**Theme: Deformation monitoring**

# Deformation time series estimation techniques for satellite radar interferometry

## Summary
Satellite radar interferometry enables the estimation of deformation time series of the Earth's surface, e.g., using the Sentinel-1 satellite (see Figure 1). Since no devices on the surface are required, a large number of estimates can be obtained in an efficient manner, see the examples in Figure 2.

The estimation process involved is however non-trivial, mainly because of the wrapped nature of the measured phase signal. Hence, the unknown number of full phase cycles needs to be estimated in order to retrieve the deformation time series (see the example in Figure 3).

Erroneous or sub-optimal estimation of these phase cycles either leads to errors in the deformation time series, and thereby in wrong interpretation, or in complete misdetection of useful measurement points. Existing datasets therefore still contain undiscovered signals, which are often the most interesting from an application viewpoint. Therefore, improvement of the phase cycle estimation process is desirable. Various applications will benefit from these improvements, such as infrastructure and hazard monitoring.

*Figure 1 Sentinel-1 SAR satellite.*

## Objective
The objective of this project is to evaluate and improve phase cycle estimation techniques for deformation analysis based on satellite radar interferometry.

## Students profile
Are you interested in a mathematical challenge with a clear practical application, and you have sufficient Python programming skills? This is your project!
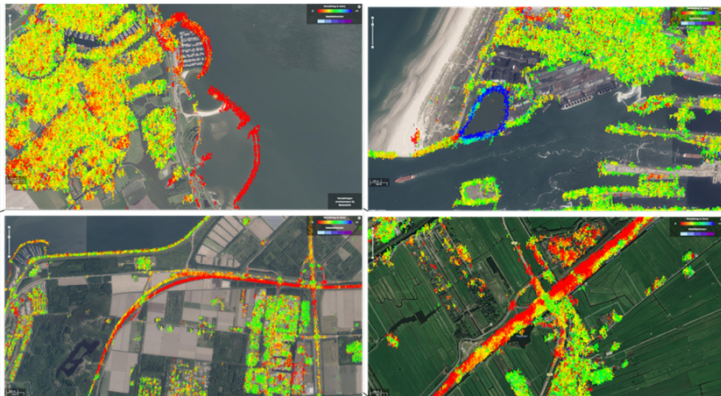


*Figure 2 Linear deformation rates of radar reflection points at a number of example locations in the Netherlands. Data taken from the bodemdalingskaart.nl .*
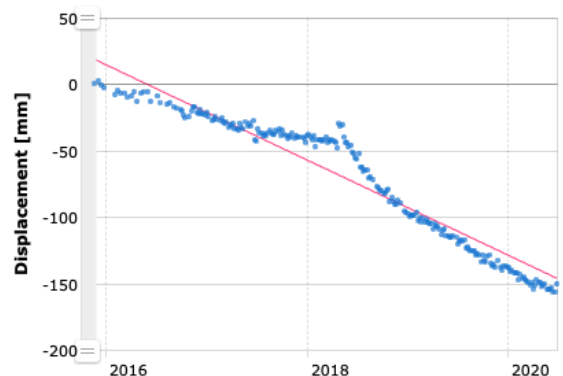


*Figure 3 Example estimated deformation time series (source: bodemdalingskaart.nl).*

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