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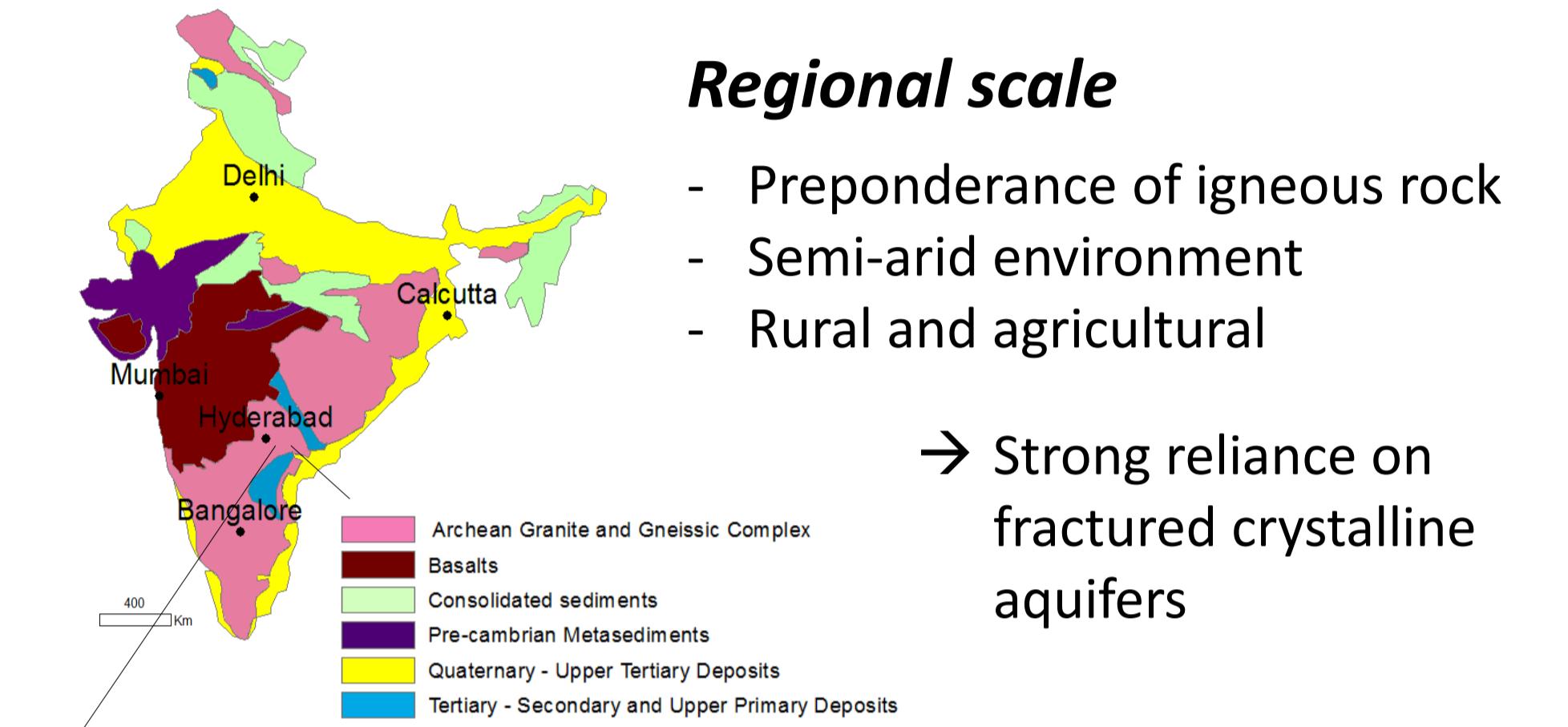
# Delineation of groundwater potential zones using non-invasive techniques to improve conceptual modelling of recharge in a non-instrumented weathered crystalline aquifer in South India

Abstract n°2400

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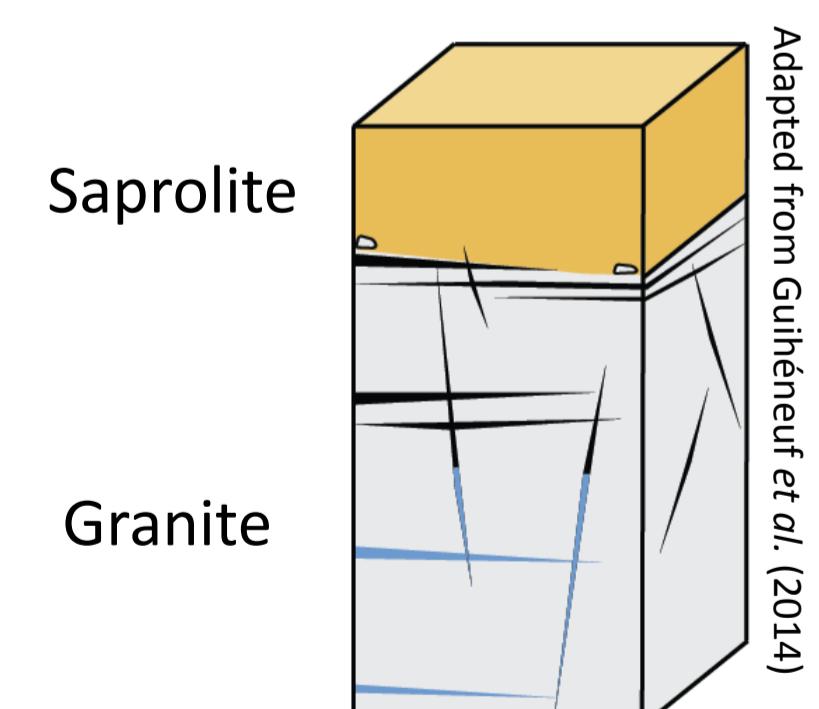
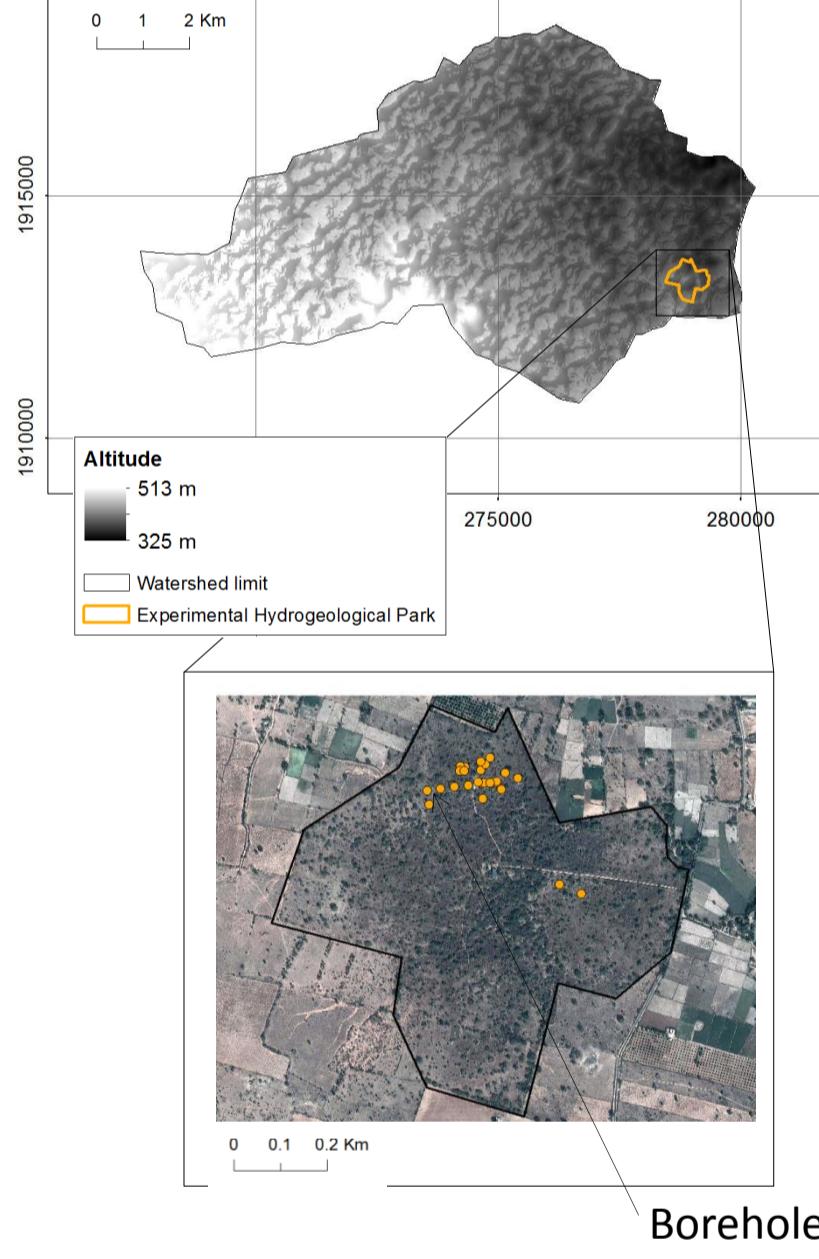
- When working in data-scarce areas, especially in heterogeneous environments, obtaining a sufficient amount of data to properly characterize hydrogeological fluxes is a crucial yet complicated task.
- Here we present the use of non-invasive techniques such as remote sensing and geophysics to delineate groundwater potential zones with distinctive characteristics and behaviour, emphasizing large scale surface data
- In term, this will allow us to create spatially distributed input parameter sets to improve conceptual modelling of groundwater recharge

## Context



### Catchment scale 56 km<sup>2</sup>

- Archean granitic complex
- Horizontal heterogeneity
- Rice paddies as dominant crop
- Water scarcity issues



- How is the EHP study site representative of catchment scale properties ?
- Can surface characteristics be used as a proxy to map groundwater characteristics ?
- Can we optimize data collection to improve conceptual modelling of groundwater processes and recharge ?

## HGU delimitation – Methodology

### Hydrogeomorphological Units

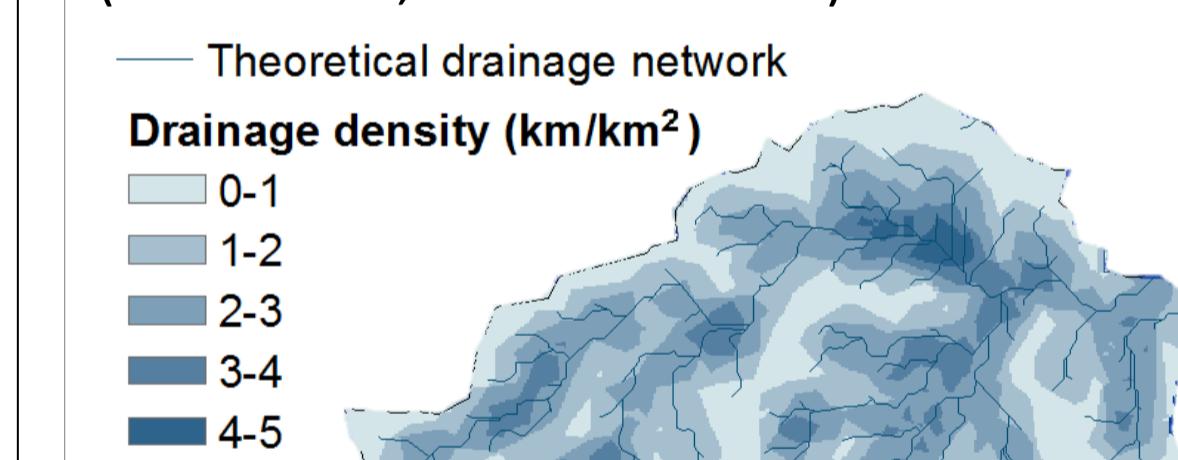
#### One unit = specific groundwater occurrences and processes

An HGU comprises one or more terrain units presenting a certain *drainage pattern*, *local topography* and the *soil and weathered zone characteristics* which govern the recharge, storage of groundwater and outflow.

### HGU delimitation - Application

#### Drainage density

(theoretical, no surface flow)

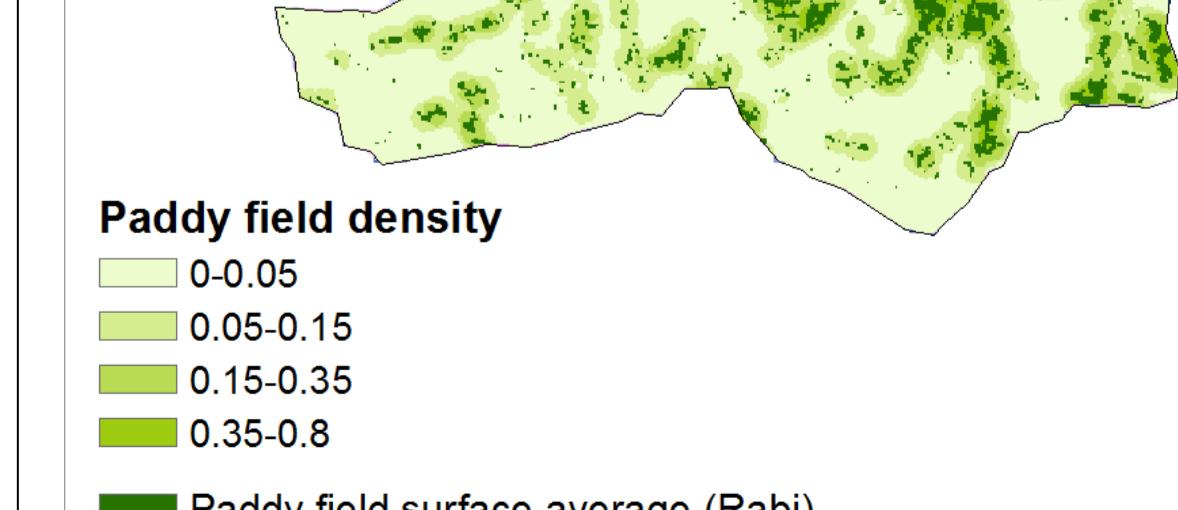
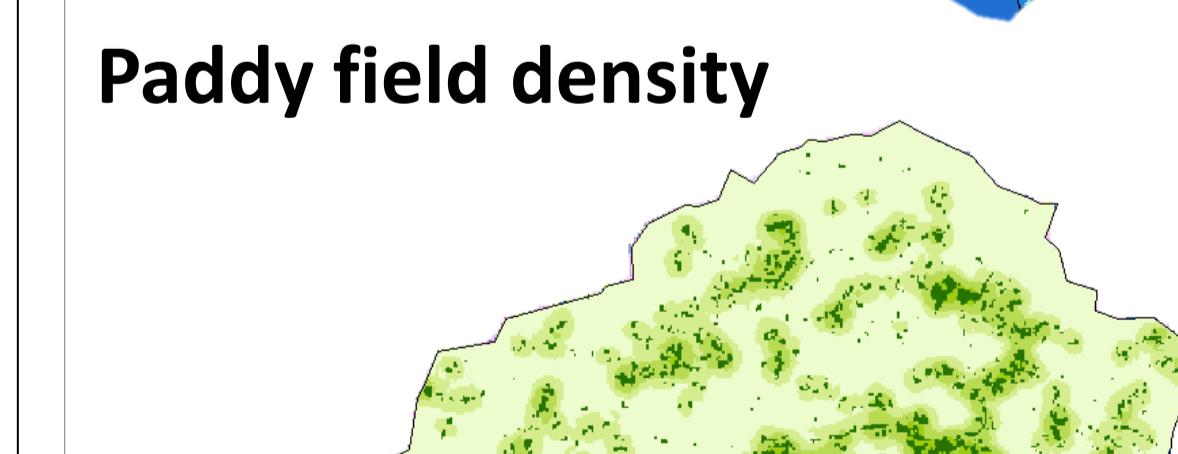
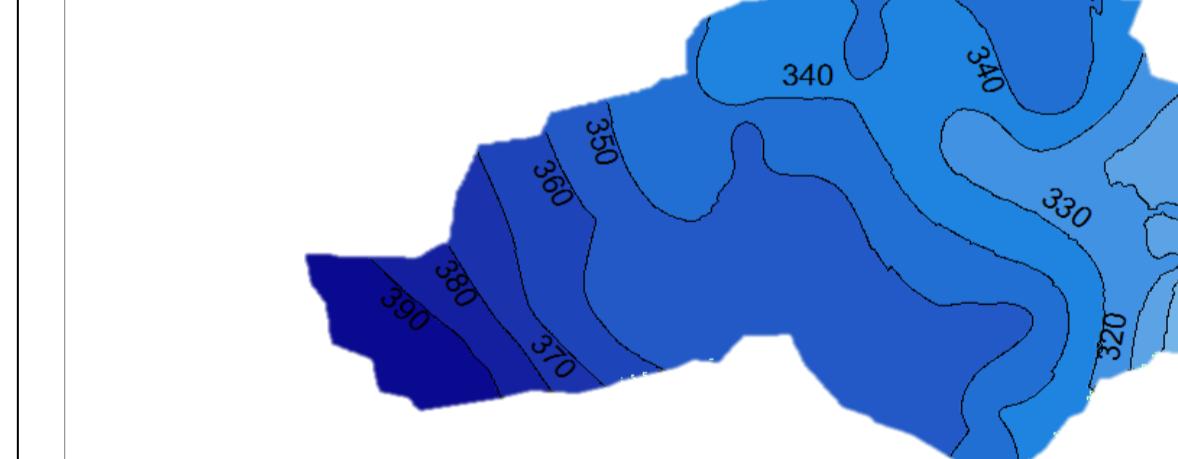


#### Slope

Slope (°)

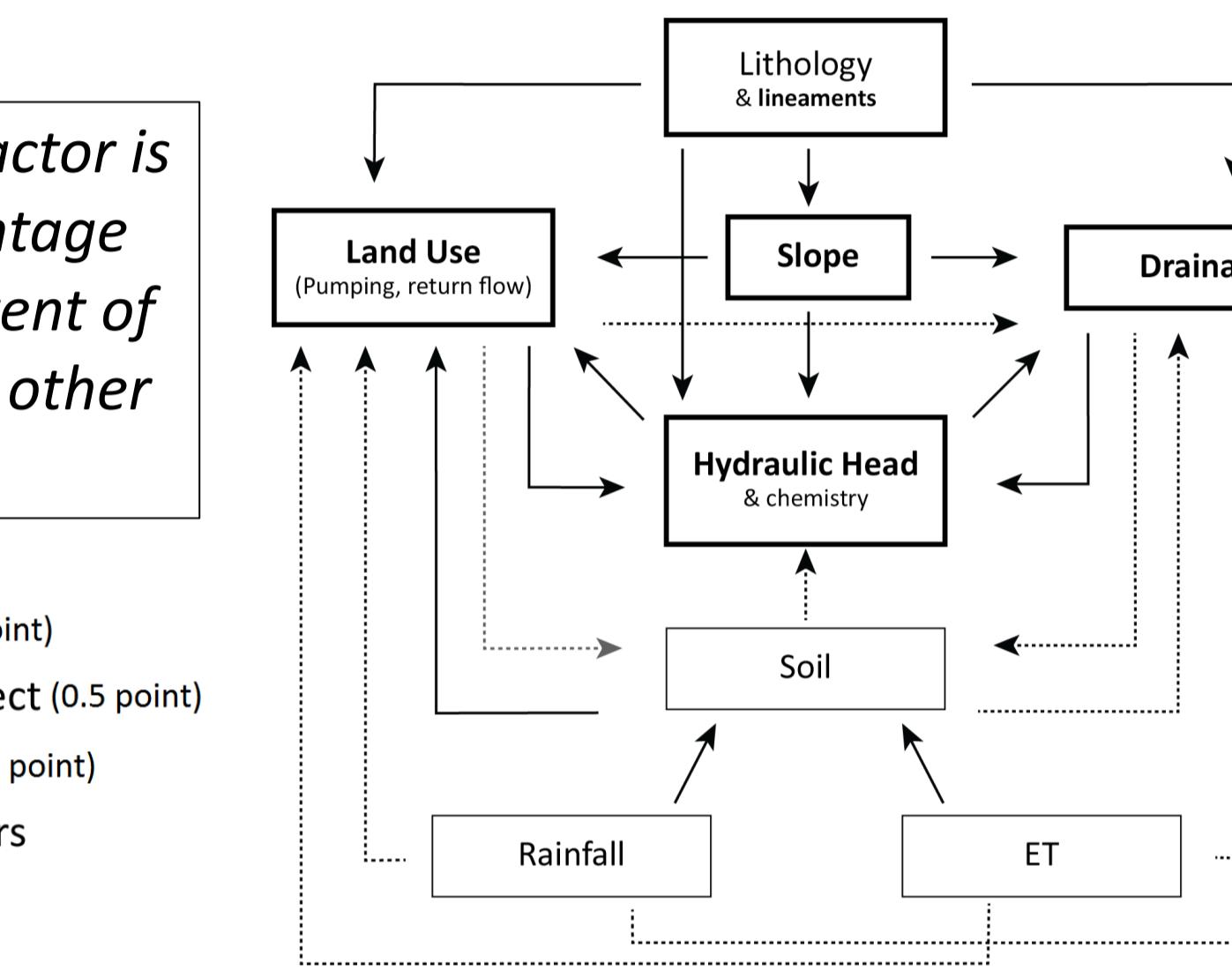
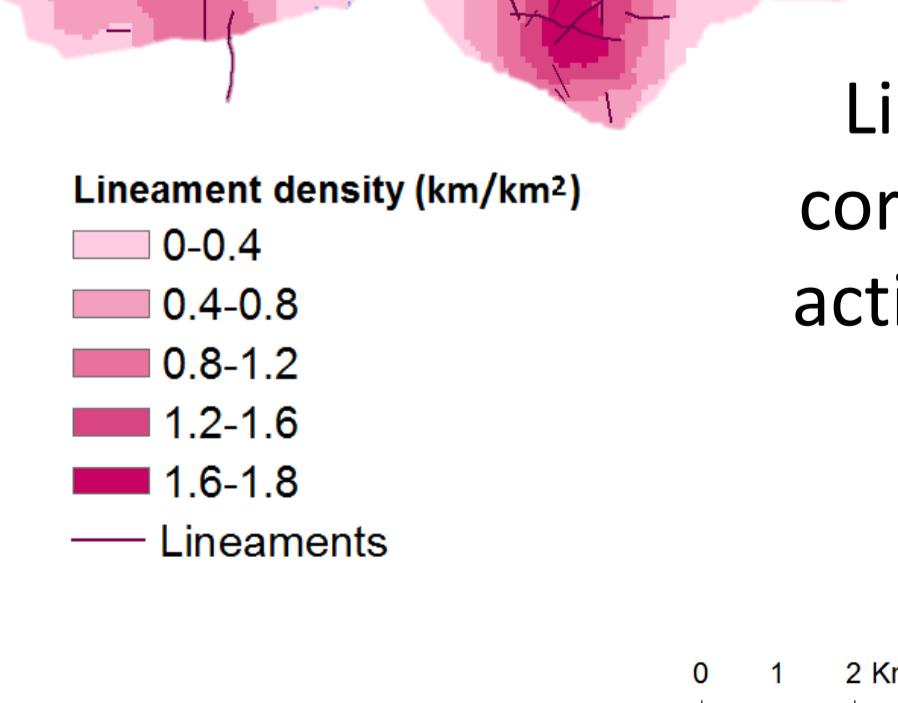


#### Hydraulic head



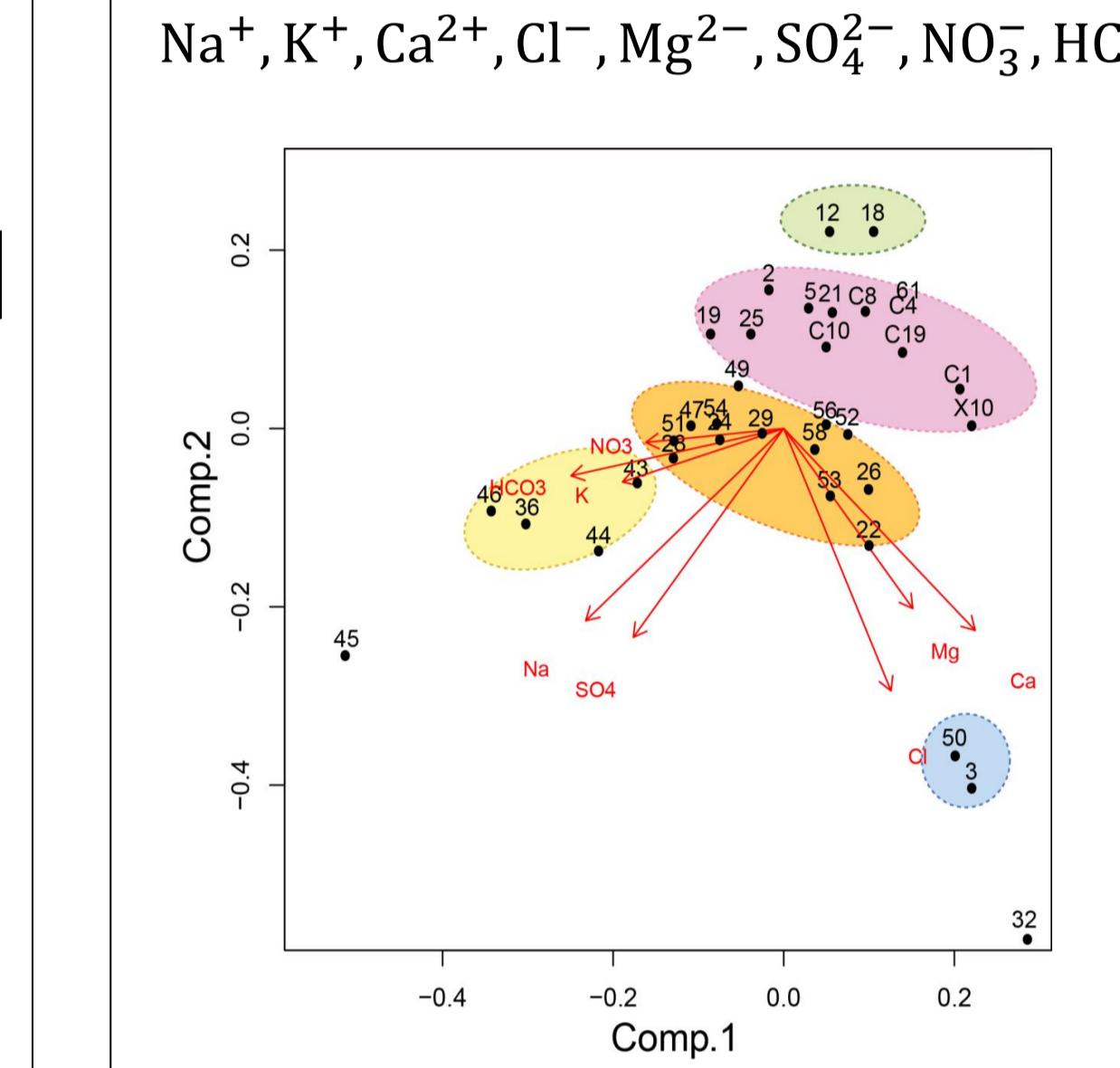
#### Lineament density

Lineament density (km/km<sup>2</sup>)



Method further described in Magesh et al. (2012)

## Correlation with groundwater compartmentalization



PCA performed on 35 groundwater samples collected from available boreholes in July 2016 (Rabi season)

Compartmentalization shown by the PCA correlates relatively well with the groundwater potential zones

## Verification through complementary field data collection

Verify the validity of the outlined hydrogeomorphological units through field data collection

↔ Use HGU categories to facilitate field data collection

- Hydraulic tests
- Applied geophysics

If representative HGUs may be defined for describing groundwater processes, then necessary data point density could be decreased

## Conclusion

Surface characteristics correlate with groundwater compartments

This finding is encouraging regarding the establishment of proxies from surface data for groundwater model parameters

Overall, separating a catchment into HGUs, for which validation is necessary through data collection, is a promising method to allow reservoir model calibration in heterogeneous non-instrumented environments

## Perspective: conceptual modelling

**Objective:** Create a conceptual model whose parameters are defined within each HGU category and which can be calibrated with hydraulic head (as there is no perennial discharge)

Establish proxies for reservoir model parameters using **remote sensing** and optimized field data collection

Calibration on a well-instrumented watershed with marked heterogeneity and where long-term piezometric time series are available

(i) Guiheneuf, N., Boisson, a., Bour, O., Dewandel, B., Perrin, J., Dausse, A., ... Maréchal, J. C. (2014). Groundwater flows in weathered crystalline rocks: Impact of piezometric variations and depth-dependent fracture connectivity. *Journal of Hydrology*, 511, 320-324. <http://doi.org/10.1016/j.jhydrol.2014.01.061>

(ii) Magesh, N. S., Chandrasekar, N., & Soundranayagam, J. P. (2012). Delineation of groundwater potential zones in Theni district, Tamil Nadu, using remote sensing, GIS and MI techniques. *Geoscience Frontiers*, 3(2), 189–196. <http://doi.org/10.1016/j.gsf.2011.10.007>