Geophysical Research Abstracts
Vol. 21, EGU2019-16568-3, 2019
EGU General Assembly 2019

Observations of Dutch Peat Soils during dry summer of 2018 and its consequences for CO_2 emissions

Floris Heuff, Freek van Leijen, Gert Mulder, Sami Samiei-Esfahany, and Ramon Hanssen
Delft University of Technology, Civil Engineering and Geosciences, Geosciences and Remote Sensing, Delft, Netherlands (f.m.g.heuff@tudelft.nl)

The Rhine-Meuse-Scheldt delta is shaped by natural and manmade landscapes. Known for their polders - dewatered lands often used as pastures - the Netherlands has many parts of the delta situated below sea-level. To keep these parts habitable and safe the water-level has to be continuously monitored and controlled, a task performed by the Dutch regional water authorities. Deciding when and by how much to adjust to water level is a challenging task, because different, often conflicting, interests have to be kept in mind.

Around 30% of the dewatered pastures are situated on peat soils composed of organic materials that oxidize and emit greenhouse gases when exposed to air as a consequence of the draining. 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 Dutch Government has set out the objective to reduce CO_2 emissions by 95% by 2050, in which the peat soils have a large contribution. The soils emit approx. 7 Mt of CO_2 yearly, which is 5% of the total emissions. Another 353 Mt is stored in the top 30 cm of soils. In addition, the societal costs due to subsidence are estimated to be 5200 million euro for urban areas and 200 million euro for peatland pastures, for a period until 2050.

Here we present two approaches that measure the dynamics and subsidence of areas situated on or nearby peat soils.

The first method combines Persistent Scatterer InSAR with GNSS and gravimetry measurements to get absolute deformation rates. This produces a map of the Netherlands with a resolution of 2 x 2 kilometers. The approach is unique, because it is capable of separating deep subsidence (i.e. due to gas extraction) from shallow subsidence (i.e. subsidence of peat soils). For the first time we have insight in the contribution of peat soil oxidation to the total subsidence, revealing many areas in the western parts of the Netherlands affected by shallow subsidence.

The second method has a much finer resolution and focuses on the dynamics of the peat soils. We analyzed surface deformation over a small peat area near Delft using Sentinel-1 SAR images, which yields a time series of data with a typical revisit rate of 2 days. Our results show that peat soils are very dynamic with shrinkage and swelling of up to 10 centimeters in summer and winter, respectively. The amount of shrinkage is an indication for the expected emission of CO_2 due to oxidation. Notably, the amount of shrinkage during the very dry summer of 2018 was significantly higher than the year before and has had a big impact on the peat soils from which they still have to recover.