Deltares

Enabling Delta Life

Deltares and the Global Centre of Excellence on **Climate Adaptation**

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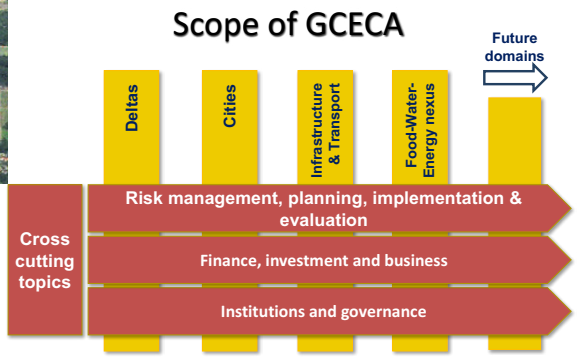
At Deltares, we are not afraid to get our boots dirty. We work on micro-organisms and mega-dams and everything in between. And we never focus only on technological solutions, but take account of ecological factors and policy constraints. True to our motto, 'Enabling Delta Life', we aim to enhance the living environment in a way that is sustainable and of benefit to all. And we 'dare to share': we believe that sharing knowledge is key to doing our work better and learning from each other.

The new Global Centre of Excellence on Climate Adaptation (GCECA) aims to accelerate climate adaptation interventions by recognising, building and promoting excellence among all stakeholders worldwide.

Deltares is an independent research institute and a strategic partner of GCECA. We are dedicated to helping people live safely and sustainably in delta areas, coastal zones and river basins, and on small islands. With our roots in one of the greatest hydraulic engineering projects ever, the Dutch Delta Plan, we have been providing expertise on water and the subsurface in the Netherlands for nearly a century. Our researchers now come from around the world and from many disciplines, including hydrology, planology, ecology, economics and morphology. And we apply our expertise worldwide to assess the risks presented by climate change, develop methodologies, models, tools and strategies to address these risks (www.simplecoast.com), and set up capacity-building programmes for local stakeholders.



Working together

Cooperation is at the core of our work. We constantly extend our knowledge base through government research programmes and contract research, forming consortia with Dutch, international and local research institutes, NGOs and businesses, encouraging innovation and the implementation of new advances.

Even top Hollywood actor Leonardo DiCaprio is aware of Deltares' work on coral reefs! He twittered: "A recent paper by researchers from the Dutch independent institute for applied research Deltares and the USGS gives guidance to coastal managers to assess how climate change will affect a coral reef's ability to mitigate coastal hazards"

Deltas
home-grown solutions

Deltas are attractive areas to live in and are therefore densely populated. However, they are threatened by human impact and climate change. As our name and our motto 'Enabling Delta Life' suggest, much of Deltares' work focuses on deltas.

Picture: Russell Watkins/DFID

Deltares is a founding member of the Delta Alliance knowledge network, through which we contribute to the Delta Coalition knowledge agenda. Deltares is also a member of the Climate and Technology Centre and Network (CTCN), an active partner in the Alliance for Global Water Adaptation (AGWA) and an associate partner of the World Meteorological Organization's Flood Management and Drought programmes.

In the Netherlands, 26% of the delta lies below sea level and 29% is prone to river flooding. Deltares helped design the Dutch government's programme to develop sustainable use of the delta. The programme resulted in decisions on flood-risk protection and adaptation, freshwater security, and detailed plans for the regions most likely to be affected: the Rhine-Meuse delta and the IJsselmeer region. Deltares also developed the Delta Model, a tool for calculating the effectiveness and impact of policy decisions in the Netherlands.

We have applied the experience gained in the Netherlands in Asia, where many countries are experiencing the immense pressure of combining multiple functions on small areas of land. In Bangladesh, we worked with stakeholders to develop a sustainable and widely accepted strategy to tackle water-related issues. In Indonesia, we were involved in the Integrated Coastal Development and Joint Cooperation Programme on water resources management. And, in the Green Water Defence project, we developed guidelines on how to adapt to future climate scenarios, integrating cost-effective, nature-based solutions to protect against sea-level rise and flooding.

In short...

Based on our home-grown experience, Deltares offers global, regional and local modelling and assessments on floods and drought, early warning and actionable pathways for water management and delta development. We encourage adaptive delta planning as a response to climate change and other uncertainties, for which we have developed a framework for Collaborative Risk Informed Decision Analysis and Support (CRIDA).

Cities
urban resilience

Over 60% of all urban areas are in coastal or delta areas, and are therefore at risk of flooding. City governments need to develop urban resilience plans to adapt to climate change and population growth, and safeguard water quality.

In the Netherlands, cities have to deal with climate change challenges, such as a growing flood risk, heat stress in the summer, and increasingly intense rainfall. Cities around the world are facing similar challenges that vary locally and across regions and continents. Deltares' experience in collaborative and integrated approaches, capacity building and multi-stakeholder involvement has proved its worth in many of these urban environments.

Together with sea-level rise, subsidence is increasing the flood risk yearly. During a round-table meeting in Jakarta in 1995, policymakers and researchers from Indonesia discussed the problem of subsidence in the city with experts from the US, Italy, Japan and the Netherlands. They concluded that groundwater abstraction had to be reduced or even stopped altogether. Together with local partners, Deltares developed a new strategy to stop groundwater abstraction in the city, and to enhance monitoring of the strategy's success.

Nature-based solutions for cities

Dhaka, Bangladesh, one of the world's most flood-prone cities, has recently lost 30% of its urban water storage capacity due to rapid urbanisation. Deltares studied the potential of 'building-with-nature' solutions in the city, including green roofs, permeable pavements and bioswales.

Green urban living

Beira, in Mozambique, is low-lying and has a poor coastal defence system. The city's drainage system is in bad condition and cannot cope with the intense precipitation. In addition, the traffic system cannot deal with the increasing activity in the port. Deltares is the lead partner in a consortium that developed a Masterplan 2035 aimed at sustainable improvement of the situation.

In the American city of New Orleans, which lies below sea level, a storm drainage system removes excess water after heavy rainfall. Because industry relies on the water, it is extracted continuously, even in dry periods, causing subsidence. Deltares helped devise an Urban Water

Jakarta- subsidence is increasing flood risk

Plan to illustrate how the city can become more resilient. We are now implementing the plan and monitoring its effects.

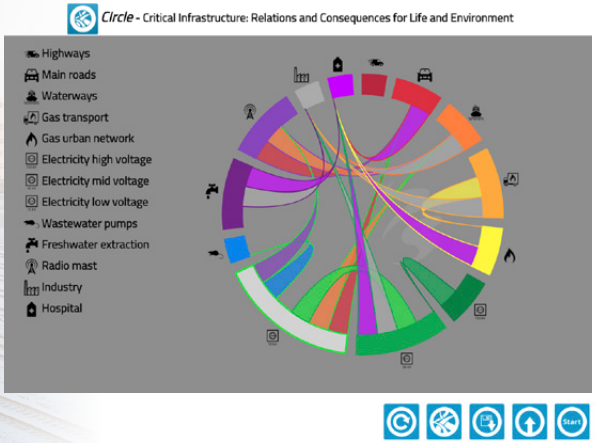
Adaptation Support Tool

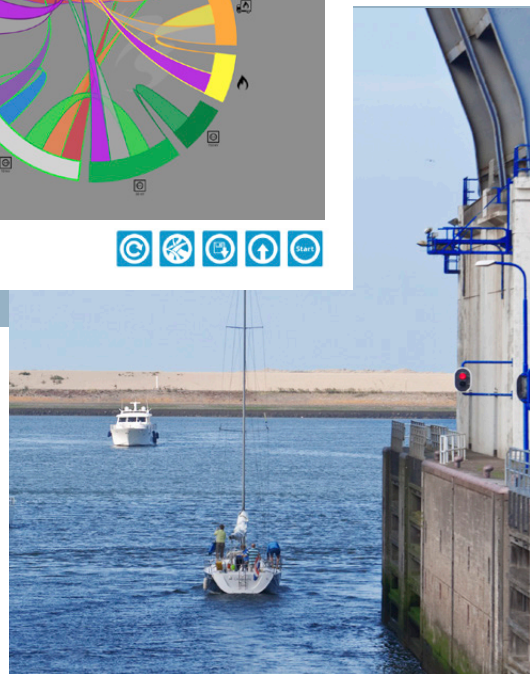
Our Adaptation Support Tool (AST) can be used by urban planners, landscape architects, water managers, civil engineers, local stakeholders and other experts planning adaptation measures. When they implement measures in a project area, AST immediately estimates their effectiveness and cost. The tool is operated with a touch table, allowing quick analysis by multiple parties and rapid visualisation.

Deltares is member of the 100 Resilient Cities network, contributing to urban sustainable development projects in cities like Rotterdam, Mexico, Colombo and Bangkok.

Infrastructure and transport

society's cardiovascular system





Infrastructure is the cardiovascular system of our society and economy. It is therefore vital to improve and maintain its weather- and climate-robustness.

Climate extremes are becoming even more intense and frequent: heatwaves, extreme cold, extreme rainfall, mist, black ice, drought, gales and storms are having an increasing impact, challenging vital infrastructure. In the INTACT project, participants from different countries (Finland, Norway, the UK, Ireland, the Netherlands, Germany, Spain and Italy) and backgrounds (universities, research institutes and consultancy firms) worked together to develop responses to the complex challenge of maintaining the weather- and climate-robustness of critical infrastructure. Deltares was responsible for flood-risk analysis and management, climate change adaptation strategies, risk analysis of urban and national critical infrastructures, and coordinating a case study on Rotterdam.

The Circle Tool

Our Circle Tool combines expert stakeholder knowledge and analyses to predict cascading effects over different critical infrastructure networks. By studying the effects of a selected natural hazard, the Circle Tool provides an insight into robustness and climate change adaptation strategies.

Nature-based solutions for infrastructure

To create more sustainable infrastructure, we have to go green. Nature-based solutions are less invasive, more cost-effective and do not require nature to make sacrifices. On the contrary, they often create opportunities for nature development. Because of the benefits, financing opportunities are also more widely available.

Adaptive planning

At Deltares, we have integrated our knowledge on risk assessment, asset management, road design, subsurface and hydrology, flood impact, and methods and tools for climate adaptation into a set of guidelines for adaptive road management (ROADAPT). ROADAPT includes a quick-scan to assess climate change risks for roads in Europe.

Less visible, but equally important, is adequate maintenance of infrastructure for the navigability of rivers and other waterways in the face of climate uncertainty. Deltares combines knowledge of hydrology, morphology, shipping, climate change and adaptation to explore adaptation scenarios for river training and management.

Deltares hosts the secretariat of the World Association for Waterborne Transport Infrastructure (PIANC).

Adaptive planning depends on quantifying uncertainties. Deltares leads the ROBAMCI (Risk and Opportunity-Based Asset Management of Critical Infrastructure) consortium, which develops methods and cases for quantitative, optimal asset management.

The food-water-energy nexus
coherent management

Food, water and energy security are inextricably linked because interventions in one area often impact the others. The demand for all three is increasing because of a growing world population, rapid urbanisation, economic growth and changes in diet.

Multifunctional large basins for storage, energy production, water supply and food production

As the main surface waters in the Dutch province of Zeeland are saline, the supply of freshwater cannot be taken for granted. A detailed picture of fresh-salt water distribution is essential to detect possible trends in the subsoil and to adapt to them in time. Deltares and its partners have developed a method of determining the three-dimensional chloride distribution in groundwater.

Water security and food production are intrinsically related

Preparing for an uncertain future

With climate change making the future uncertain, Deltares was involved in an EU-funded project to develop and analyse Europe-wide freshwater scenarios. These scenarios serve as a reference for European water resources development, alert policy-makers and stakeholders about emerging problems, and allow river basin managers to test local and regional water plans.

Deltares also makes a substantial contribution to improving European climate adaptation policies. A good example is the Bottom-up Climate Adaptation Strategies for Europe (BASE) programme, in which we assessed river flood risk and adaptation options. In INSPIRATION, a Horizon2020 project, Deltares developed the specific knowledge needed for sustainable use of the soil-sediment-water system, covering both the subsurface and land use in Europe.

Our open access RIBASIM model can be used to quantify the trade-offs and synergies between the water, energy and food sectors. As the allocations of water for drinking water, industrial uses, energy or food production are strongly interdependent, the consequences have to be well known in advance.

With climate change making our future more uncertain, Deltares became involved in developing and analysing Europe's freshwater scenarios.

Climate change and adaptation
in small island developing states

Training session at the island of Sao Tome (SimpleCoast project)

Coastal flooding in the Marshall Islands

Within the next few decades, many of the 500 million inhabitants of atolls in the Pacific and Indian Ocean will probably have to find a new home. Since human activity in these small island developing states (SIDS) tends to be concentrated in the diminishing coastal zone, they are very susceptible to sea-level rise and natural disasters. On average, they lose between one and nine percent of their GDP each year. These averages hide extremes, since a single disaster can sometimes cripple an island's entire economy.

Assuring supplies of fresh water

One major threat for life on these islands is the loss of freshwater and agricultural land after flooding by sea water. Deltares developed methods to increase their resilience, to enable them to stay self-sufficient and adapt to future threats. Two examples are SeepCat (seepage catcher), which captures excess saline groundwater that flows towards freshwater lenses when the sea level rises, and CARD (Controlled Artificial Recharge and Drainage), which stores fresh water from precipitation below ground.

Deltares

Postbox 177
2600 MH Delft
The Netherlands
T +31 (0)88 335 82 73
info@deltares.nl
www.deltares.nl