



Flood Control 2015

FC2015

RSDYK

Dyke quality assessment by remote sensing

Robert Hack

Pilot project: RSDYK2008

Trial to establish whether remote sensing in combination with geological knowledge can be used for quality assessment

- Brief literature review
- Remote sensing data acquisition in different seasons
- Borehole, CPT, geophysics for ground truth
- Brief preliminary analyses

Test sites in Reeuwijk – Zuid Holland

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(map: Routenet-Routeplan, <http://www.routenet.nl> ; 16 Feb 2009)

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Test sites

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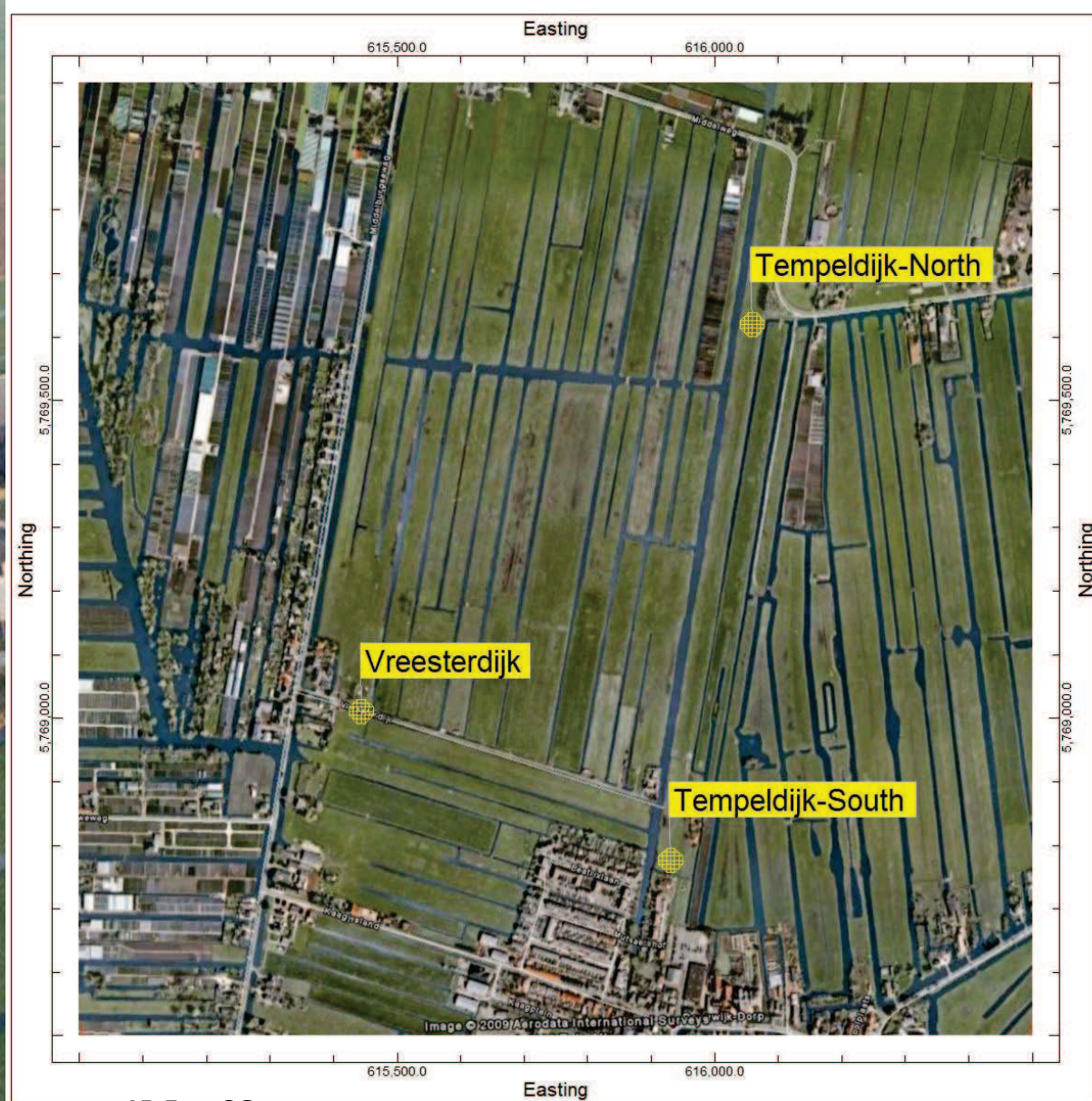
Area:
*Partially excavated for peat
excavation*

Tempeldijk = "veenkade"

Location:

North – No known problems

South – Seepage ("kwel")

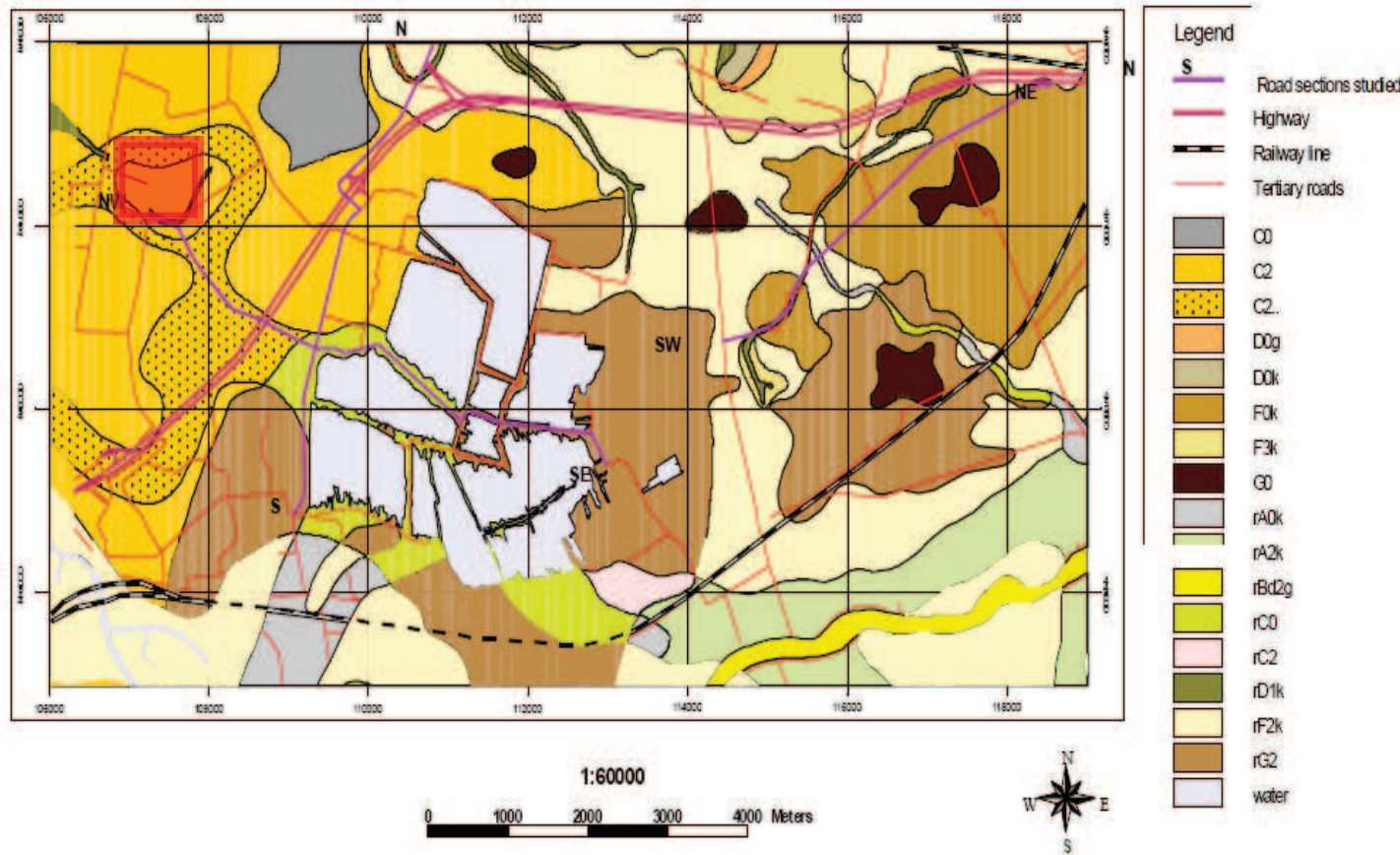


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Geology

GEOLOGICAL MAP OF REEUWIJK

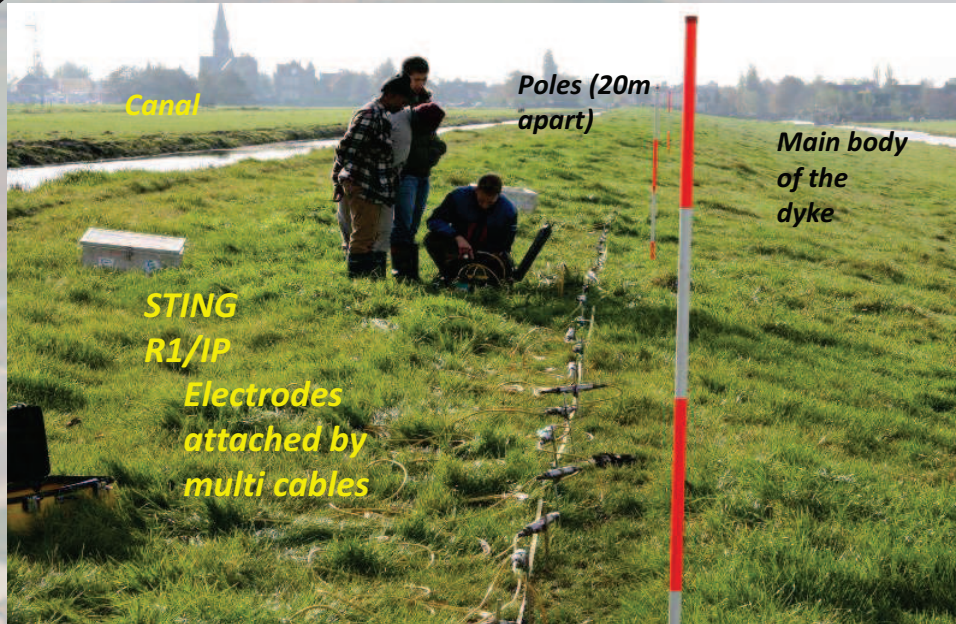


- G0: Holland peat
- C2: Holland peat on Callais III Deposits (tidal flat deposits) on an alternation of Holland peat and Gorkum deposits
- C2..: Holland peat on Callais III Deposits (tidal flat deposits) on Gorkum deposits (channel deposits)
- rC0: Holland peat on Gorkum deposits (channel deposits)

Geological map of the area around Reeuwijk (after Bosch and Kok, 1994)

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Tempeldijk



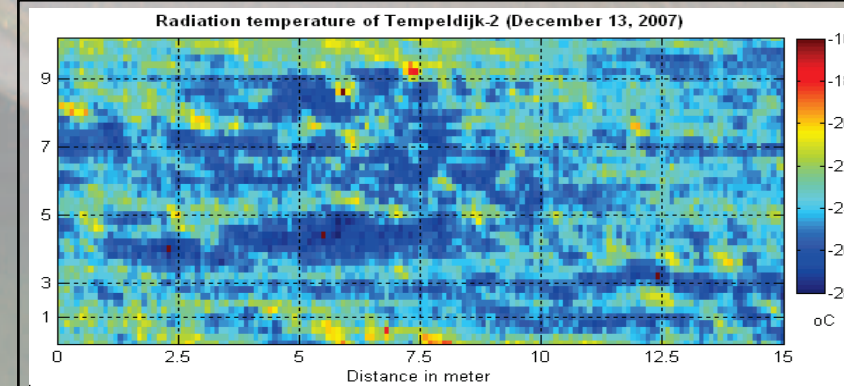
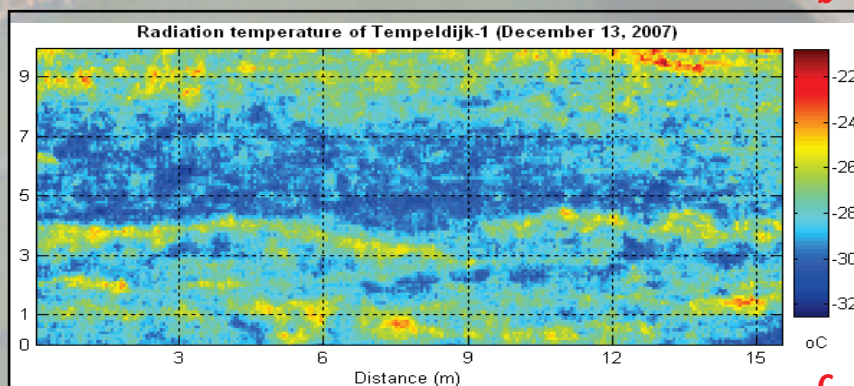
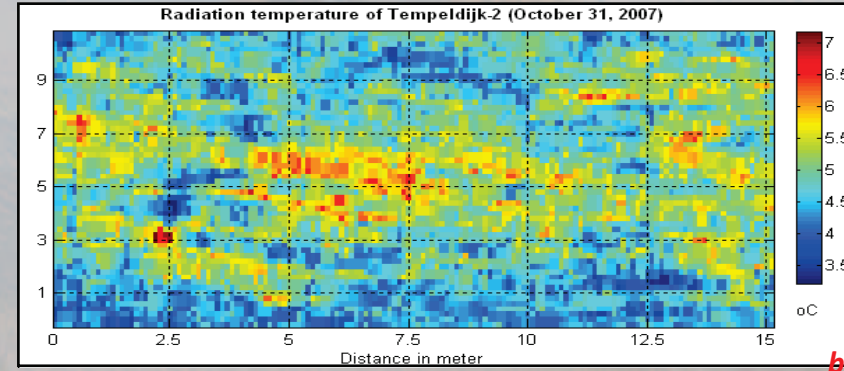
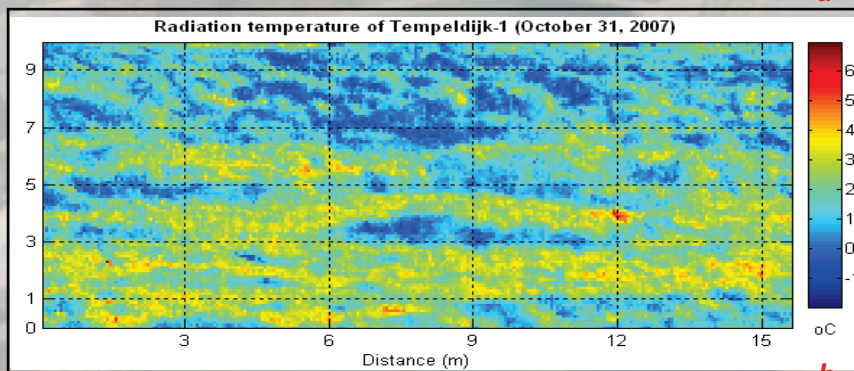
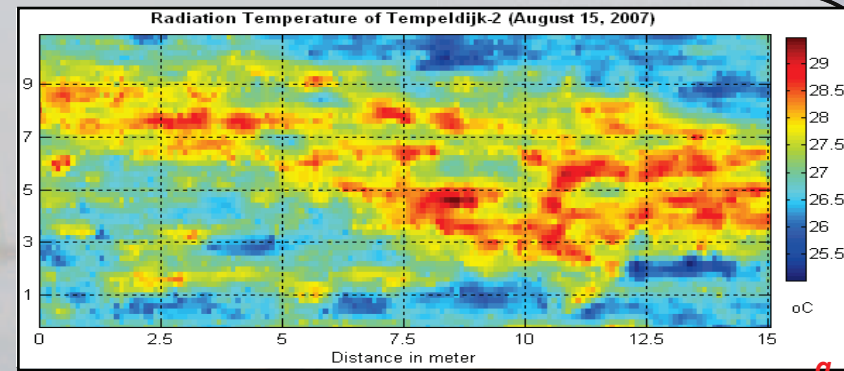
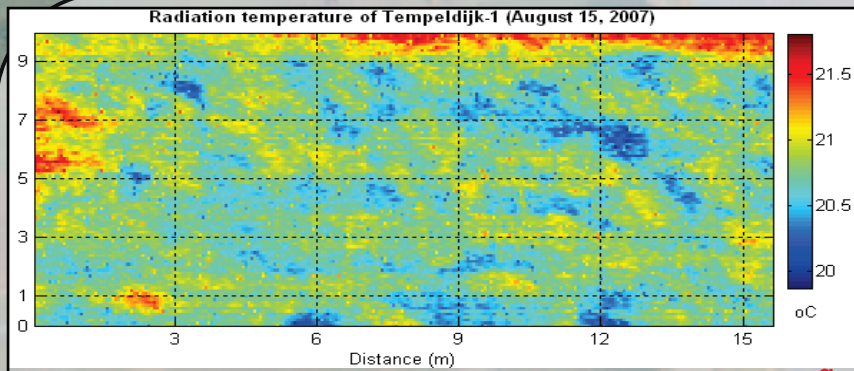
A 2-D electrical imaging survey on the Tempeldijk-North



Visual images of Tempeldijk-South showing the difference in the apparent surface roughness in (a) August 15, 2007, (b) October 31, 2007 and (c) December 13, 2007 field campaigns.

Tempeldijk - temperature

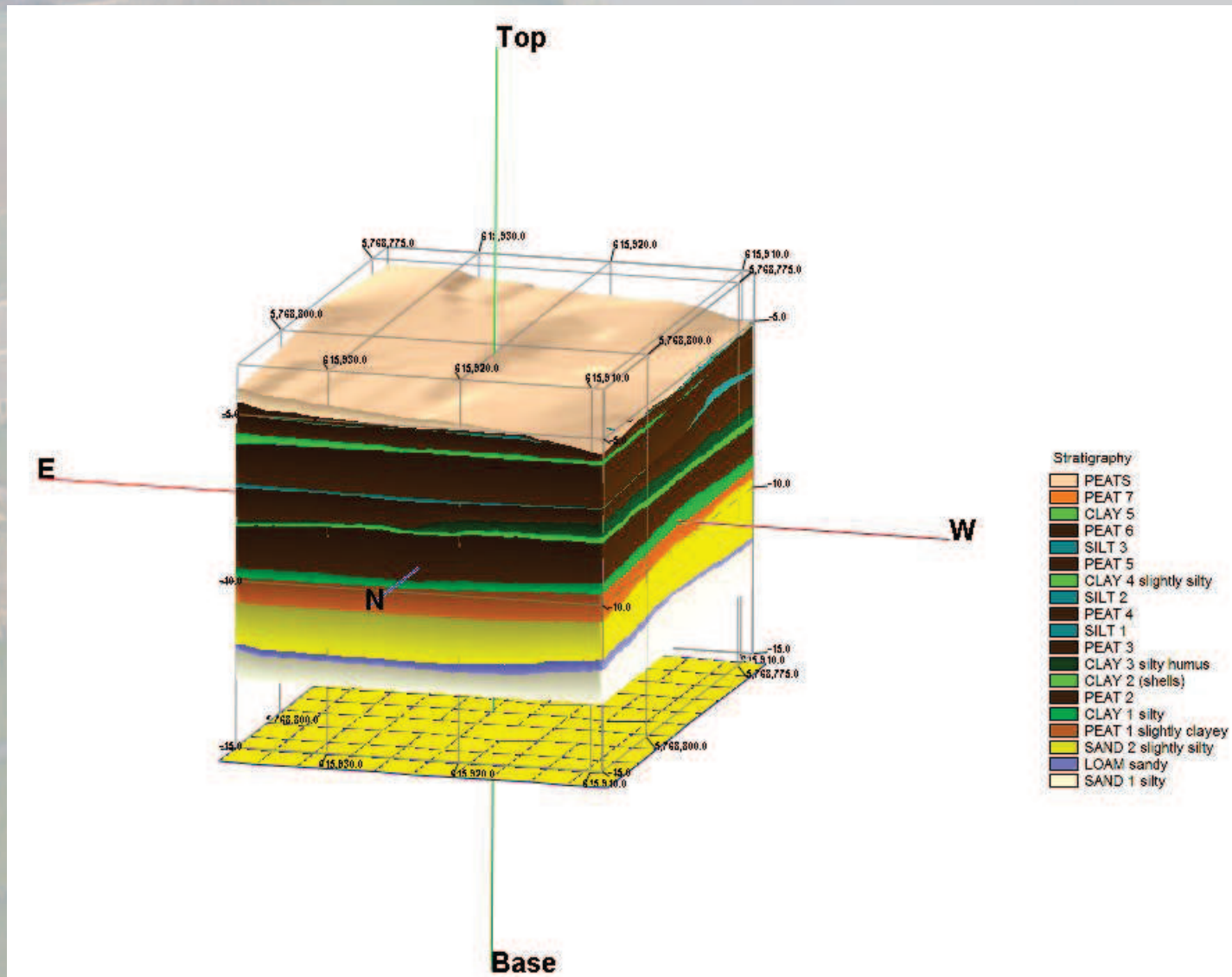
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Subsurface – Tempeldijk - South



Conclusions

- All surface and subsurface investigations the Tempeldijk-South surface and subsurface structure are more irregular which are due to or indicate “problems” such as “kwel” and subsidence.
- The thermal infrared images of Tempeldijk-South showed a layered structure which is reflecting the subsurface structure of the dyke. The layered structure was detectable likely because excess water was present in some of the layers.
- Visual images showed differences in vegetation cover at locations where excess water is likely present.
- The gamma ray survey shows a pattern that is likely related to the real subsurface structure, but further investigations are required to determine the exact nature of this relation.
- Lidar surveys are probably accurate enough to determine surface patterns with high detail.
- Reflectance is highly depending on the vegetation properties such as the leaf area, biomass, chlorophyll concentration in leaves, plant productivity, vegetation cover, accumulated rainfall etc.
- Position of the sun angle, apparent roughness and wind direction are also some of the external factors that affect the true reflectance.
- Surface roughness: the greater the roughness (compared to λ) will have the greater the surface area and the greater the emission.

RSDYK2009-2012

- Pilot project gives enough indications for further investigations and research
- 2 full-time PhD students
- Relations between subsurface and remote sensing on dykes
- Relations between groundwater and remote sensing on dykes
- Relations quality assessment dykes and remote sensing