Abstracts

Geophysical Geodesy:

Name: **Yuhang Gu, Menno-Jan Kraak, Yuri Engelhardt**

Affiliation: Faculty of Geo-Information Science, University of Twente.

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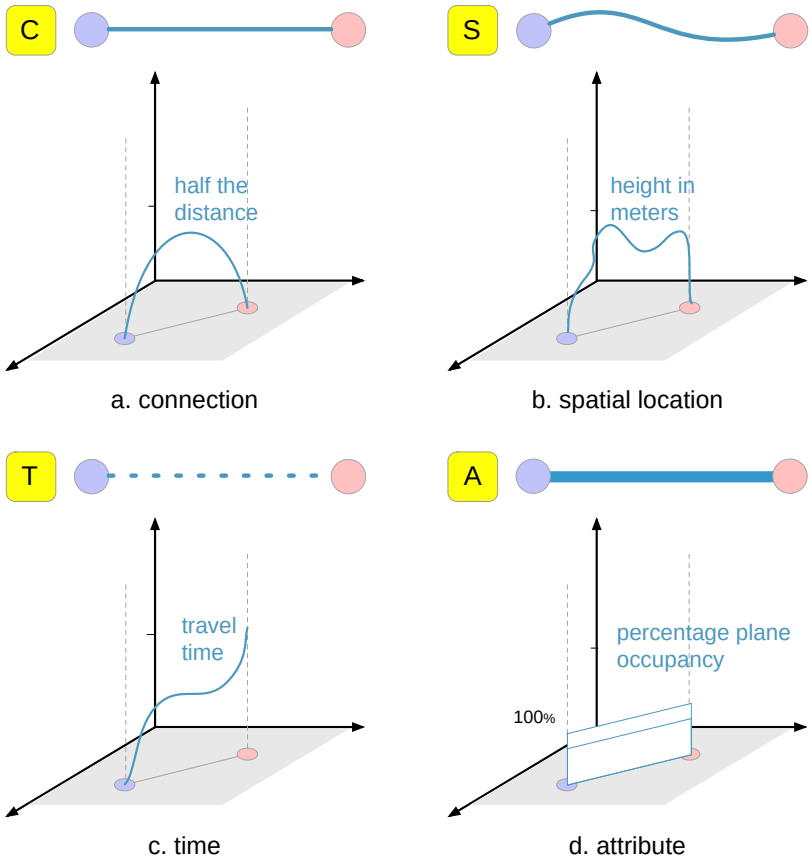
Presentation title: **Exploring with the 3D flow map as an alternative of 2D flow map**.

Origin and destination (OD) data describes movement between its start and end. Flow maps are one of the common visualization methods for OD data which draws links or trajectory between origins and destinations, and also express the characteristics of the movement. However, there are restrictions using the traditional 2D flow maps when dealing with a large amount of data, multiple variables and temporal analysis, which made the 2D flow map cannot support visual analysis of movement quit well. Researchers have tried several ways to reduce visual clutter such as flow bundling, aggregation, space time cube and so on. We propose using the third dimension as an additional axis for flow map to achieve movement visualization task, with which can be encoded with spatial, temporal and attribute information on it, in order to support diverse visualization objective and reduce the visual clutter.



Name: Karen M. Simon, Riccardo E. M. Riva

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Presentation title: **Evaluating the ability of geodetic data to constrain contemporary GIA signals in Scandinavia and North America**

The present-day glacial isostatic adjustment (GIA) signal in Scandinavia and North America is constrained in a semi-empirical model by joint inversion of GPS-measured land deformation rates and GRACE-measured gravity changes. The observational data are combined with a suite of forward GIA model predictions which allow for variation in both ice sheet history and Earth model characteristics, with the best-fit posterior model simultaneously minimizing the misfit between both types of constraint. Within formerly glaciated regions, the method provides a formal prediction of the uncertainty associated with the GIA process at a level ~1 order of magnitude smaller than that associated with forward GIA models. The GIA predictions can be used to better constrain the magnitude and uncertainty of the GIA contribution to total measured rates of change.

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Presentation title:
A consistent sea-level reconstruction and its budget on basin and global scales over 1958-2014.

Different sea-level reconstructions show a spread in sea-level rise over the last six decades and the sum of contributors fails to explain the observed rise of most reconstructions. To assess this discrepancy and its potential causes, reconstructed sea level and the contributors are investigated on a local, basin, and global scale. It is shown that for most basins, the reconstructed sea-level trend and acceleration can be explained by the sum of contributors, as well as a large part of the decadal variability. The sparsely-sampled South Atlantic Ocean forms an exception. The global-mean sea-level reconstruction shows a trend of 1.5 +/- 0.2 mm/y over 1958-2014, compared to 1.3 +/- 0.2 mm/y for the sum of contributors.

Name: Riccardo Riva

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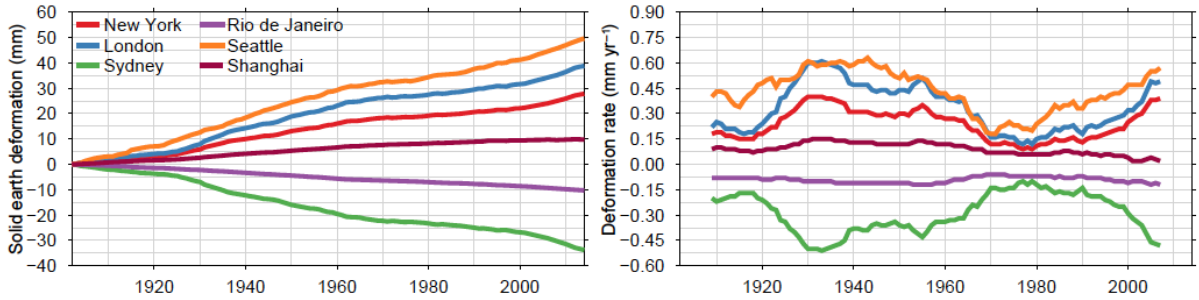
Presentation title: **The global signature of post-1900 land ice wastage on vertical land motion**

Abstract (~100 words and optionally 1-2 figures):
Melting glaciers, ice caps and ice sheets have made an important contribution to sea-level rise through the last century. Self-attraction and loading effects driven by shrinking ice masses cause a spatially varying redistribution of ocean waters that affects reconstructions of past sea level from sparse observations. We model the solid-earth response to ice mass changes and find significant vertical deformation signals over large continental areas. We show how deformation rates have been strongly varying through the last century, which implies that they should be properly modelled before interpreting and extrapolating recent observations of vertical land motion and sea-level change.



Name: Bart Root

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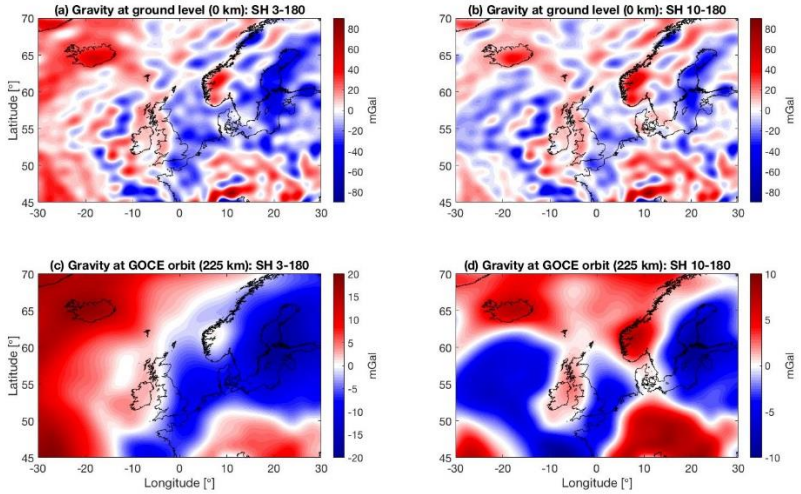
Presentation title: **Gravity Fields Constraints for the upper mantle**

Satellite gravimetry has given us an incredible dataset to study the solid Earth. Both the static as the time-varying gravity field can be used to study density structures in the interior of our planet. New methods and models have been constructed to better constrain these structures. Especially the spectral content of global gravity fields proves to be a useful tool to improve our understanding of the upper mantle. Together with seismic exploration, gravity field data is now able to construct global density maps of the upper mantle that are used to better understand the processes that happen below use.



Title: "Ice sheets in a changing climate: processes, observations and modeling"

Author list: Miren Vizcaino, Sarah Bradley, Laura Muntjewerf, Raymond Sellevold

Abstract:

The Greenland and Antarctic ice sheets are currently losing mass at an accelerated pace, becoming a major contributor to sea level rise. This mass loss is the result of ocean and atmospheric warming. Our Ice and Climate group at GRS in TU Delft investigates interactions between ice sheets and climate using advanced Earth System Modeling. In this presentation, I present 1) the outstanding scientific questions regarding ice sheet and climate interaction for the past (focusing on the last deglaciation), current and future climates, 2) recent advances in the observation and modeling of ice sheets, and 3) an overview of our contribution to this field of research.

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Presentation title:
Assessment and Construction of a Precipitation Dataset for the Yalong River Basin

Abstract (~100 words and optionally 1-2 figures):
To construct a real-time flood forecast system for the Yalong River, complete precipitation dataset of high accuracy should be collected as the input for running hydrologic models. The most accurate national precipitation dataset currently is the hourly 0.1° real time precipitation product published by national meteorological agency. But the dataset contains many nodata values, especially in the Qinghai-Tibet Plateau area including the Yalong River Basin. Two interpolation methods are proposed in this research. After the implementation, cross validation is performed to assess different interpolation methods considering spatial and temporal influence.

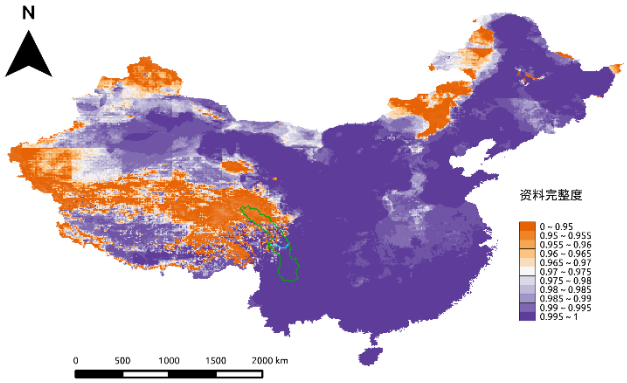

Figure 1. Data integrity map of the national hourly 0.1° real time precipitation product in 2008

Correlation Analysis of GPS Zenith Tropospheric Delay and Precipitable Water Vapor

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Abstract: Nowadays, as water vapor content is changing fast and there are many factors affect it , there is still much difficulty in determining its content accurately. The paper used six reference station CORS data in Hongkong area, and calculated ZTD and PWV and compared them with actual rainfall by using GAMIT software. The results showed that ZTD and PWV and actual rainfall have maintained a correspondence relationship in one or two hours or longer period after rainstorms and that ZTD and PWV will occur surges and dips phenomenon ,and showed that the faster changes in ZTD and PWV, the more unstable the atmosphere environment, the higher precipitation actual rainfall probability. Although the variation Characteristics and time series relationship between ZTD and PWV were discovered during rain storm, the paper has not yet reached the standard which can be used for numerical analysis of meteorological forecasts. The paper used Landi(HKLT) reference station data as examples.

Keywords: Ground-based GPS Meteorology; PWV; ZTD; Storm; Characteristics Analysis

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Path dependent landslide susceptibility modelling

Jalal Samia

Wageningen University

With rapid climate change the frequency of natural disasters are increasing which leads to economic losses and causalities. Landslides are considered as a disaster affected by with climate change and associated extreme precipitation. Landslide susceptibility maps are prerequisite for the assessment of landslide hazards and risks. In this paper we present a new approach for modelling landslide susceptibility based on path dependency analysis. The landslide path dependency effect was recently quantified using a multi-temporal landslide inventory and showed that susceptibility changes over time as an decay exponential response to the previous landslide.

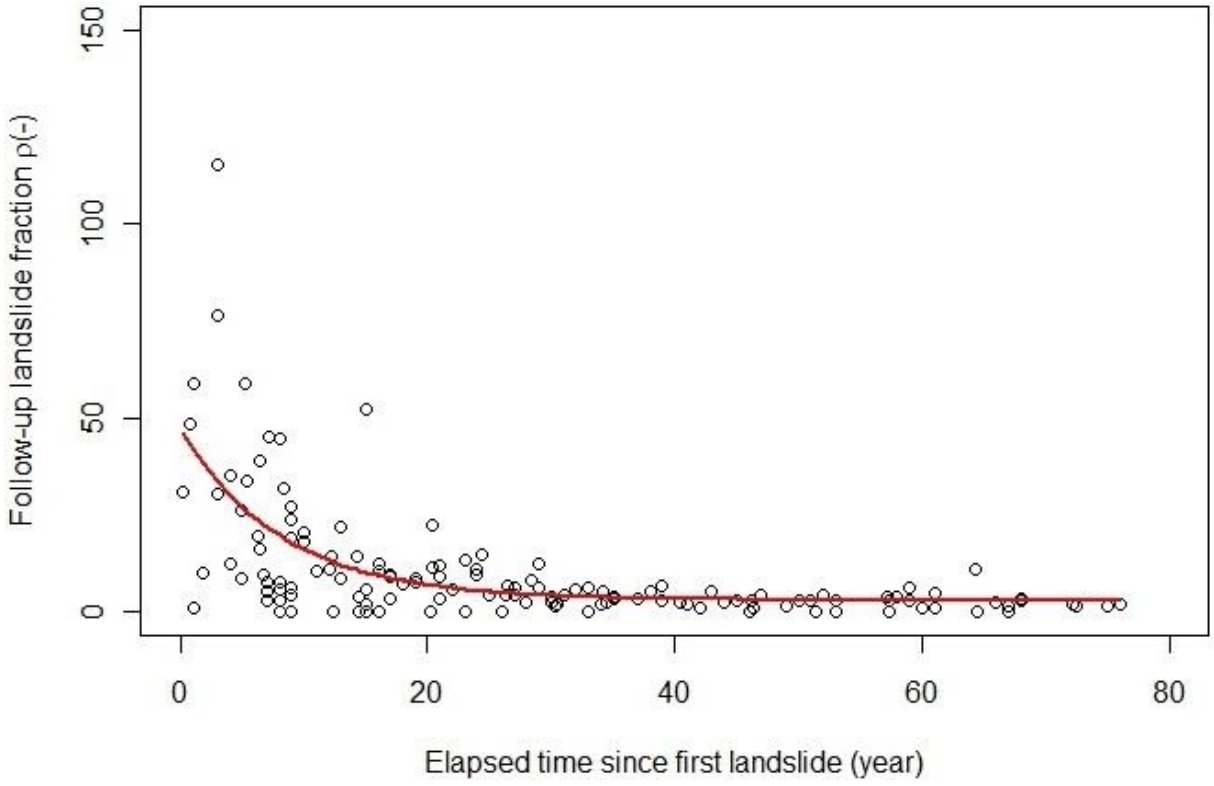

Fig1. Change in landslide susceptibility over time

Implementing this affect into landslide susceptibility modelling has prediction power almost as equal as to the power of traditional variables (e.g., slope and geology) used in landslide susceptibility modelling. We present and compare three landslide susceptibility maps modelled by traditional landslide susceptibility, combined traditional susceptibility with landslide path dependency effect and a landslide susceptibility map purely modelled by landslide path dependency effect.

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Presentation title: **An atmospheric turbulence power factor to improve the estimation of surface deformation and atmosphere phase screen using SAR interferometry**

Differential atmospheric delays in (time series) InSAR data are still a main cause for uncertainties and errors in deformation estimates. Therefore, most approaches for atmospheric mitigation are based on the assumption that the atmospheric signal can be 'averaged out' by using tens of SAR acquisitions. Implicitly, this assumes that the magnitude of the atmospheric signal is rather constant over time.

To improve this method we propose to weigh interferograms with an atmospheric turbulence factor, based on Kolmogorov turbulence theory. This factor is derived using a logarithmic fit of the phase variation in interferograms over different length scales. The strength of this method is that this factor is robust for most deformations and can be summarized with a single number for each interferogram.

We will show how this method is beneficial in InSAR atmospheric phase screen and deformation time series estimation.

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Presentation title: **Detecting dewatering of peatland pastures using Sentinel-1 satellite radar interferometry**

Abstract:

The Netherlands are famous for their polders and the draining of soils to be used as pastures. Around 30% of the pastures are situated on peat soils, mostly in the western part of the Netherlands. Peat is composed of organic materials that oxidize and emit greenhouse gases when exposed to air. Oxidation of peat soils results in volume reduction and subsequent subsidence. As a result, the groundwater level rises relative to the surface. Consequently, the soil needs to be dewatered to keep it sufficiently dry for farming, resulting in more oxidation, and therefore more subsidence. This process is bound to continue until the peat soils have disappeared completely. The societal cost of land subsidence due to peat soils are estimated to be 5200 million euro for urban areas and 200 million euro for peatland pastures, for a period until 2050.

Measuring the subsidence is not straightforward, if not impossible, with conventional geodetic means as soft soils make it impossible to install fixed benchmarks for repeated surveying. Also, due to the very fast temporal decorrelation over pastures, conventional InSAR approaches cannot measure a signal due to loss of coherence.

Here we deploy a complete set of available SAR data from Sentinel-1, Radarsat-2 and TerraSAR-X to estimate the spatio-temporally varying subsidence signal due to the dewatering of peatland pastures over the western part of the Netherlands. We compute the InSAR coherence matrix for all possible interferometric combination, and compute an equivalent single-master stack to estimate the subsidence. Using terrain and land-use defined coherence estimation areas we optimize the phase

estimation over areas severely affected by temporal decorrelation. This leads to a first estimate of deformation signals correlated with ancient shallow soil structures due to fluviatile structures. We use the methodology to investigate the effect of advanced local drainage schemes to slow down the subsidence phenomena.

The impact of noise in a GRACE/GOCE global gravity model on a regional quasi-geoid

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Recent global gravity models (GGMs) which are mainly based on data of the GRACE and GOCE satellite gravity missions such as GOCO05s, are provided with full noise covariance matrices. The latter are often based on a post-fit residual analysis, which has improved their quality significantly. At the same time, improved noise covariance models have been developed for other datasets used in regional quasi-geoid modelling. Therefore, it makes sense to consider a statistically optimal combination of all the datasets by taking the information about the noise variances and covariances into account.

Here we present the results of extended numerical studies related to the impact of noise in the GGM on a regional quasi-geoid. All numerical experiments are done with real data for an area covering the Netherlands, Belgium, parts of Germany and large parts of the North Sea. The approach to be presented uses a parameterization of the regional residual disturbing potential in terms of spherical radial basis functions (SRBFs). The GGM is combined with all other datasets (terrestrial, airborne and shipboard gravity and altimeter-based along track geoid height differences) using weighted least-squares techniques in combination with variance component estimation for a proper weighting of the datasets. The regional quasi-geoid computed in this way is compared with a quasi-geoid computed with the classical remove-compute-restore approach. Differences between the two solutions are used as an indicator of the impact.

Keywords: quasi-geoid, global gravity field model, noise covariance matrix, weighted least-squares, remove-compute-restore.

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Presentation title: **Improved geocenter motion and changes in the Earth's dynamic oblateness from GRACE data and geophysical models**

Abstract: The Gravity Recovery and Climate Experiment (GRACE) satellite mission has enabled the monitoring of mass transport in the Earth's system on a monthly basis. In spite of continuous improvements in data processing techniques, an estimation of very low-degree spherical harmonic coefficients remains problematic. GRACE is insensitive to variations in the degree-1 coefficients (ΔC_{11}, ΔS_{11} and ΔC_{10}), which reflect the motion of the geocenter. The variations of C_{20} coefficients, which characterize changes in the Earth's dynamic oblateness (ΔJ_2) are corrupted by ocean tide aliases and usually replaced with estimates from other techniques.

In this study, the methodology proposed by Swenson et al. (2008) to estimate geocenter motion is updated and extended to co-estimate changes in the Earth's dynamic oblateness. The algorithm uses monthly GRACE gravity solutions (in the form of spherical harmonic coefficients), an ocean bottom pressure model (over the oceans), and a glacial isostatic adjustment (GIA) model (globally).