

## DON'T POUR MONEY DOWN THE DRAIN - FIX IT!

*Detailed knowledge about land subsidence from Copernicus Sentinel-1 mission data changes the way the Danish utility sector guards its subsurface assets to the financial benefit of its customers.*

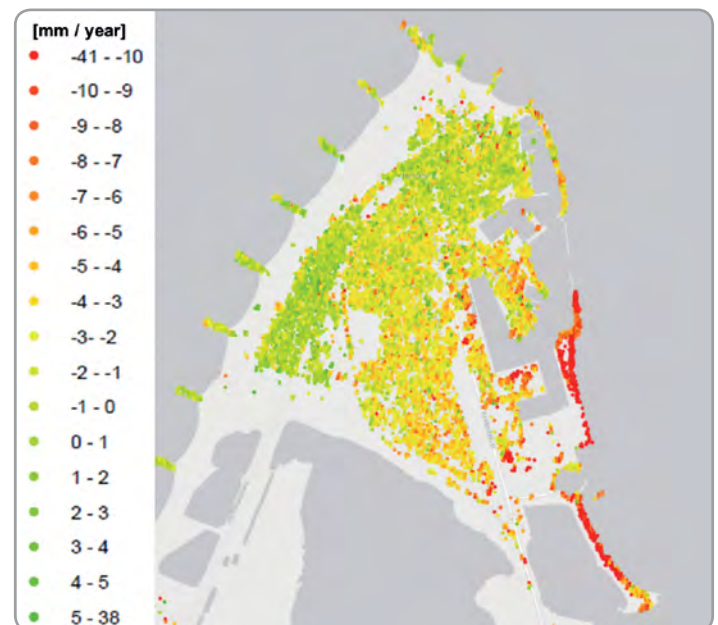
### The challenge

Well-functioning water supply and wastewater systems are crucial to the utility sector and society at large for obvious health, environmental, and economic reasons. Long term investments for sewer renewal accompany maintenance work. Additionally, climate change impacts on hydrology must be considered when addressing future investment needs and the municipal task of climate change adaptation. Approximately 95% of the utility sector's financial assets are subsurface, with only the customers i.e., citizens and industry, to pay the bill in the privatized Danish water sector. Thus, it is of the utmost importance to trim expenses and ensure cost-efficient businesses. Data on vertical land movement from Copernicus Sentinel-1 is becoming a game changer in the utility sector that links Earth Observation to the 'guys working the sewers'.

### The space based solution

Knowledge of local land subsidence rates made available from the Copernicus Sentinel-1 data in a local cross-sectorial collaboration has led to behavioural changes with the Lemvig Municipality and the Lemvig Utility Company in the Central Denmark Region (CDR); and experiences are currently being shared between municipalities and utilities regionally and nationally. Traditionally, broken sewer pipes led to costly replacements of entire strings based on the assumption that the pipes had degraded. Now, detailed subsidence maps often provide a causal explanation and pipe repairs can be targeted locally to optimise maintenance work. Coupled with information on local geology and maps of the sewer system in a web-based service, the Sentinel-1 based subsidence maps provide utility employees with an on-site overview of subsurface conditions to act upon.

Likewise, loss of pipeline gradients may be ascribed to local phenomena of vertical land motion and not to a generally malfunctioning system. This knowledge has led to diversion of water flow in existing pipelines and is directly incorporated into pipeline design and urban planning in new developments.



A differential pattern of vertical land motion (red colours indicate large subsidence rates) over the town of Thyborøn, Central Denmark Region. Contains modified Copernicus Sentinel-1 data.

*Credit: Contains modified Copernicus Sentinel data [2017]*

### Benefits to Citizens

Copernicus Sentinel-1 based mapping reveals areas of vertical land motion. A normal life-time expectancy of sewers of 70-100 years cannot be granted in such areas, but investments can be targeted to avoid excessive costs of replacements and repairs. To the Lemvig Utility the shift in operational practices is rewarding and has already led to decreased costs for maintenance, and the use of EO data is currently being mainstreamed into the municipality and

Thematic Area



CLIMATE, WATER AND ENERGY

Region of Application



MIDTJYLLAND - VESTJYLLAND

Sentinel mission used



S1

Copernicus Service used



-

Usage Maturity Level



4

utility's strategic plans e.g. through training of local government employees. This leads to a more cost-efficient water sector to the financial benefit of all citizens and businesses within the Lemvig Municipality. Additionally, the region's resilience to climate change will increase through cross-sectorial and shared use of Earth Observation data in mitigation and adaptation. Corner reflectors that act as unique identifiers in the satellite images have been locally developed and deployed.

The reflectors link to the Danish height system and to the bottom of sewers via traditional leveling techniques. This provides very detailed and precise determination of height changes over time and secures cross-sectorial use e.g. in the construction sector thereby making EO results applicable to the public.



Corner reflector developed by DTU Space & Agency for Data Supply and Efficiency and manufactured by Lemvig Utility. Reflectors serve to link height variations in EO data to the Danish datum network (Photo by kind permission of Mr. Karsten Vogensen).

“The use of EO data is becoming mainstreamed into our long-term strategic planning leading to a more cost-efficient water sector to the financial benefit of all citizens.”

*Lars N. Holmegaard, CEO, Lemvig Utility*

## Outlook to the future

The use of Copernicus Sentinel-1 for monitoring land motion provides Lemvig Utility with a very good business case in relation to pipeline maintenance and renewal, and climate change adaptation. In the future, the use of EO data will become one cornerstone to secure a cost-efficient and knowledge-driven water sector and where much potential is still to be unveiled in climate change adaptation.

## Acknowledgements

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C. Sørensen<sup>1</sup>, L.N. Holmegaard<sup>2</sup>, T. Damgaard<sup>3</sup>

1. Danish Coastal Authority, Denmark

2. Lemvig Utility, Denmark

3. Lemvig Municipality, Denmark

Emails: cas@kyst.dk, lanh@lvs-as.dk,

thomas.damgaard@lemvig.dk

## ABOUT COPERNICUS4REGIONS

This Copernicus User Story is extracted from the publication “**The Ever Growing use of Copernicus across Europe's Regions: a selection of 99 user stories by local and regional authorities**”, 2018, Edited by NEREUS, the European Space Agency and the European Commission.

The model cases focus on local and regional authorities who successfully applied Copernicus data in 8 major public policy domains. The views expressed in the Copernicus User Stories are those of the Authors and can in no way be taken to reflect the official opinion of the European Space Agency or of the European Commission.

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