

## Enhancing the value of climate data - translating risk and uncertainty utilizing a living labs approach

### Story mapping to communicate scientific information

Storytelling has a large potential to raise awareness for a specific topic (Harder & Brown 2017) and can help to simplify complex information or to make it more relevant for a specific target group. In EVOKED we have developed a new story map template that allows us to share the source code and remove any restrictions usually imposed on the format or design functionalities of the story map. It further allows more flexibility in the visualisation of the scientific information and can be used actively in the co-development process as it gives room for adjustments according to feedback from the stakeholders.

**Story map for Flensburg, Germany.** In order to visualise and to communicate complex information on climate change impacts, we have produced a pilot story map as a climate service focusing on sea-level rise in Flensburg and addressing the general public as a target group. Adaptation to sea-level rise has become an emerging topic for the city of Flensburg. Thus, our story map has the goals to:

- Raise awareness and inform about sea-level rise.
- Contribute to decisions in dealing with local sea-level rise.
- Support the adaptation process.



Figure 1. Title slide of the Flensburg story map.

The first part of the story map includes short information on the scientific background, such as global mean sea-level rise trends, and defines specific terms such as uncertainty and risk. The second part visualises coastal flood risk and provides information on areas vulnerable to coastal flooding with assistance of a flyover map. The last part of the story map contains information on adaptation options in general, primarily in text-based form and for specific locations in Flensburg.

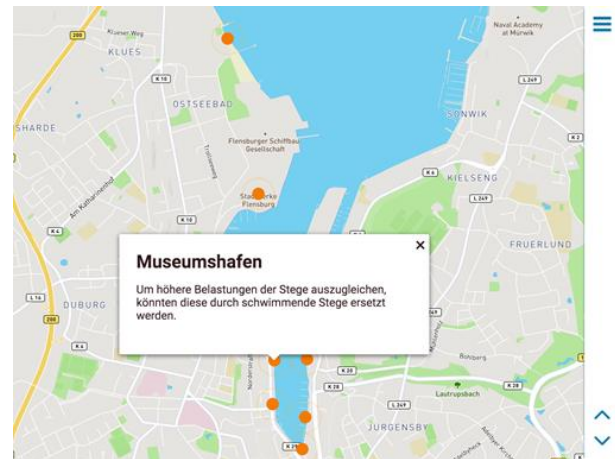


Figure 2. One section of the story map, emphasizing potential adaptation measures for Flensburg (<http://meeresspiegelanstieg-in-flensburg.info/>).

One specific purpose of the EVOKED project is to increase the usability of climate services through a feedback loop. Thus, we have included a feedback form at the end of the story map. We finalised the feedback process in September 2019 and adjusted the story map based on the feedback to improve the usability of the climate service. Flood maps considering different sea-level rise scenarios were included and more details on adaptation measures are given.

### Story maps for in other EVOKED case studies.

The Swedish Geotechnical Institute (SGI) plans to produce two story maps by the end of this year. One story map will concentrate on decision makers of the Värmland Country Administrative Board to raise awareness of how climate change may impact society and to understand their own role in climate adaptation work. The second story map targets citizens in Arvika and addresses water quality problems and actions to improve water quality.

The Province of North Brabant has produced a story map for the very dry summer of 2018. The story map aims to use this event to inform the public about the effects of climate change in Brabant. It is also used as an introduction to the risk dialogues in the EVOKED pilot region of Northeast Brabant. Specific effects are described and include health, nature, agriculture, recreation and housing.

**Story maps as a climate service.** In the past, web applications and web tools on climate change-related issues have been developed, but they rarely have been connected to the concept of climate services. Thus, research is very limited on how effective such web applications are as climate services. One of the first reviews that assesses web portals as climate services recommends that these should take a wide diversity of users into account, assure and manage quality of data presented, be complemented by additional services, take care of continuity also after the project, and ensure that their guidance is appropriate (Swart et al. 2017). Story maps, as web-based applications, can be an effective tool to function as a climate service, taking all the characteristics and challenges of climate services into account.

## References.

Harder C, Brown C (eds) (2017). *The ArcGIS Book. 10 big ideas about applying the science of where*, Second Edition. Esri Press, Redlands, California.

Swart RJ, Bruin K de, Dhenain S, Dubois G, Groot A, Forst E von der (2017). *Developing climate information portals with users. Promises and pitfalls*. *Climate Services*, 6:12–22.

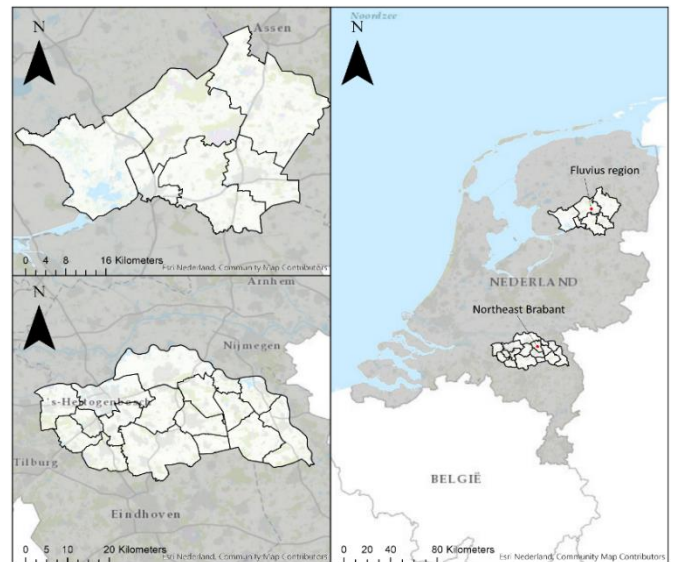


Figure 3. Map showing the location of both regions with the Netherlands.

## Fluvius region and Northeast Brabant, Dutch case study sites

EVOKED's Dutch partner, Deltares, is working with two different case study sites in the Netherlands. This allows for sharing knowledge and experiences between both case study sites as well as cross-study comparison within the Dutch national context.

**The Fluvius region**, located in the north of the Netherlands (see Figure 3), is home to roughly 200,000 inhabitants and consists of 6 municipalities and a water board that work together. As the region is quite rural, agriculture is an important sector and thus the region is vulnerable to both extreme precipitation and drought as these can lead to crop failure. However, it is not just the rural areas that are experiencing climate change. For example, the city of Hoogeveen has experienced pluvial flooding several times in the past decade and in 1995 long periods of rain almost flooded the regional water system in the city of Meppel. In addition to extreme precipitation in the more urban areas, heat stress, especially in the summer, is also becoming an increasing problem.



Figure 4. Photos showing different climate impacts in the Fluvius region (Source: Meternieuws.nl; RTV Drenthe).

deal with a wide array of different climate change impacts which are also expected to intensify in the future. Approaches and solutions must balance both the urban and rural contexts, as well as their priorities. Furthermore, this is accomplished in collaboration between the aforementioned municipalities, a water board and the Provinces of Drenthe and Overijssel.

**Current steps being taken by governmental stakeholders.** Currently, the governmental stakeholders in the region are busy with the tender process for the 'stress test' that is expected to help identify potential areas in the region vulnerable to the impacts of climate change impacts. This also is in line with the national programmes as the region is expected to include climate adaptation within their policies and actions. Therefore, identifying these areas is a constructive first step towards this goal.

**Role of EVOKED within the current processes in the Fluvius region.** Deltares, as part of EVOKED, has joined the Fluvius region project group which is tasked with setting out the tender for the 'stress test'. In this work, internal information needs and external societal stakeholders have been documented. This work supports the development of story maps and Deltares is helping the project group with analysing the proposed story maps. Additionally, an existing climate service (the Climate Impact Atlas, <http://www.klimaat-effectatlas.nl/en/>) has been improved for pluvial flooding to include socio-demographic aspects as well as the predicted water heights.

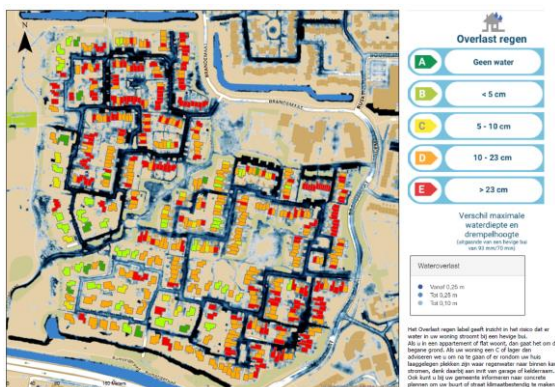


Figure 5. The improved pluvial flooding map that also shows the impact flooding may have for private properties.

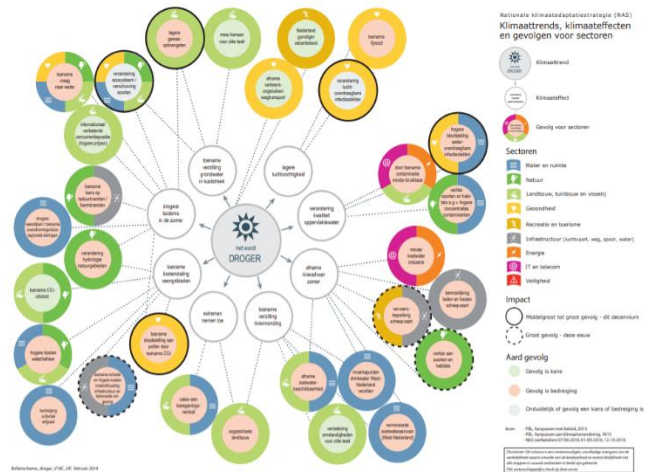


Figure 6 Dutch National Adaptation Strategy, The NAS-Bollenschema.

**Northeast Brabant**, located in the south of the Netherlands (see Figure 3), is home to roughly 580,000 inhabitants and consists of 17 municipalities, the province of North Brabant and a water board. Although this region is larger than the Fluvius region and consists of more municipalities, the regions are similar in their agriculture and rural attributes. Additionally, similar climate change impacts can be found as well. For example, this region was also impacted by the 2018 drought and pluvial flooding is an issue.

**Current steps being taken by governmental stakeholders.** This region is also focusing on climate change adaptation by focusing on understanding where the vulnerable areas are located and beginning the work to initiate risk dialogues. The main difference between the two case study sites is that a version of the 'stress test' has already been conducted and therefore the region is already moving forward to start the risk dialogues.

**Role of EVOKED within the current processes in North Brabant.** To some degree Deltares has a similar role in this process as is the Fluvius region case, supporting the processes for the 'stress test' and the risk dialogues. Since the risk dialogues are the main focus area, the objective of the climate service being developed will be to communicate the expected risks and impacts of climate change in the region to local and regional stakeholders. To this end, a choice was made to connect this



Figure 7. Extreme weather impacts in the region of Northeast Brabant in the last years.

objective to the climate service that has already been developed for the Dutch National Adaptation Strategy (see Figure 6).

This climate service provides an overview of the expected impacts in the Netherlands (flooding from the main/regional water system, extreme precipitation, drought and heat stress). These impacts are then translated to the regional effects this impact will be expected to have as well as which stakeholders in turn will be affected.

For the risk dialogues, the work of Deltares will focus mainly on testing whether this approach will be useful and fulfils to the expectations and information needs of the local and regional stakeholders. This can then for example result in changing the graphical representation the impacts and socio-economic consequences of climate change within a local climate adaptation strategy.

## Partners: end-users and research organizations



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