

Øyvind Christophersen, miniseminar CCS, Oslo, September 9 2008

CO₂-storage in Norway, National Regulations and International Guidelines



Storage technology and methodology

Geological CO₂ -storage uses many of the same technologies and methodologies that have been developed by the oil and gas industry and have been proven to be economically feasible under specific conditions for oil and gas fields and saline formations.

CCS assessed in several international organisations - IPCC, London Convention/London, OSPAR, IEA, EU-research projects

Their conclusions are to a great extent consistent

- CCS as part of a portfolio of climate change mitigation options
- safe storage for carefully selected well designed and monitored geological storage formations
- need for guidelines and regulations

Regulations and guidelines

- IPCC, LP and OSPAR have developed guidelines for CCS which is in line with the proposed regulations in the draft CO₂-storage directive
- The directive and changes in other directives will be important for facilitation of CCS
- Relevant for Norway (EEA-agreement)
- Development of Monitoring and Reporting Guidelines for CCS under the European Trading Scheme

Key issues for CCS projects

- Selection of a suitable site, including simulation of the reservoir's ability to absorb the CO₂ and keep it stored
- Project design
- Monitoring
- Reporting and verification

Some important questions

- Flexibility related to technology development; separation, transport, monitoring methodologies
- CO₂ stream - composition
- Exploration permit
- Monitoring requirements (level of detail, flexibility regarding methodology)
- How to deal with existing CCS projects

Norwegian Pollution Control Act

Application for an emission permit:

- Characteristics of the storage site
- Characterisation of the CO₂ -stream
- Documentation of the geological formation's suitability for CO₂ -storage, consequence assessment, risk assessment.
- Injection project design and operation
- Monitoring plan

Sleipner CO₂-storage

- Since 1996 Statoil has injected and stored CO₂ in the Utsira formation.
- The CO₂ has been separated from natural gas produced from the Sleipner field.
- The Norwegian tax on CO₂ made CO₂ storage profitable in this case.
- So far nearly 10 million tonnes of CO₂ have been stored in the Utsira formation.
- When the injection system is out of operation CO₂ is vented to the atmosphere. So far only 0,2 million tonnes of CO₂ have been vented.

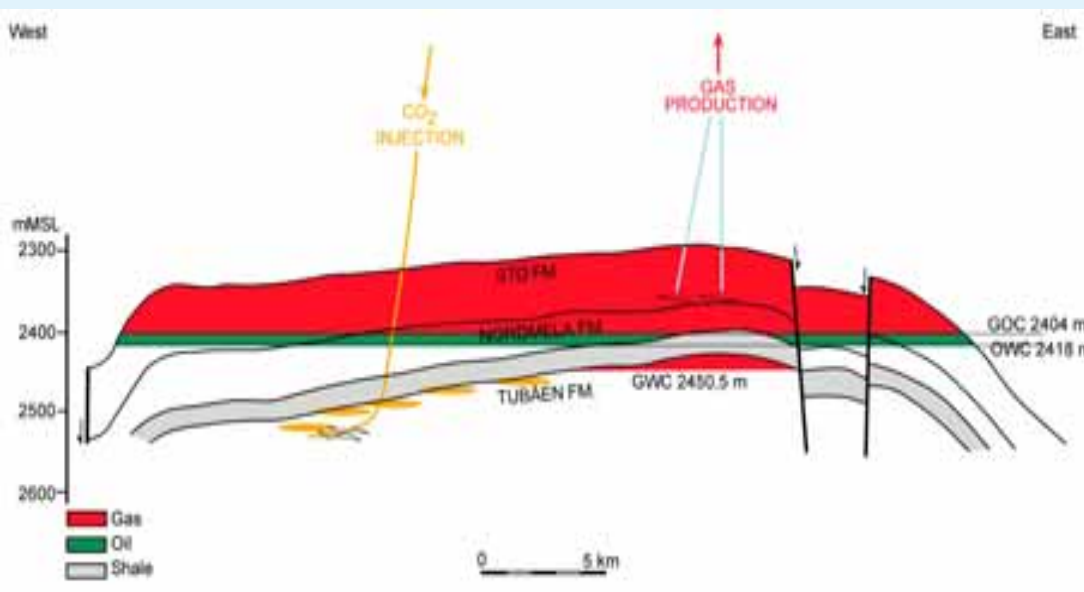
Captured and stored CO₂ at Sleipner is considered not emitted

- All evidence and monitoring indicate that CO₂ stored in the Utsira formation is not reaching the atmosphere.
- Hence: When reporting to UNFCCC, CO₂ stored in the Utsira formation is not reported as an emission.

Describing the Sleipner-case in the national inventory report to the UNFCCC

- Storage site selection and characterisation
- Methods for modeling and monitoring the injected CO₂
- Results from monitoring
- The reports are reviewed by review teams from the UNFCCC

Snøhvit reservoirs

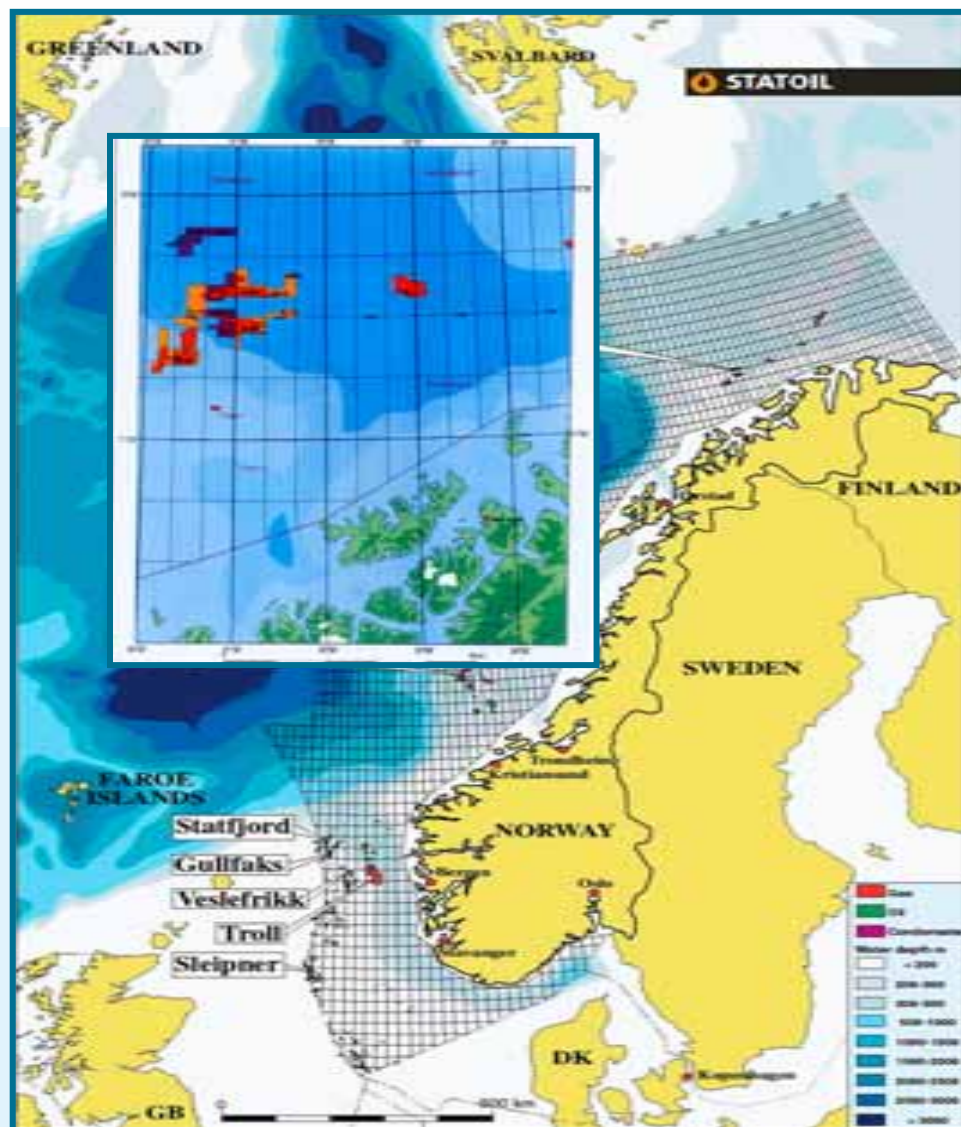


Start-up April 2008

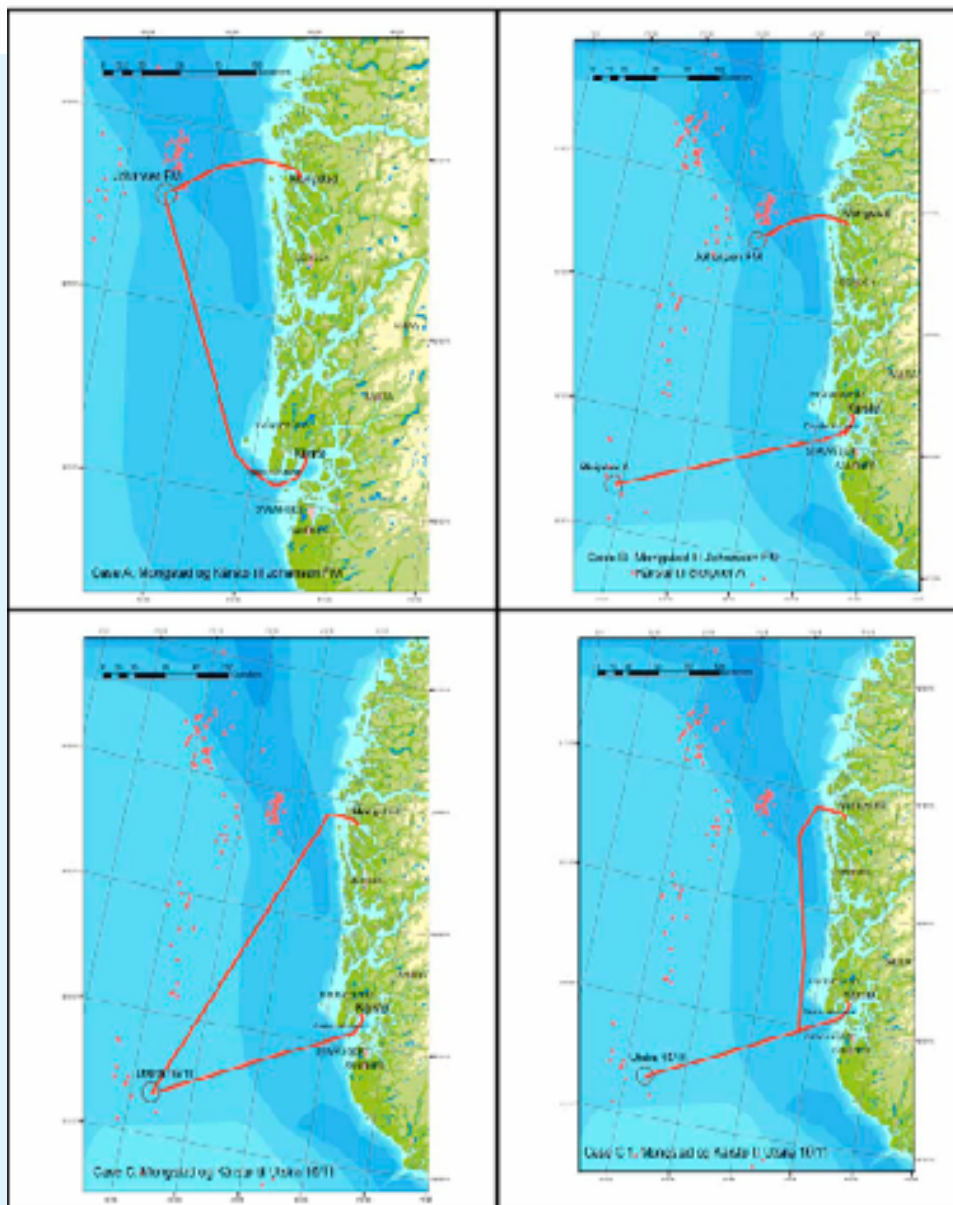
Water depth: 250– 340 m

Distance to shore: 140 km

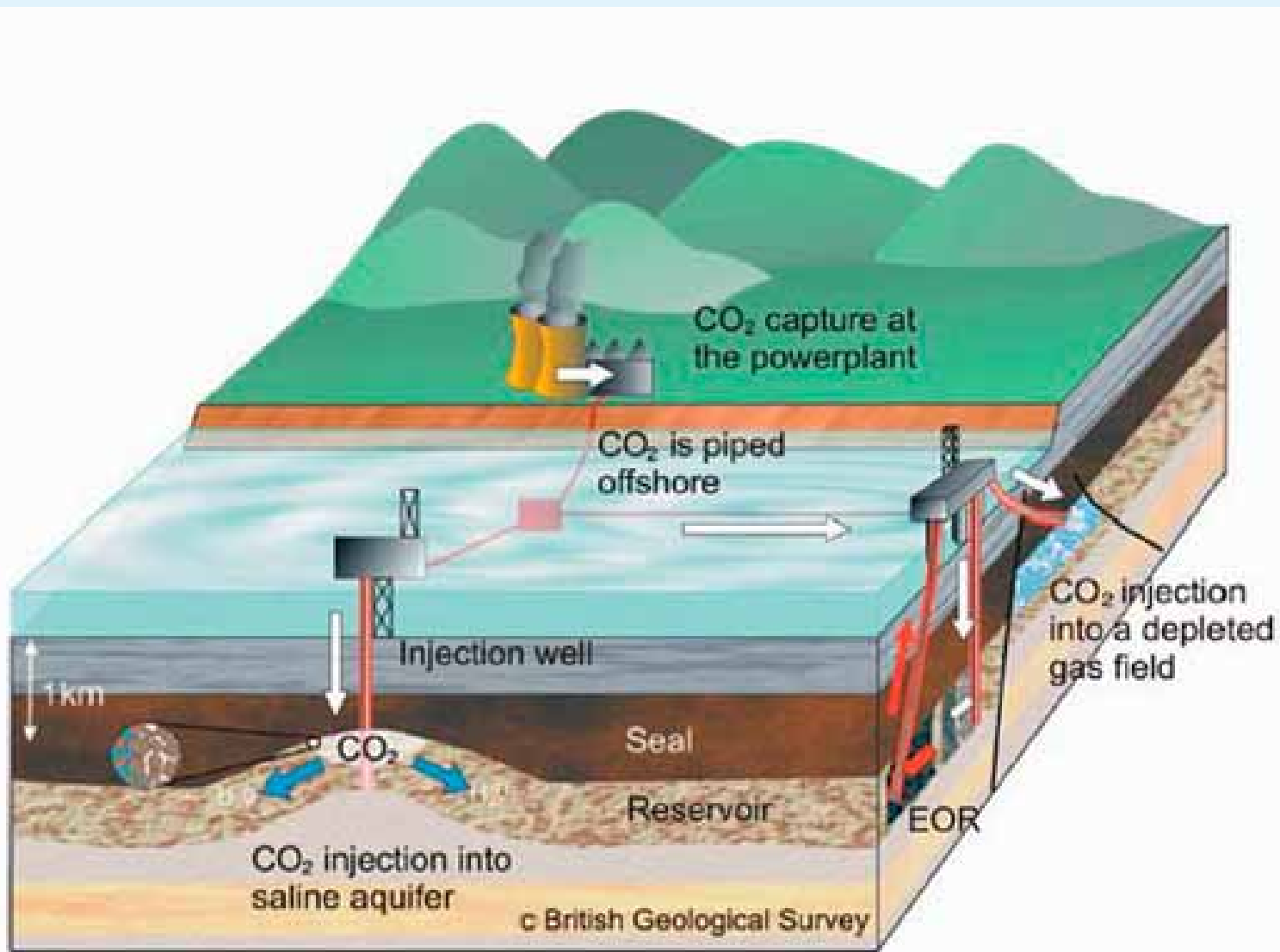
→ Re-injecting 700,000 tons CO₂/year



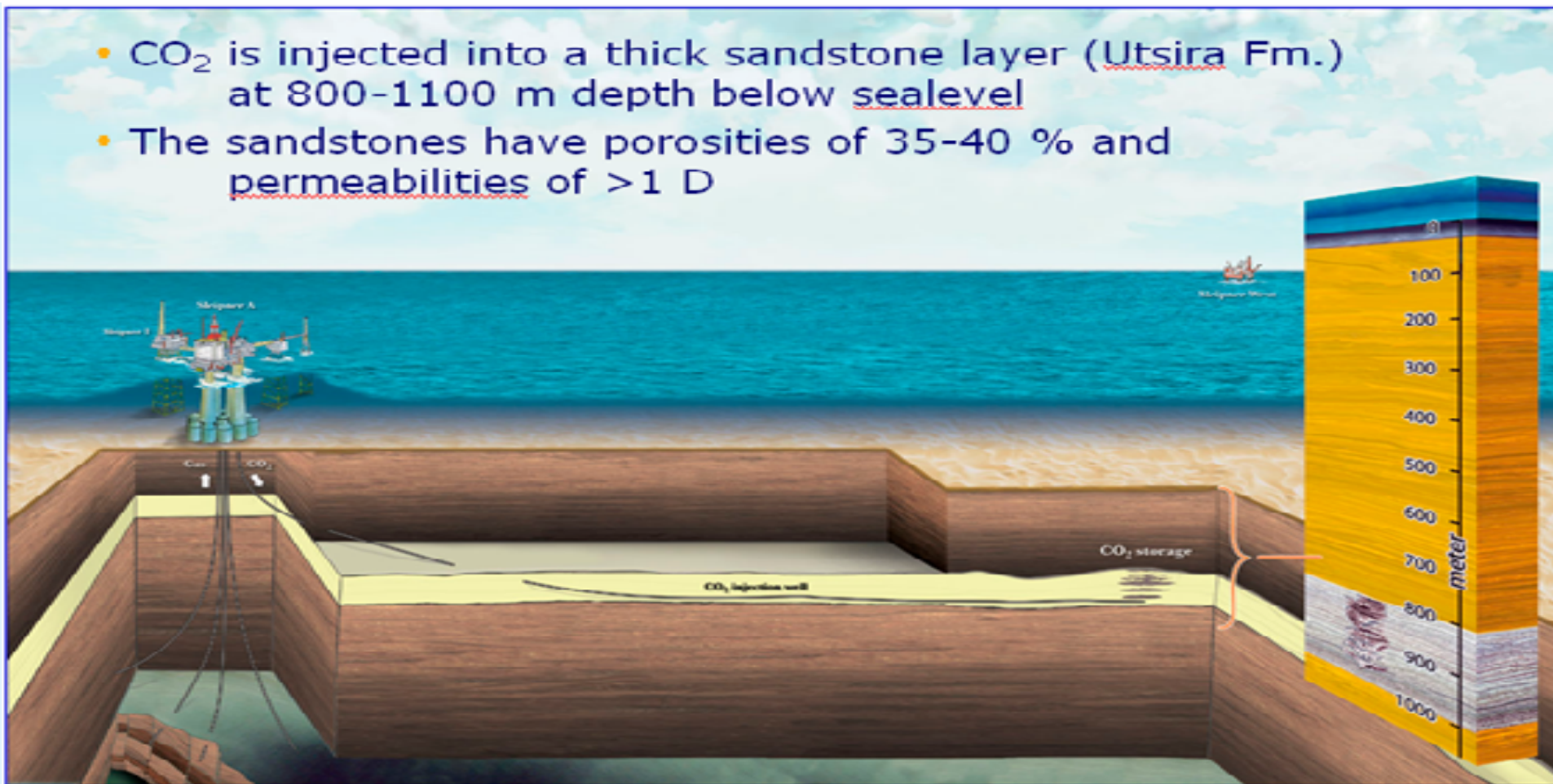
Transport and storage alternatives Kårstø and Mongstad



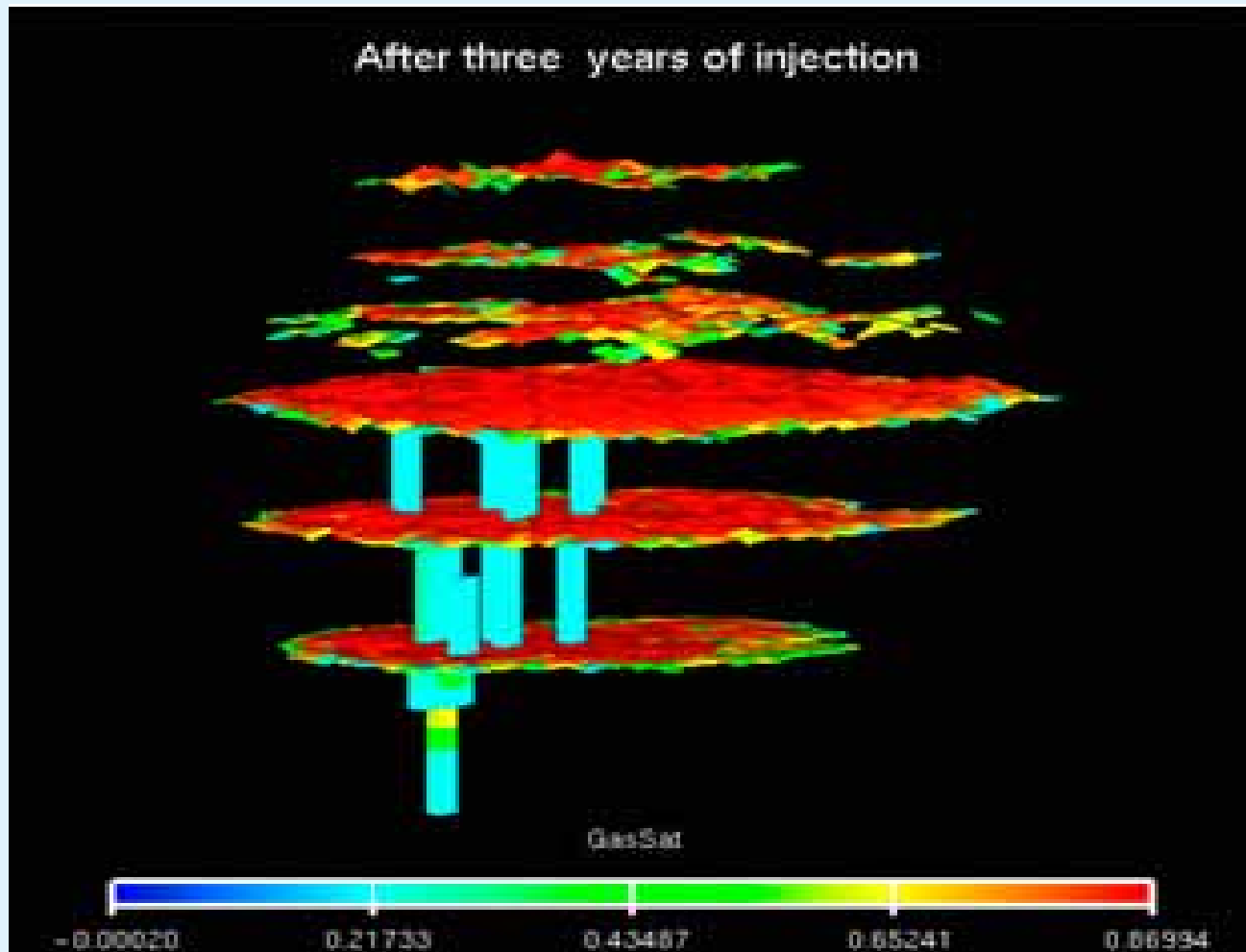
Thank you!



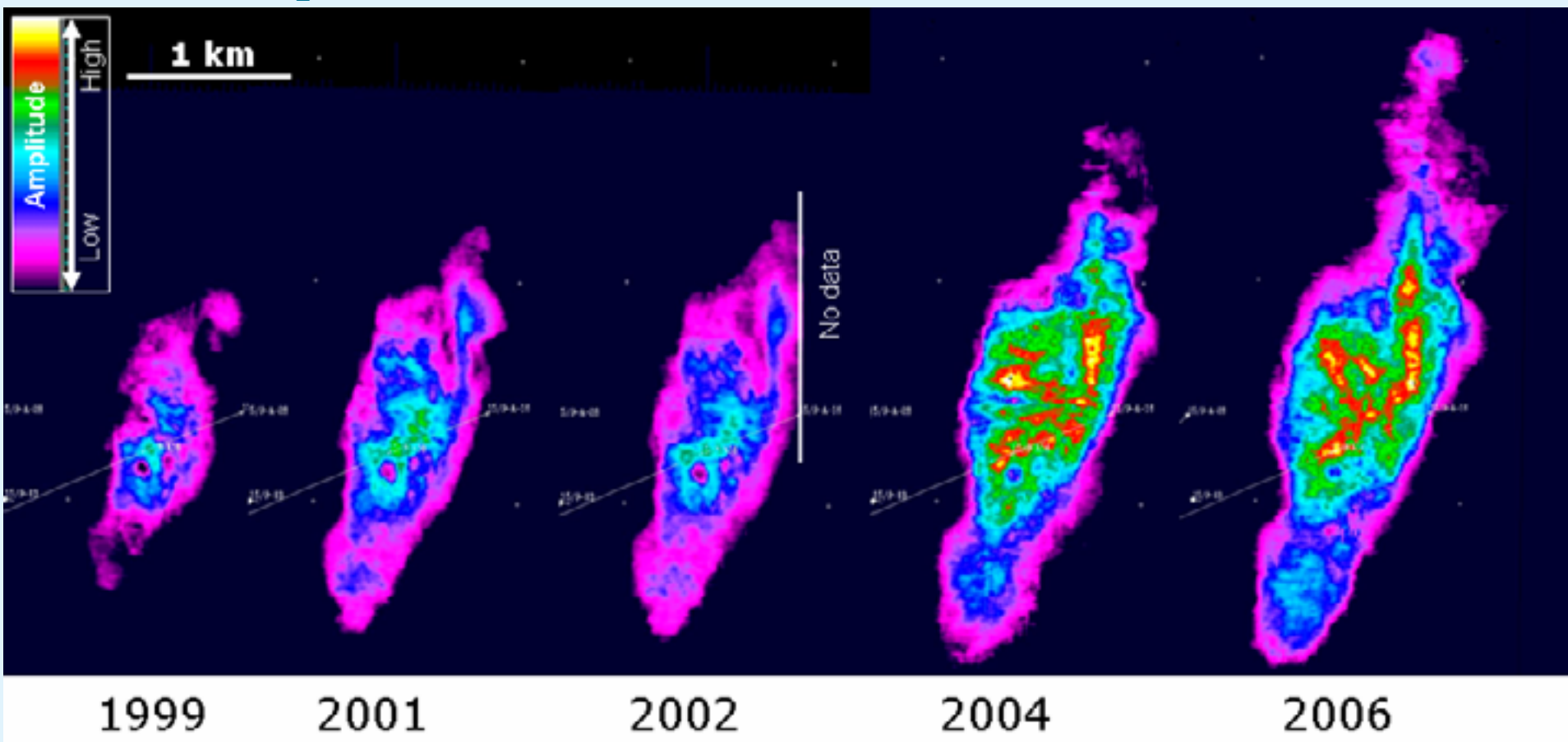
- CO₂ is injected into a thick sandstone layer (Utsira Fm.) at 800-1100 m depth below sealevel
- The sandstones have porosities of 35-40 % and permeabilities of >1 D



Monitoring of Sleipner CO₂-storage



Sleipner CO₂ plume extension in 1999, 2001, 2002, 2004 and 2006



Snøhvit 8 wells + 1 CO₂ injector

Albatross 4 wells

Askeladd 8 wells (2013/14)

