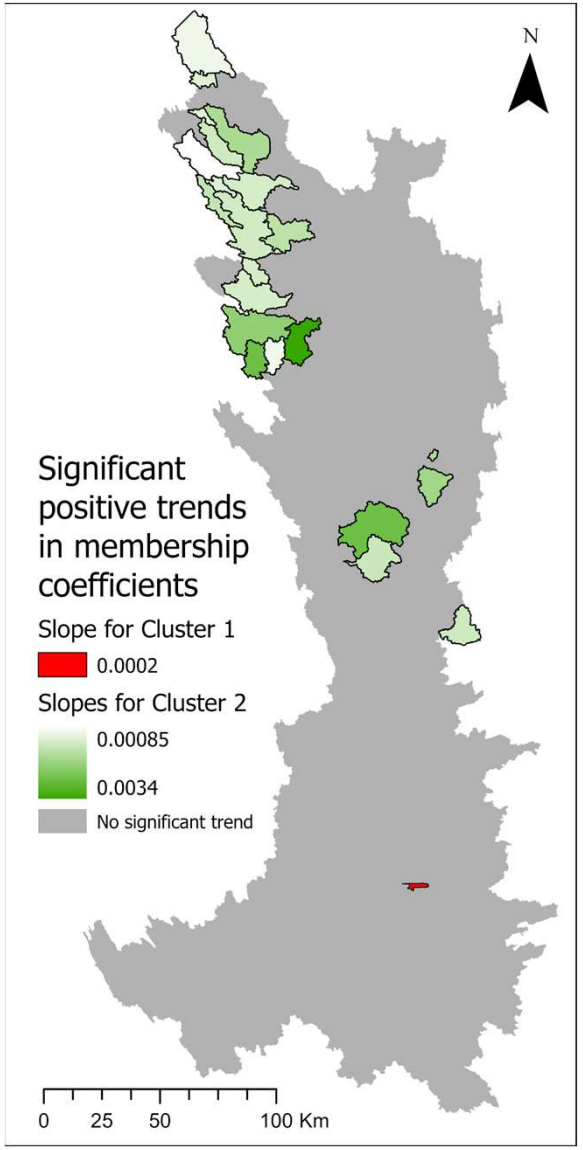
Topographic, land cover and subsurface metrics statistical distribution by cluster (C1 in red and C2 in green). Mean elevation, mean slope, mean NDVI, NDVI fractional coverage, mean NDMI, thaw-stable and thaw-sensitive surface deposits cover are the metrics that highlight the most the differences between the clusters

Trends in land cover metrics and clustering results (1985-2019)



Significant trends in (a) mean NDVI, (b) NDVI fractional coverage, (c) mean NDMI and (d) NDWI fractional coverage, for the 1985-2019 period. A darker color represents a higher trend in magnitude. Gray areas indicate no significant trend identified.

Significant trends in membership coefficients for the period 1985-2019 present only one subwatershed with a positive trend in its membership to C1, compared to 22 subwatersheds for C2. A darker color represents a higher trend in magnitude. Gray areas indicate no significant trend identified.



Significant trends in membership for C2 concern only subwatersheds that show high trends in at least three land cover metrics :

- mean NDVI
- NDVI fractional coverage
- mean NDMI

This increasing trend in the subwatersheds' membership to C2 suggests that they are becoming more **hydrologically similar** to the southern type, with potential **augmentations of infiltration processes and evapotranspiration rates**, as a consequence of increasing **vegetation growth and moisture content in soil and vegetation.**

Thank you !

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