



Vision

Deltas are susceptible to flooding; therefore a sound adaptation policy is urgently needed. Flood risk management requires constant adaptation to changing physical and societal circumstances, the rate of which is uncertain. Such uncertainties can be dealt with by designing robust and flexible adaptation responses. Their design requires insight in the effectiveness of individual adaptation measures, such as flexible structures to control water levels, measures to reduce wave attack, innovative embankments, and measures to reduce flood consequences.

Aims

The research programme aims to support the national, regional and local authorities in their quest for a joint flood risk management and spatial development strategy for the 21st century and beyond. This is pursued by enhancing our common understanding and knowledge on the effectiveness, attractiveness and applicability of individual flood risk management measures and policy instruments.

Topics

- Developing methods to help dealing with flood risk management
 - the effectiveness of technical measures and policy instruments to reduce flood risks
 - the implications of their implementation for urban and countryside environments
 - the robustness (resilience and resistance) of comprehensive flood risk management strategies in view of uncertainties
- Providing guidelines for the design of flood risk management measures and comprehensive long-term strategies. These should be based on effectiveness (flood risk reduction), robustness and their contribution to the development of entire regions (multi-functional use, natural values and spatial quality).

Load reduction

The load on flood defences can be reduced by storm surge barriers, by making room for rivers or by dampening waves. We established that the Maeslant barrier, even when it formally fails, may reduce the design water level substantially when it 'partially functions'. This may lower the flood level by several decimetres and needs to be taken into consideration. Making room for rivers not only lowers the design water levels, but also influences the relationship between discharge and water level and reduces the flooding depth in case of failing flood defences. These effects imply an effective reduction of flood risk and provide additional arguments to prefer making room for rivers above raising embankments in the non-tidal river reaches.

Flood protection

Embankments will be one of the keystones for flood protection well into the future. A shift towards stronger instead of higher embankments may imply larger footprints. Against a background of lack of space this calls for seeking combinations of functions in flood defence zones as well as new governance arrangements between Water Boards and local users.

The first results of our investigations on dune development under a sand nourishment regime show that most dunes of the Netherlands' coast have recently increased in volume. This suggests that this management policy may be attractive in a more dynamic climate too.

Exposure reduction

Many coastal floodplain areas are effectively compartmentalised by existing secondary embankments along canals, roads and railroads. These reduce the area which can be flooded in one event. As this effect diminishes with rising sea level, it is advised to reconsider earlier conclusions on the attractiveness of compartmentalisation in view of climate change. Also 'practically unbreachable' embankments may reduce the flooded area, the flood depth and especially the flood level rising rate. We established which stretches should be given priority in a policy focused on reducing societal fatality risk, e.g. near Wage-

ningen, along the Lek River where it runs between Alblasserwaard and Krimpenerwaard, near Spijkenisse and on the Island of Dordrecht.

Vulnerability reduction

An area's vulnerability may be reduced by a policy of 'building elsewhere if possible, and building otherwise if needed'. Such a policy requires adequate hazard maps to inform spatial planners and as an aid to risk zoning policies as well as modernisation of building requirements. We made substantial progress on both. An inventory of insurance arrangements world-wide allowed us to define the key success and failure factors which may help in deciding on the most adequate burden-sharing arrangement for the Netherlands' situation.

International comparative analysis

A comparison of governance approaches in Rotterdam, London, Venice and New Orleans showed that, despite climate change being acknowledged as potential trigger, none of these cities is really aiming for a true transition in flood risk management. London and Rotterdam both prepare for more extreme sea level rise and climate change scenarios than New Orleans and Venice, but all build on conventional approaches.

Towards comprehensive flood risk management

Flood risk management aims to reduce flood risks to an acceptable level against acceptable costs. But it should also prevent disasters by increasing the whole system's robustness, which means that the failure of one system component (e.g. an embankment, sluice or storm surge barrier) does not lead to an unmanageable event or disaster. We found that a flood risk system's robustness may be enhanced by reducing the uncertainty about where, when and how embankments will fail, and a good balance between a high resistance threshold and yet a relatively low flood damage in case of failure.

Working with stakeholders

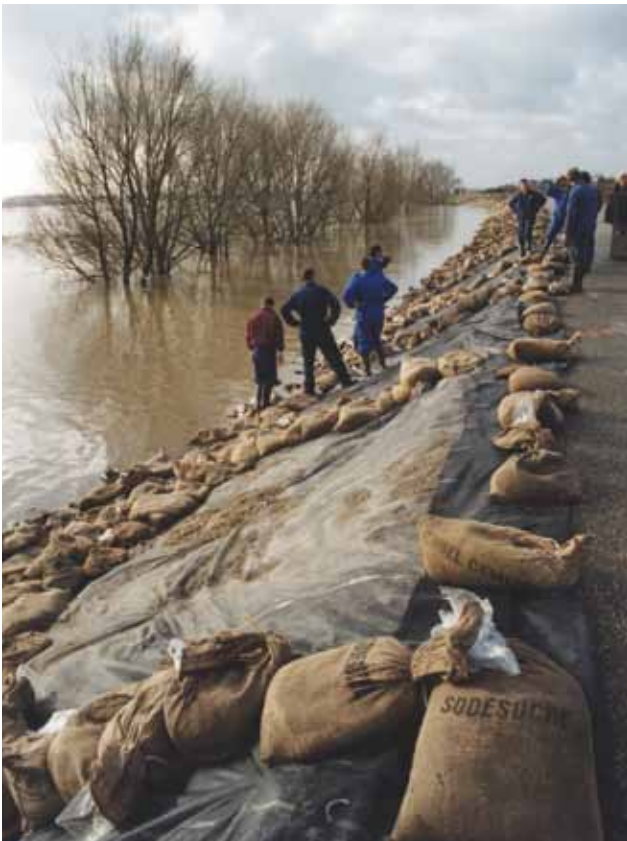
Our consortium is strongly engaged in the societal debate on flood risk management in the Netherlands, both at national level and regional levels. We have very close working relations with the Delta Programme. Our participation – with some invited lectures – in subsequent ‘knowledge conferences’ of the Delta Programme (both 2011 and 2012) reflects this good working relationship.

We are especially involved in the generic Delta Programmes ‘Water Safety’ and ‘Urban Development and Re-development’, and do case study research in co-operation with the regional programmes Rhine-Meuse mouths, Rivers, Southwestern Delta and Wadden Sea. We thus have close working relations with the Knowledge for Climate Hotspots too, as these geographically largely correspond with the regional Delta Programmes.

We also have a very close working relationship with STOWA’s research programme Delta Proof, which aims to support the regional water managers and flood risk managers, and with provincial authorities. With STOWA we developed a joint communication strategy, have common workshops and sustain STOWA’s initiative on Delta Facts.

Case studies

- Ameland: dune development
- Terschelling: saltmarshes to reduce wave impact
- Wadden Sea: saltmarshes and shoals in multi-functional flood defence zones
- IJssel Valley: robust flood risk management alternatives
- Large Rivers: enhancing spatial quality while reinforcing embankments
- Dordrecht: jacking buildings to allow raising embankments
- Maeslant barrier: the effect of partial functioning of a 2-wing storm surge barrier
- Rijnmond-Drechtsteden: joint flood risk management planning and spatial development planning
- Feijenoord, Rotterdam: adaptive planning and building in unprotected areas
- Westerschelde: assessing a sand engine’s potential in an estuarine setting
- Rhine-Meuse mouths: joint learning and joint planning through SimDelta



Contact

Consortium leader

Frans Klijn

T +31 88 335 8273

Frans.Klijn@deltares.nl

Communication

Nicole de Jong-Kolleman

T +31 88 335 8258

Nicole.deJong@deltares.nl

Deltares

www.deltares.nl

www.knowledgeforclimate.org/climateproofloodrisk

Subscribe to newsletter

Nicole.deJong@deltares.nl

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Working with Hotspots / Stakeholders

- Delta Programme
- STOWA (Applied Water Research)
- Hotspot Rotterdam region
- Hotspot Major rivers
- Hotspot South-West Netherlands Delta
- Hotspot Wadden Sea

Consortium partners

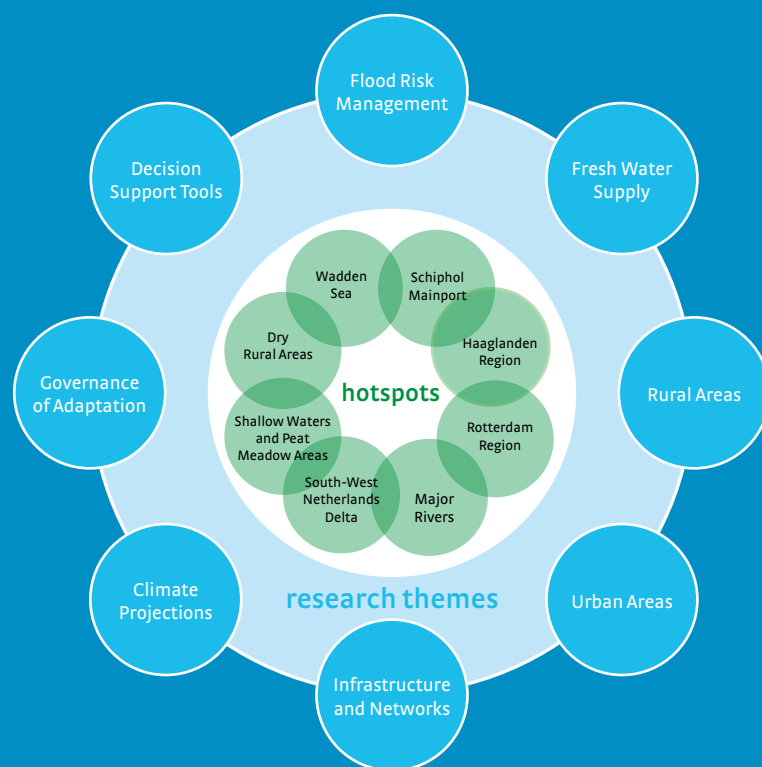


Knowledge
for Climate

To develop the scientific and applied knowledge required for climate proofing the Netherlands and to create a sustainable knowledge infrastructure for managing climate change

Knowledge for Climate is a research programme (2008-2014) that develops knowledge and services needed to make the Netherlands climate proof. Governmental organisations (national government, provinces, municipalities and water boards) and businesses actively participate in the research programme. Knowledge for Climate focuses on eight areas, called hotspots: Mainport Schiphol, Haaglanden Region, Rotterdam Region, Major Rivers, South-West Netherlands Delta, Shallow waters and Peat Meadow Areas, Dry Rural Areas and the Wadden Sea Region. The scientific research is carried out in eight themes by consortia.

- Climate Proof Flood Risk Management
- Climate Proof Fresh Water Supply
- Climate Adaptation for Rural Areas
- Climate Proof Cities
- Infrastructure and Networks
- High-quality Climate Projections
- Governance of Adaptation
- Decision Support Tools



Programme Office Knowledge for Climate

Secretariat

T +31 88 335 7881

office@kennisvoorklimaat.nl

Communication

T +31 317 48 6540

info@kennisvoorklimaat.nl

www.knowledgeforclimate.nl

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