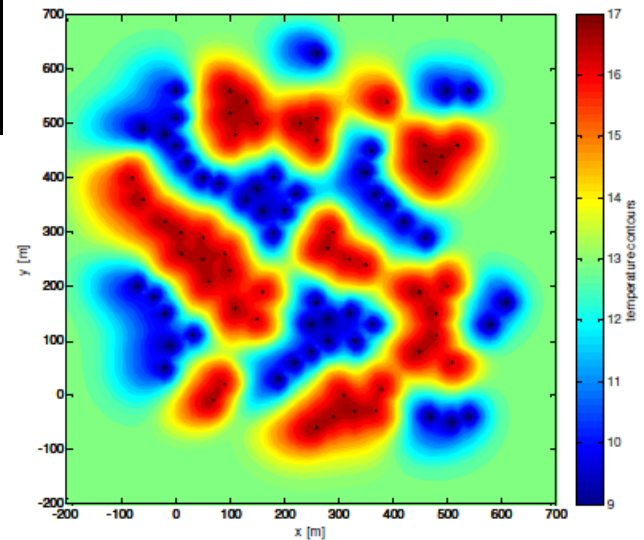


Optimal and sustainable use of the subsurface for ATEs

Delft University of Technology, The Netherlands

Martin Bloemendal, Theo Olsthoorn,
14-5-2013

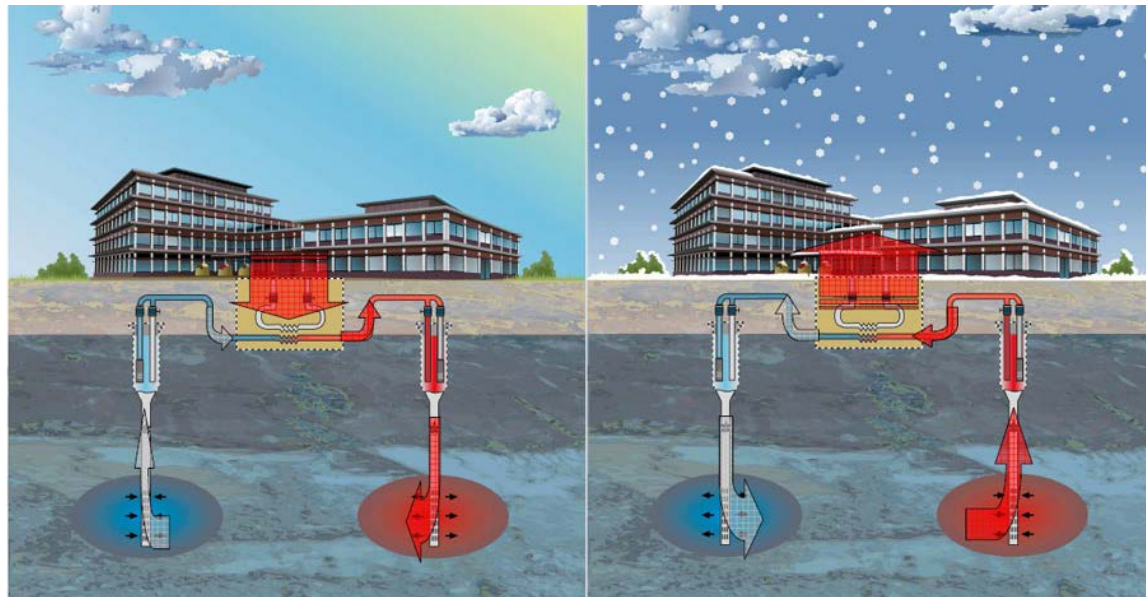


My message to GQ13:

- Organise ATES systems beyond individual system
- Organise ATES systems during operational phase

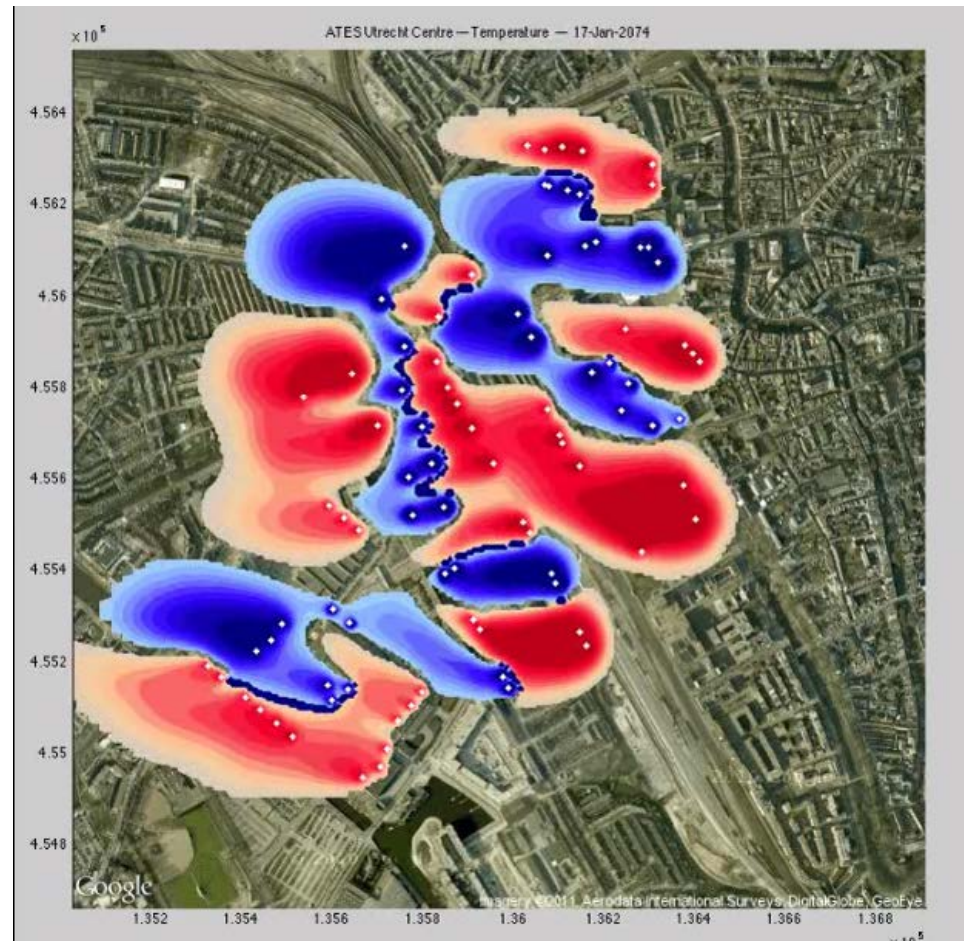
Aquifer Thermal Energy Storage

- 50% energy reduction
- climate & aquifers
- 10% growth/year
- Permit system



Spatial impact

- Uncertainties
 - Large permits
 - Safe design rules
- Urban areas
 - High demand
- Temperature distribution in subsurface
 - expected vs practice



Scarcity of space

Because of:

- Precautionary principle
- Longevity of impact

Resulting in:

- Suboptimal use

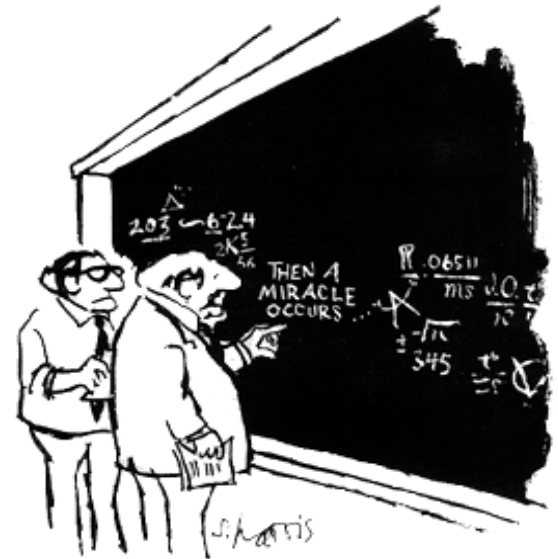
&

- Not sustainable use of subsurface

Self-organization as perspective

- More ATEs systems
- Insight in distribution of heat and cold

- Corrective feedbacks
- Incentives for temperance

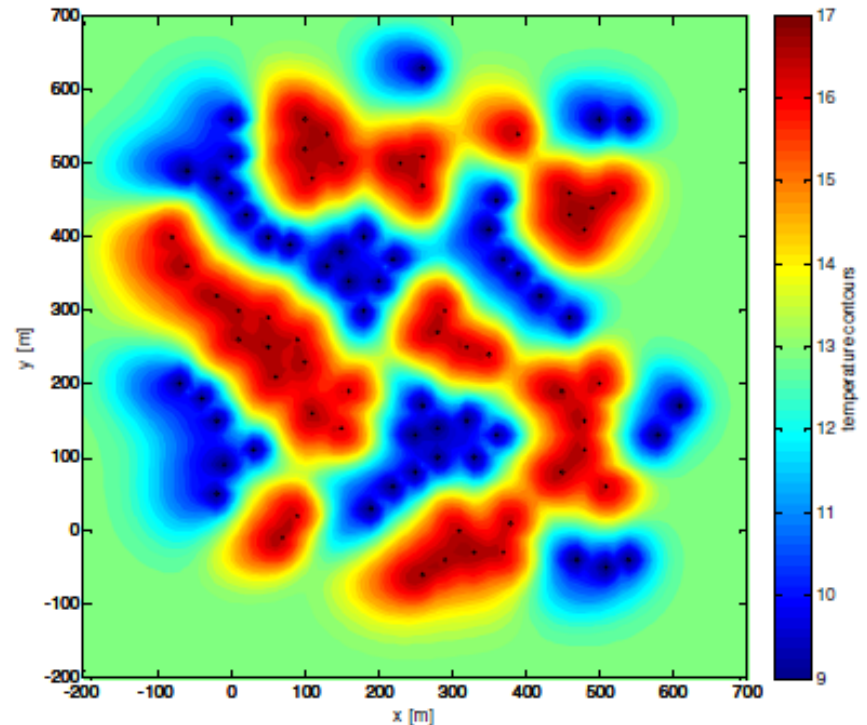


"I think you should be more explicit here in step two."

Self-organizing systems

Communication must lead to:

- Self configuration
 - **Self optimizing**
 - **Self healing**
- ATES Systems



Self organization vs. Precaution

Permit

- Uncertainty
Estimate of energy use
- Precautionary principle
- No temperance
(only within issued permit)

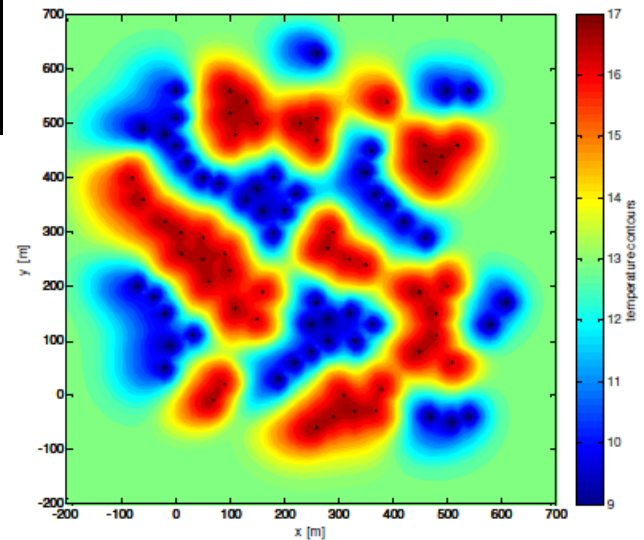
Self organization

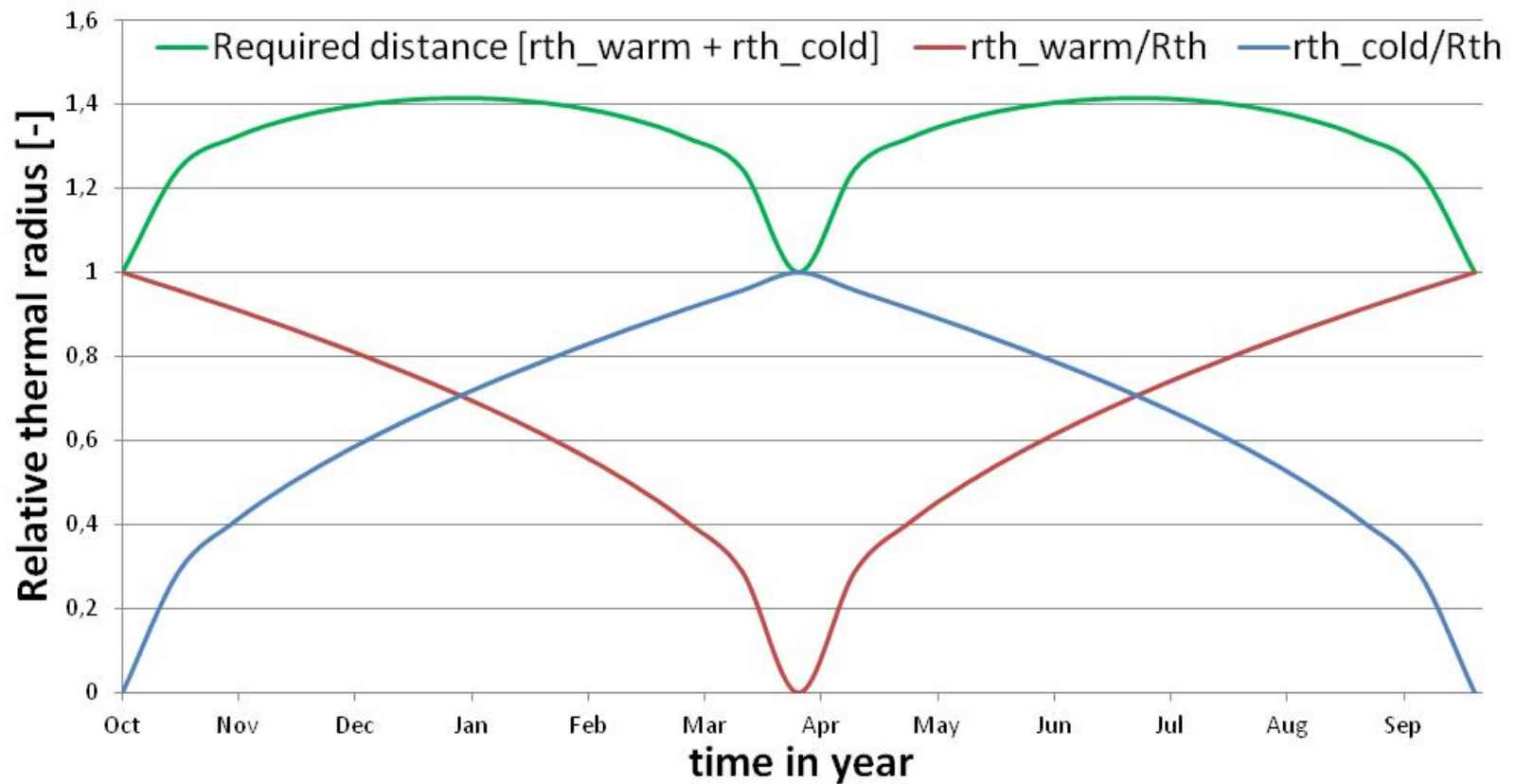
- Evolving model
Actual data
- Optimize at collective level
- Market; value of heat and cold

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ATES smart grid optimisation environment

ATES optimisation lab

