THREE CASE STUDIES: IMPROVED ASSESSMENT OF HYDROLOGICAL PROCESSES ON CATCHMENT SCALE USING A NEW TOWED GROUNDBASED TEM SYSTEM

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Objective

- Mapping shallow geology and assessing its effect on runoff in agricultural lowland areas located in moraine landscape with heterogeneous geology

Methods

- Three sites of varying size: Gedved (case 1), Javngyde (case 2), and Sillerup (case 3) (150, 1000, and 3000 ha, respectively)
- Applying a new geophysical imaging method (tTEM, Auken et al 2018) to map the three sites in detailed 3D to 50-70 m depth
- Measuring runoff (drain or stream flow) at several locations at each site
- Combining tTEM data and runoff data to assess the effect of the shallow geology on the spatial variability in runoff

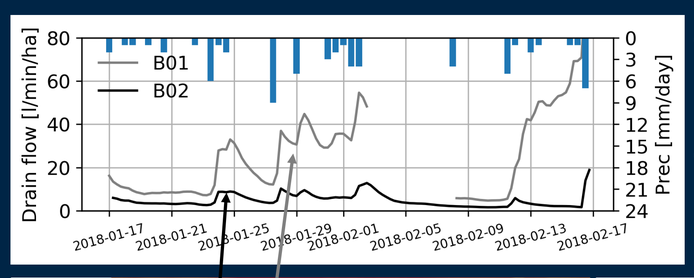
Implication for management

- Understanding the link between shallow geology and runoff from field- to watershed-scale will likely be critical as water managers in Denmark move toward a more spatially detailed regulation of agricultural nitrogen

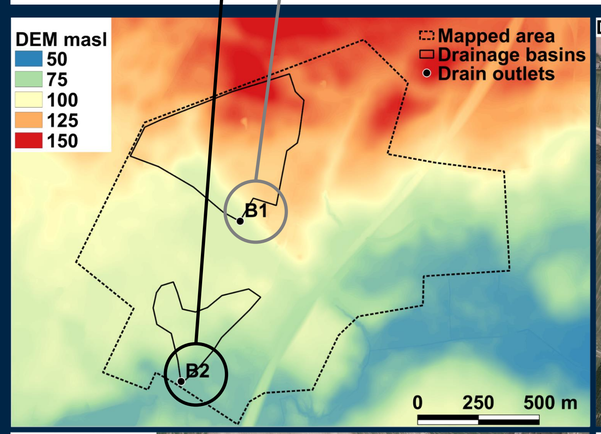
Conclusion

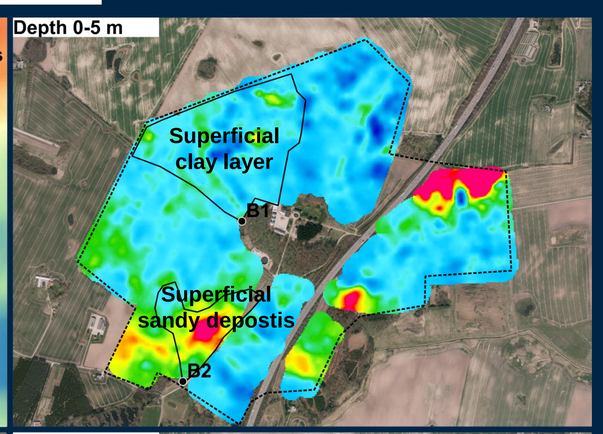
- A new geophysical imaging method (tTEM) was successfully applied to map shallow geology in detailed 3D which helped explaining spatial variability in runoff

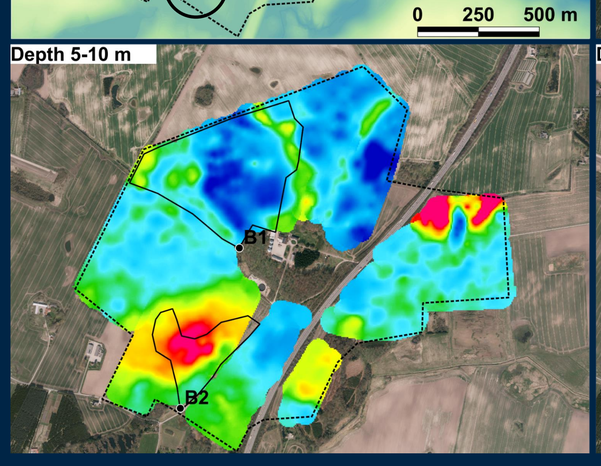
Case 1: Results

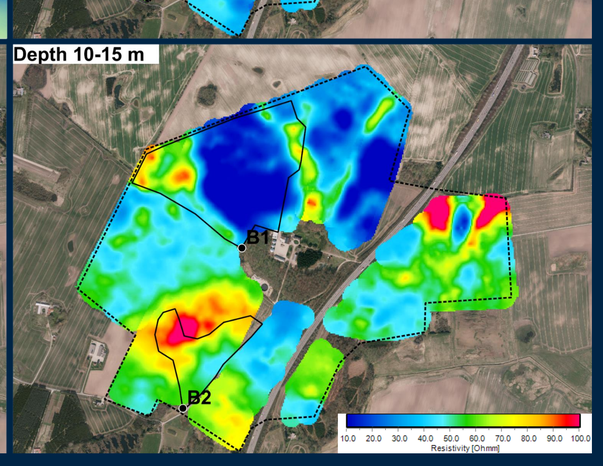


- Northern field: superficial clay layer explains the large specific drain flow
- Southern field: superficial sandy deposits explain the lower specific drain flow

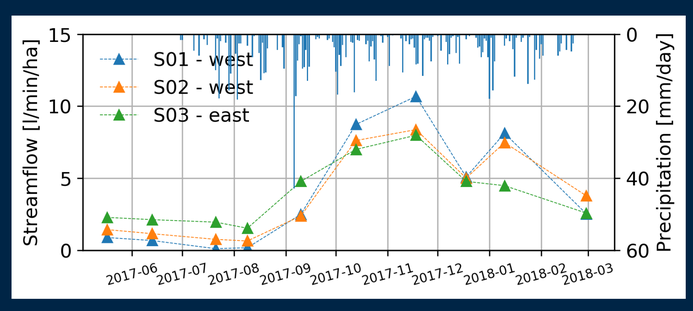




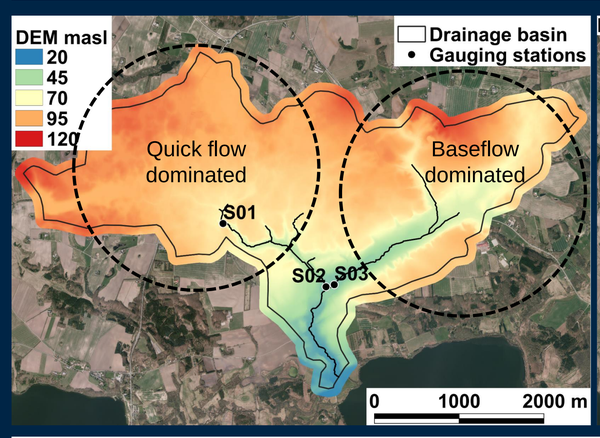


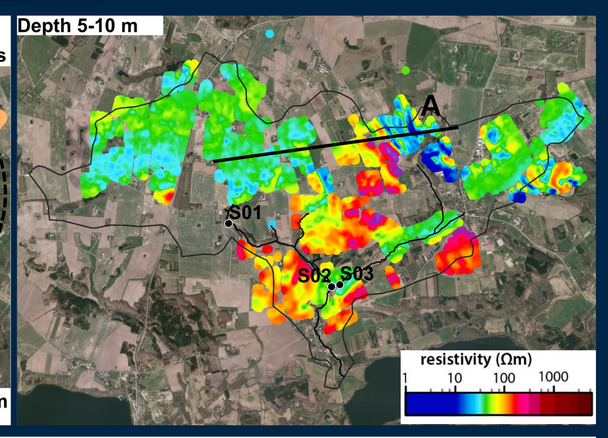


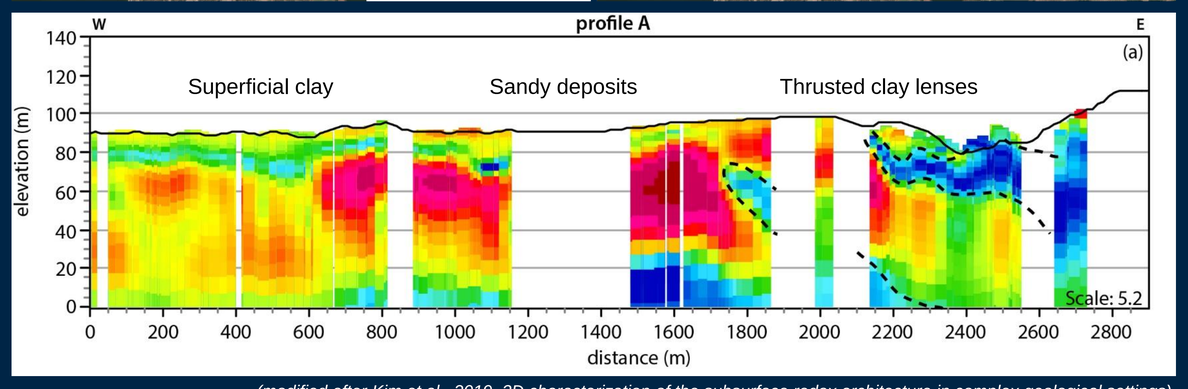
Case 2: Results



- Western sub-basin: superficial clay layer explains the quick flow dominated runoff
- Eastern sub-basin: sandy deposits and thrusted clay lenses explain the baseflow dominated runoff



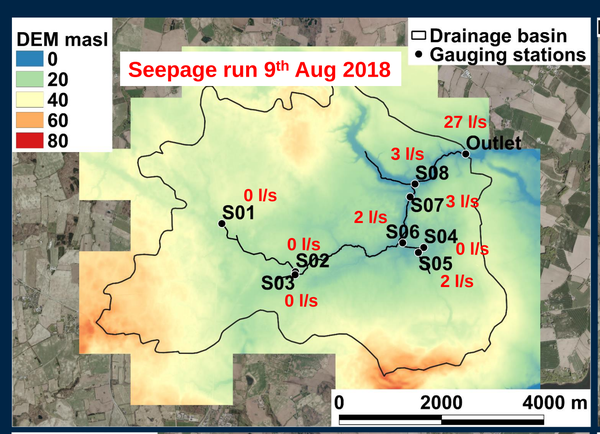


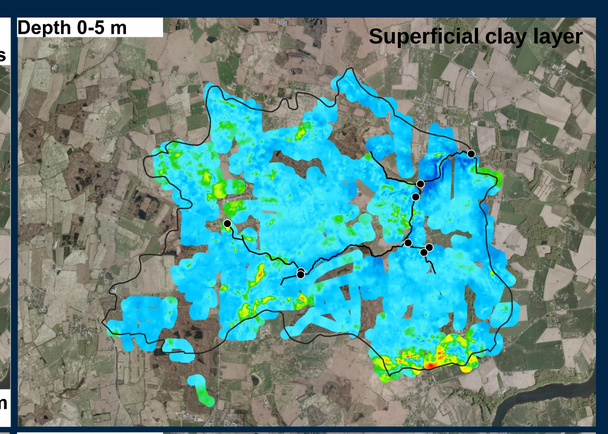


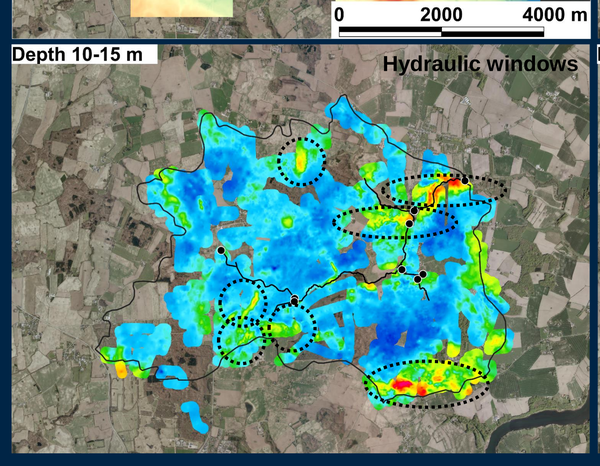
(modified after Kim et al., 2019, 3D characterization of the subsurface redox architecture in complex geological settings)

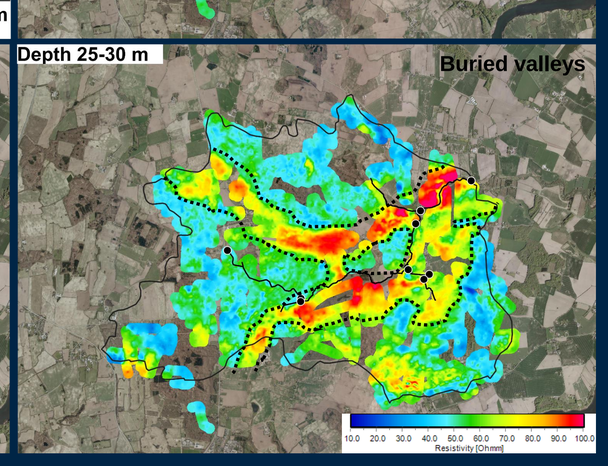
Case 3: Results

- Seepage run 9th Aug 2018 (dry summer situation) shows significant baseflow gain between S08 and outlet station (lowermost part of stream)
- Superficial clay layer covers the basin
- A few hydraulic windows allow recharge to deep aquifer
- Two sand filled buried valleys run west-east and southwest-northeast
- Mapped geology explains the baseflow pattern









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