Presentations “SAR”

Application of fully-focused SAR altimetry to the Wadden Sea

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The future state of the Wadden Sea strongly depends on the sediment balance, which is related to the hydrodynamics of the regions. To ensure the region's hydrodynamics are properly modelled, measurements of the instanteneous sea surface height are required for validation. We aim to enhance the spatial coverage of sea surface height measurements by fully exploiting the satellite altimetry data from Cryosat-2. In order to obtain a better resolution and to mitigate the pollution of land signals in Cryosat waveforms a fully-focused SAR algorithm is applied. This will provide a better separation between signals over open water and tidal flats, and it will enhance the accuracy of sea surface heights near-shore.

Change Detection in Urban Construction Area using ATS Multi-temporal InSAR Method

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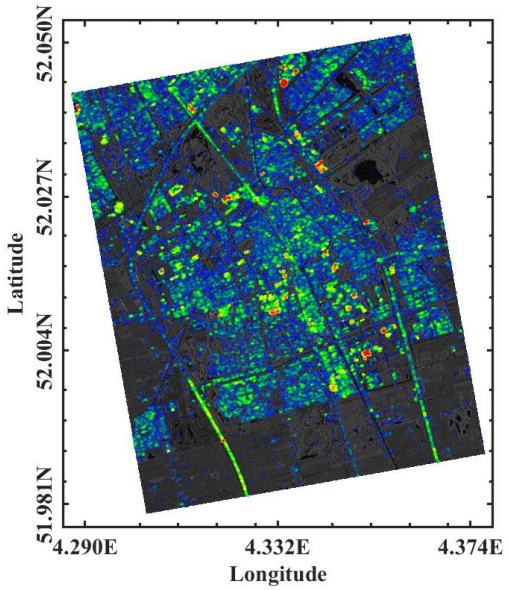
Change detection based on remote sensing images has been one of the most important applications in recent years. Most presented change detection methods are designed using couples of the images and results only show the changes in the spatial domain. Multi-temporal interferometric synthetic aperture radar (MT-InSAR) is able to extract scatterers with high coherence using time-series SAR images. This technique works well in an urban area as these scatterers are related to the man-made infrastructures. As a result, changes in surface scattering lead to decorrelation, which can be used to locate the step-times. Here, we propose a new method to detect changes with their step-times by ATS (Adaptive Temporal Subset) MT-InSAR. Both amplitude analysis and interferometric process are conducted to select TCS candidates and identify the step-times automatically. The density of TCSs is used to highlight the changes in the spatial domain. The main advantage of our method is obtaining changes in both the spatial and time domain accurately. Experimental results from real data show both disappearing and appearing buildings with their step-times were successfully recognized in Delft, Netherlands.



Detecting dewatering of peatland pastures using Sentinel-1 satellite radar interferometry

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Many of the pastures in the Netherlands are situated on peat soils. Due to dewatering the peat soils are subsiding, caused by the exposure to air. The peat decomposes and compacts, emitting greenhouses gases. Measuring the subsidence is nearly impossible using conventional geodetic means, although water management boards would benefit greatly from accurate subsidence measurements.
We discuss our ongoing effort to detect subsidence using radar interferometry over these quickly temporal decorrelating areas.

Identification of deformation pattern changes caused by enhanced oil recovery using satellite radar interferometry

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Continuous hydrocarbon production and steam/water injection cause compaction and expansion of the reservoir rock, leading to irregular downward and upward ground movements.
Detecting such anthropogenic ground movements is of importance, as they may significantly influence the safety and sustainability of hydrocarbon production activities, in particular, enhanced oil recovery (EOR) and even lead to local hazards. To identify the associated deformation pattern changes, this study focuses on InSAR (satellite radar interferometry) deformation model optimization, in order to automatically detect irregularities, both spatially and temporally.
This article has been accepted by the international journal of remote sensing in August 2018.

Improving InSAR point density on dikes using full information from the coherence matrix

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In the past it has been shown that the deformation of dikes can be measured by PS-InSAR. However, the PS density in relation to the full profile of the dikes is relatively low. In this research a method is proposed to improve the InSAR point density on dikes. Hereby, the information content of the full interferometric coherence matrix is used to estimate the differential deformation. The approach is applied to the dike around Marken and the results are compared to the conventional approach.

Increased spatial resolution through swath processing of CryoSat-2 L1b altimetry data.

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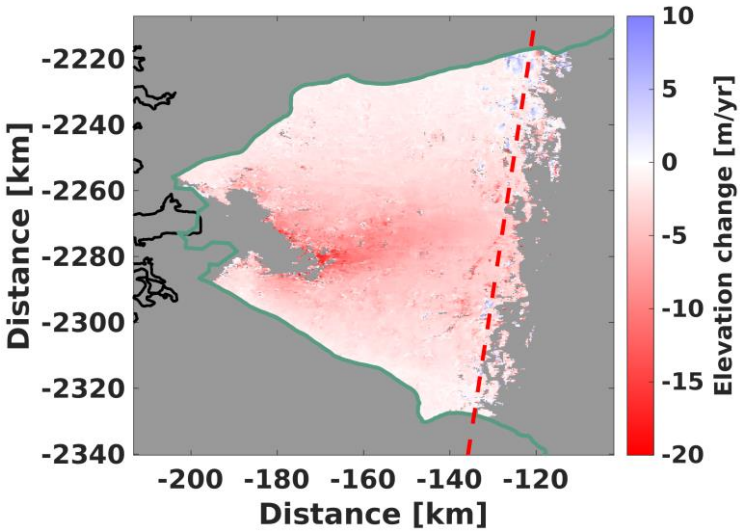
ESA's CryoSat-2 is equipped with a dual antenna, normal-incidence, radar altimeter (SIRAL), exploiting synthetic aperture radar (SAR) and interferometric processing. Thanks to the interferometric processing, the incoming angle of each waveform sample is known, allowing users to swath process CryoSat-2 waveforms. This means that each waveform sample is a potential scatterer with retrievable surface elevation, which provides an unprecedented spatial resolution. In contrast to a conventional altimetry processing strategy with retrackers, swath processing displayed in our case over 2 orders of magnitude more elevation estimates. Moreover, we demonstrated surface elevation change estimates at a resolution down to 250 m.



Elevation.change estimates at 250 m resolution near the terminus of the Jakobshavn glacier using CryoSat-2 data.

Performance of atmospheric noise reduction methods for PS-InSAR deformation estimates over the Groningen gas field

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Interferometric SAR data is a widely used satellite product to analyze deformation patterns worldwide. However, the deformation signal is often obscured by atmospheric noise, because the radar signal is delayed by the atmosphere. Over the years different statistical models are developed to smooth or suppress this noise, but corrections based on high-resolution weather models or important weather parameters are currently in development. In our study we compare the performance of the current statistical models together with our newly developed methods, to include weather information for a study case over the Groningen gas field.

Potential of synthetic aperture radar for monitoring meltwater dynamics on Antarctic ice shelves

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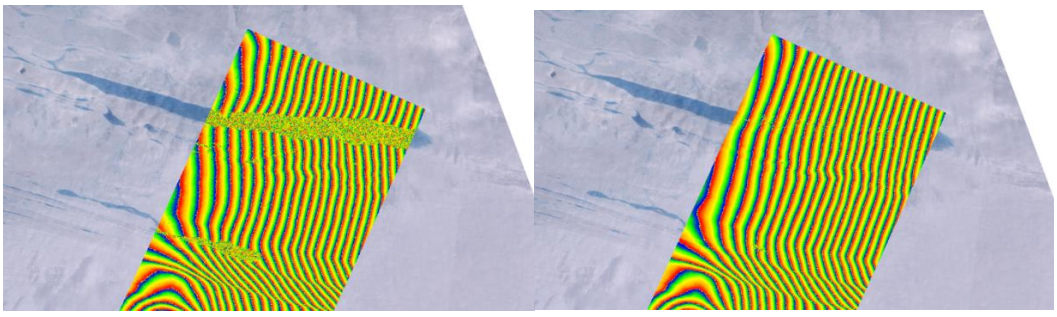
Meltwater ponding and refreezing on Antarctic ice shelves can lead to a fracture network, which subsequently increases the vulnerability of the ice shelves to hydrofracturing. The objective of this study is to assess the potential of synthetic aperture radar (SAR) to monitor the spatial and temporal dynamics of meltwater features. Therefore SAR backscatter and SAR Interferometry images were implemented on meltwater regions of the Roi Baudouin and Amery ice shelves. Our results highlight the potential and limitation of SAR data for revealing the occurrence and refreeze of several meltwater features, and show that SAR can indicate instant meltwater behaviours such as drainage and collapse under certain circumstances.

Figures:



Interferograms (left) between 28/01/2017 and 03/02/2017; (right) between 22/04/2017 and 28/04/2017.

Simulation of Bistatic SAR data of ocean surfaces in preparation for the STEREOID mission.

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In order to build an end-to-end simulator in the context of the STEREOID mission studies, a bistatic ocean SAR simulator is developed. A new methodology using a time-subaperture approach is implemented to significantly improve the computational efficiency. The SAR image is provided using the scattering map of the scene and the impulse response of the SAR system and the effect of the moving ocean surface is implemented. The bistatic scattering of the ocean surface is simulated using the two-scale model and the influence of the ocean geophysical parameters upon the scattering signatures for the different polarization modes and bistatic configurations is studied.

Surface mass balance changes along an ice rise in East-Antarctica from ground penetrating radar and regional climate models, compared with Sentinel-1 backscatter

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Understanding the surface mass balance (SMB) of Antarctica is critical for assessing overall Antarctica's mass balance and (potential) contribution to sea level rise contribution. Here we first combine in-situ ground penetrating radar measurements from the Frank-Kenny ice rise in East Antarctica with the RACMO regional climate model to better understand the surface mass balance variability introduced by ice rises. Secondly, the variability in SMB is compared to spatiotemporal variability in SAR backscatter across the ice rise to assess the potential of SAR for determine SMB

Presentation title: Swarm-SAR: a Dutch mini-satellite radar formation concept

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In the last decades, we assisted to the launch of large Synthetic Aperture Radar (SAR) satellites, with masses over 1000 Kg. As much as these systems are highly performant they are also highly expensive, with costs in the order of hundreds of millions of euros. Supported

by a Dutch-led network of partners with a broad spectrum of competences on Radar instruments and applications, we promote a cost-effective concept with miniaturized Radar satellites. The design envisions the achievement of high-resolution, low-noise and multi-application imagery by a swarm of lightweight (within 100 Kg) bistatic Radars operating in a close flying formation.

Using Capon/APES Based SAR Reprocessing Algorithms to Increase PSC Density in PSI

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Capon's minimum-variance method (MVM) and Amplitude and Phase Estimation (APES) spectral estimation algorithms can be applied to SAR processing to improve the resolution and suppress sidelobe level. Therefore, we use Capon/APES based SAR reprocessing algorithms to increase Persistent Scatterer Candidates (PSC) density in Persistent Scatterer Interferometry (PSI). We propose a PSC selection algorithm that applies to the reprocessed images and the corresponding processing chain. The performance of the proposed algorithm is evaluated by a quantity of simulation and a stack of TerraSAR-X data. The results show that the Capon algorithm outperforms others in PSC selection.

Characterization of Oil Spills using L-band polarimetric UAVSAR data.

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Abstract :
This research explores the potential of polarimetric SAR data for characterizing oil spills using a novel probabilistic surface modelling approach. The study is conducted using quad-polarized L-band UAVSAR data of the Norwegian Radar Oil Spill Experiment (NORSE-2015) in the North Sea, Norway. Wishart distribution based maximum likelihood classifier (W-MLC) [1] is chosen for oil spill classification. Gaussian probability surface models are constructed using soft W-MLC output which correctly estimate the orientation, shape and areal extent of the spills. This method is able to depict the differences in the evolution of mineral oils and biogenic slicks. It is concluded that probabilistic surface modelling is useful in oil spill monitoring and spill categorization.