

# Climate change & water resources: call for smart climate adaptation strategies & innovations



Patrick WILLEMS

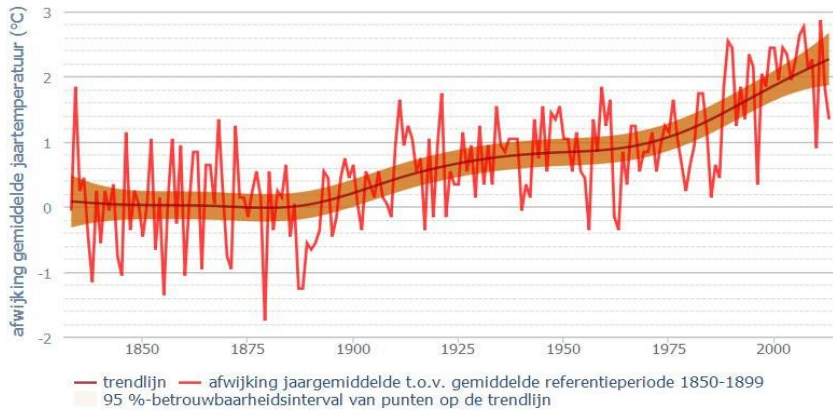
Dept. Civil Engineering, Hydraulics Section

# Climate change & urbanization

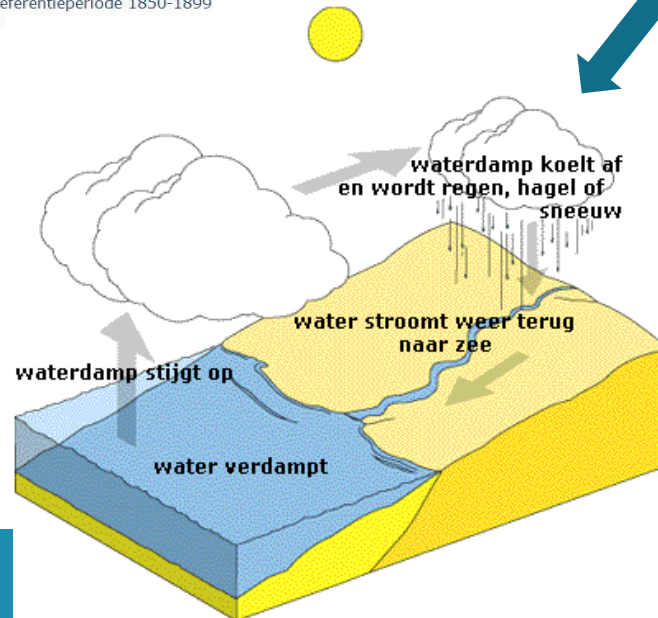
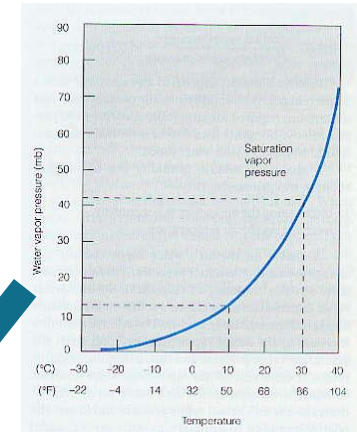
bring additional challenges  
to water management

# Global warming → more hydrological extremes

Temperature rise at Brussels since 1830:



Increase of saturation concentration air vapour:



# Higher frequency of drought events

Such as drought of spring – summer 2017 Flanders:

## Waterkwaliteit in West-Vlaanderen levensbedreigend door droogte



di 25/07/2017 - 16:50 Denny Baert, Belga

In West-Vlaanderen is het water in sommige waterlopen zo zout geworden, dat er een gevaar is voor de dieren. Daarom verlengt gouverneur Carl Decaluwé het oppompverbod in het IJzerbekken, het bekken van de Brugse Polders en het Leiebekken tot 18 augustus.

Ondanks de regen van de afgelopen dagen is het waterpeil nog altijd veel te laag. De recente regenval heeft de aanhoudende droogte van de afgelopen maanden bij lange nog niet gecompenseerd.

Bovendien wordt al het zoete water in die waterlopen alsmat zouter. "Wij zien dat de verzilting de voorbije 14 dagen in verschillende waterlopen sterk is gestegen", stelt gouverneur Carl Decaluwé vast.

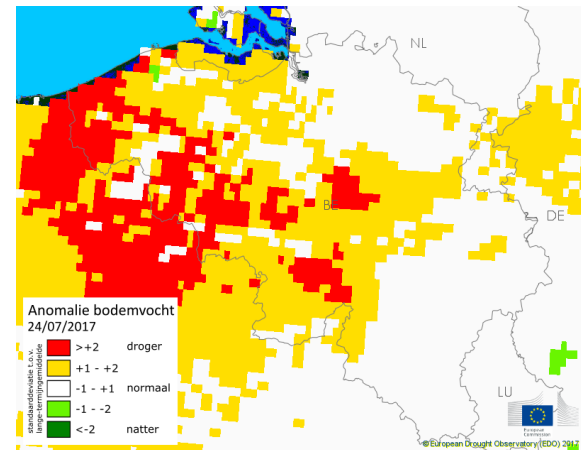
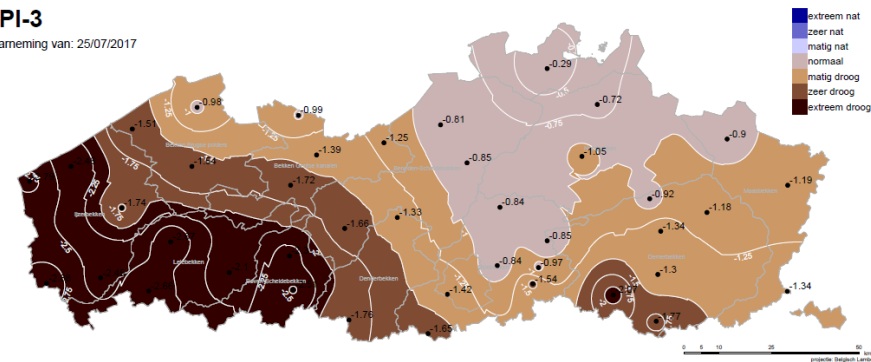
### Levensbedreigend

Het zoutgehalte in het oppervlaktewater zou op sommige plaatsen zo hoog zijn, dat dieren mogelijks kunnen sterven door ervan te drinken.

Zoutwaarden hoger dan 4.000 milligram per liter water vormen een risico voor de volksgezondheid. "Er is een risico, zelfs levensbedreigend als de zoutwaarden boven de 10.000 milligram per liter gaan. Op verschillende plaatsen is die op verschillende plaatsen overschreden", zegt Decaluwé. In het kanaal Plassendale-Nieuwpoort ter hoogte van Middelkerke bedroeg het zoutgehalte zelfs 14.000 milligram per liter.

### SPI-3

waarneming van: 25/07/2017

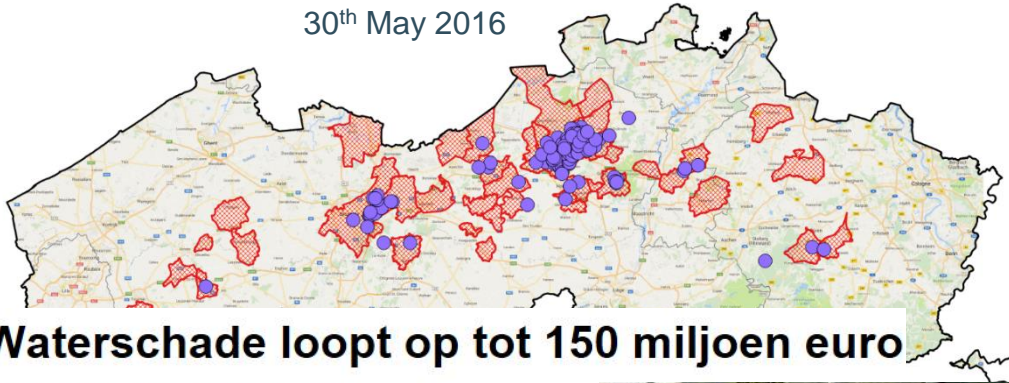




# Higher frequency of pluvial floods

Such as extreme rainfall events & pluvial flooding 27 May – 6 June 2016 Belgium:

30<sup>th</sup> May 2016



Gemeenten kondigen rampenplan af na hevige regen

31/05/2016 om 00:08 door thbe, mtm, mige, ph, er, dgs



## Waterschade loopt op tot 150 miljoen euro

Aanbevelen Delen 13 Tweet G+ 0

Door: redactie  
23/06/16 - 20u52 Bron: vtmnieuws.be

BEWAAR ARTIKEL



Waterschade loopt op tot 150 miljoen

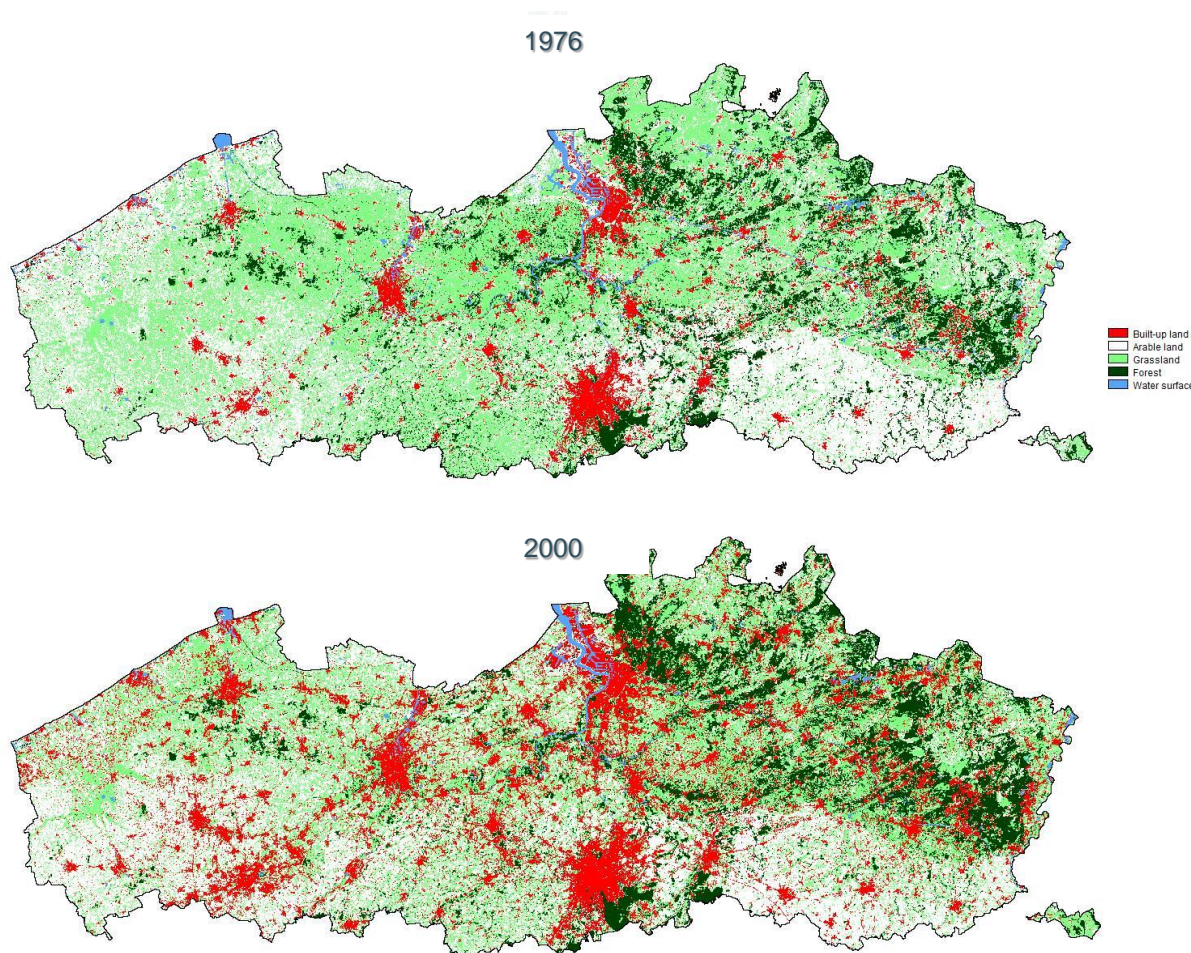


**VIDEO** De schade van de vele regen van de afgelopen weken zal verzekeraars 150 miljoen euro kosten. Dat bevestigt Assuralia, de verzekeringskoepel, aan VTM NIEUWS. Er zijn zo'n 35.000 schadegevallen, per schadedossier komt het op zo'n 4.000 euro.



# Urbanization -> Soil sealing

Increase in build-up areas and pavements:



*Flanders and Brussels:*

*1976: 4 – 5% paved*

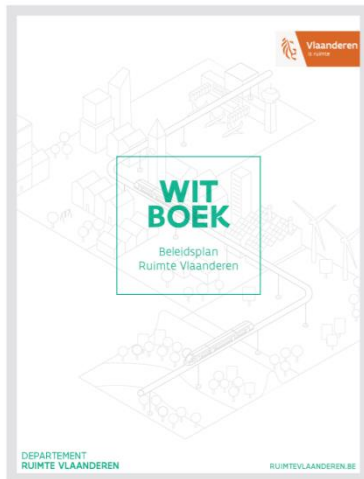


*2018: 14,5% paved*

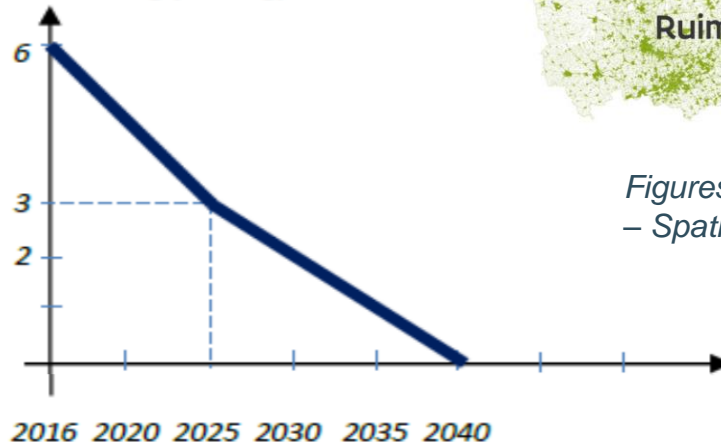


# “Stop the soil sealing” plan

Flanders’ new White Book Spatial Planning (BRV):



ruimtebeslag (ha/dag)



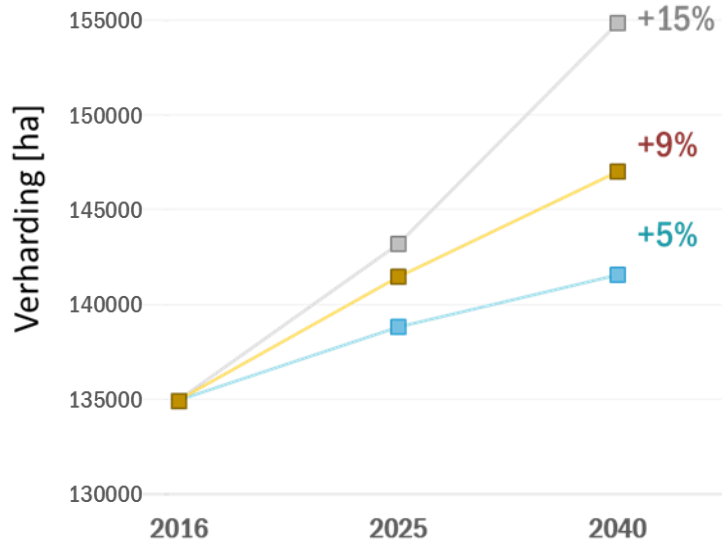
Figures: Authorities of Flanders  
– Spatial Planning Dept.

Two types of actions:

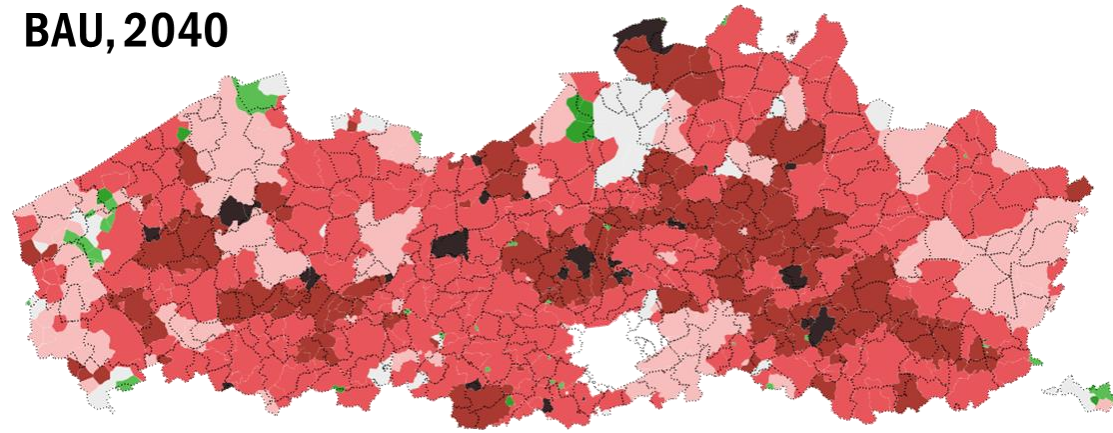
- Preserve the open spaces / urban expansion as an exception
- Increasing the spatial efficiency (densification in urban areas, but with attention for “liveability”)

# “Stop the soil sealing” plan

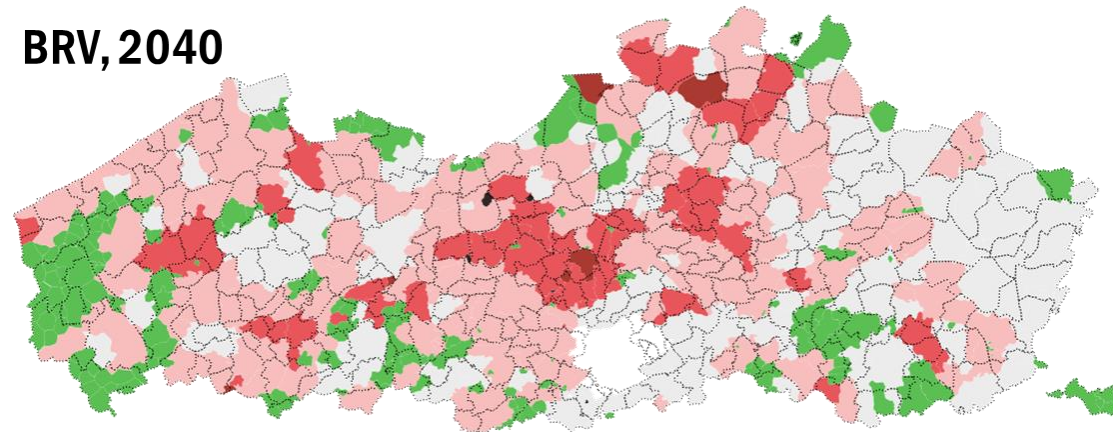
Impact on urban water planning (recent study for **VLARIO**):  
OVERLEGPLATFORM



## BAU, 2040



## BRV, 2040



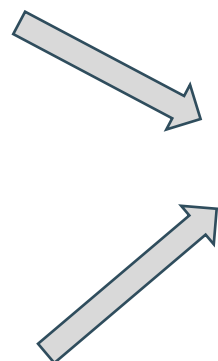
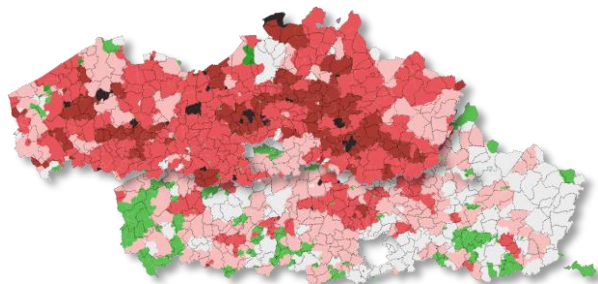
- Meer dan 5% ontharding
- 5% tot 0%
- 0% tot +5%
- +5% tot +10%
- +10% tot +20%
- +20% tot +30%
- Meer dan 30% extra verharding



# “Stop the soil sealing” plan

Impact on urban water planning (recent study for **VLARIO**):  
OVERLEGPLATFORM

Scenarios on land use & population density:



# Sirio

<https://www.sumaqua.be/sirio>

Source control measures:



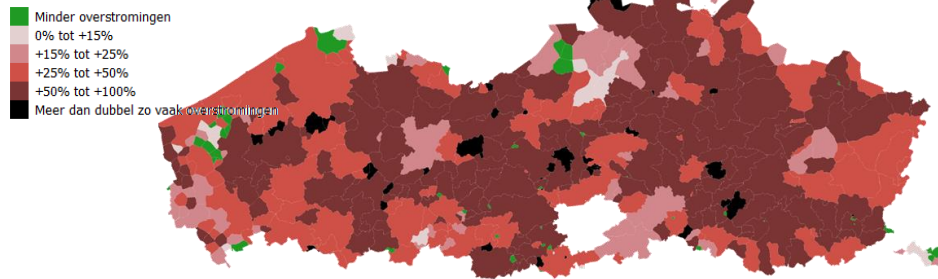
# “Stop the soil sealing” plan

Impact on urban water planning (recent study for **VLARIO**):  
OVERLEGPLATFORM

Changes in flood frequency:

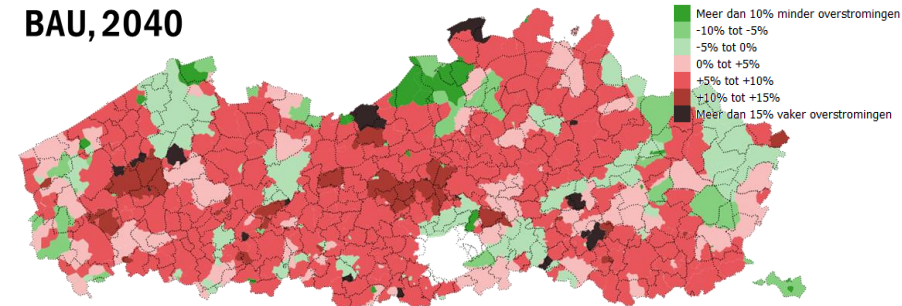
without source control measures:

**BAU, 2040**

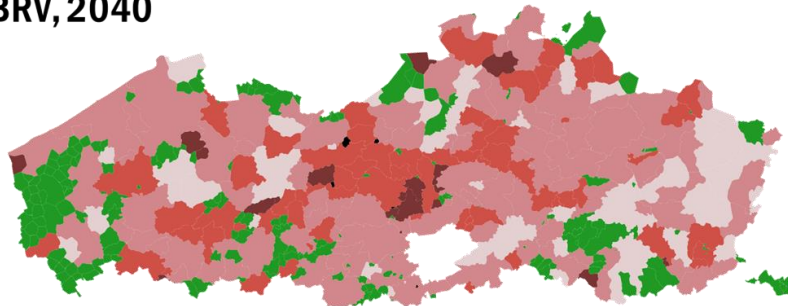


with source control measures:

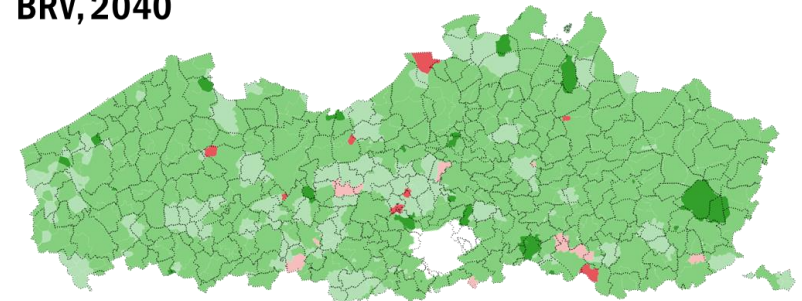
**BAU, 2040**



**BRV, 2040**



**BRV, 2040**

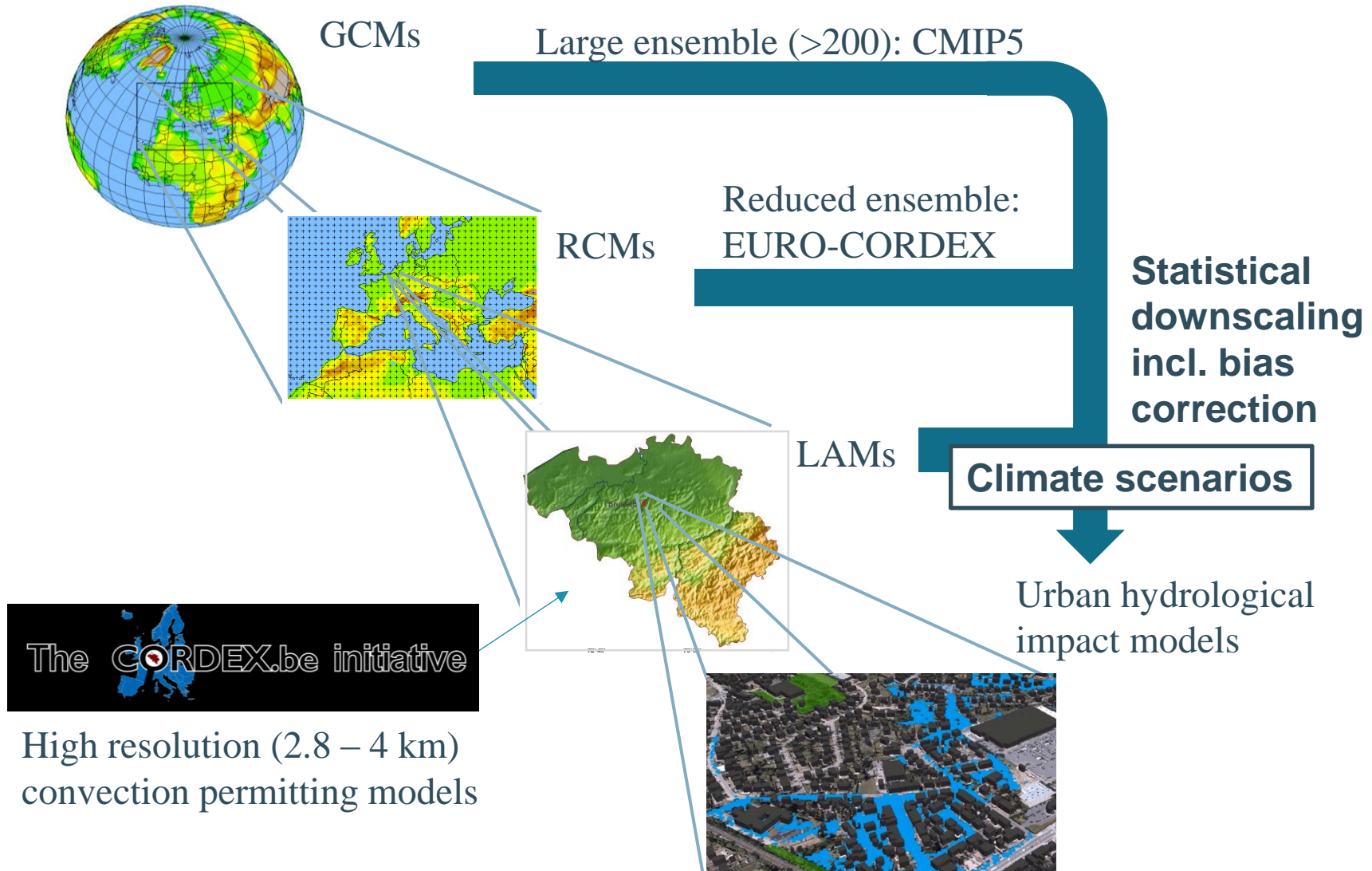


Economic benefits for urban drainage management:

urban water planning cost in Flanders reduces from 3,4 to 1,8 billion €

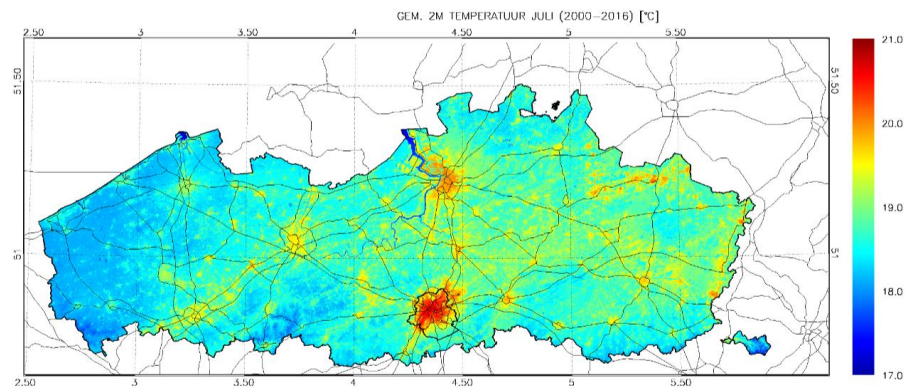
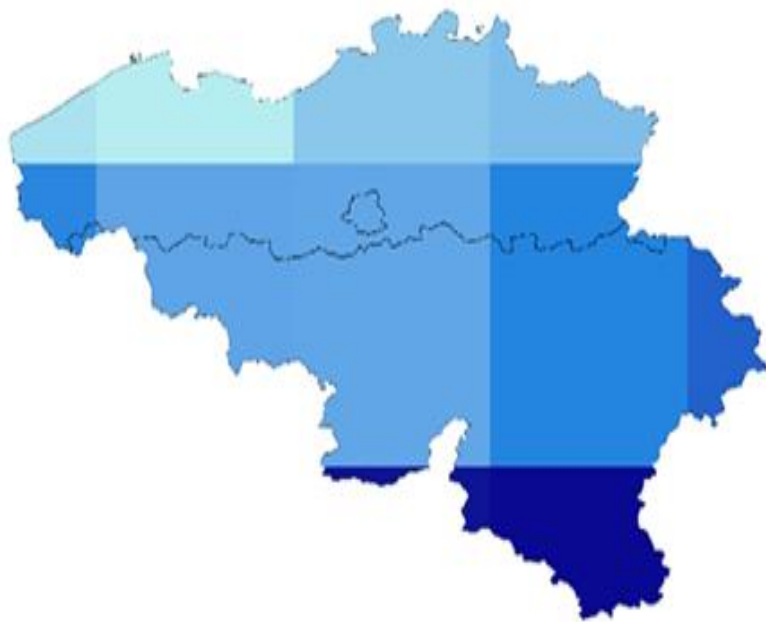
(non-private investments)

# Future climate change ?





# Higher resolution climate modelling



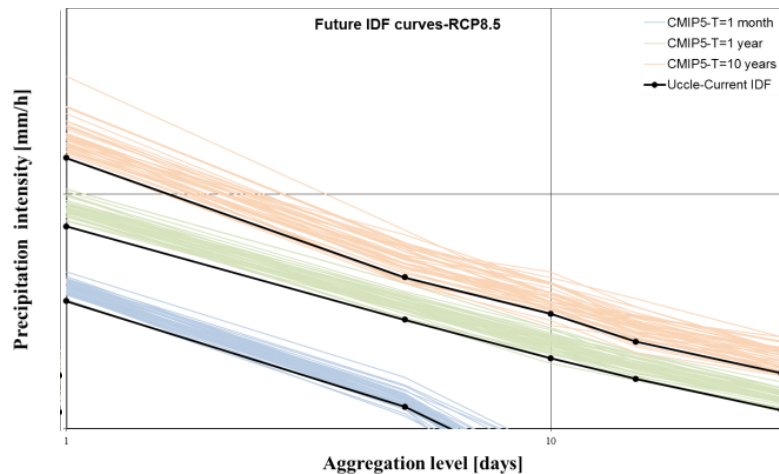
# Climate change tools for impact analysis

## Impact analysis on urban drainage

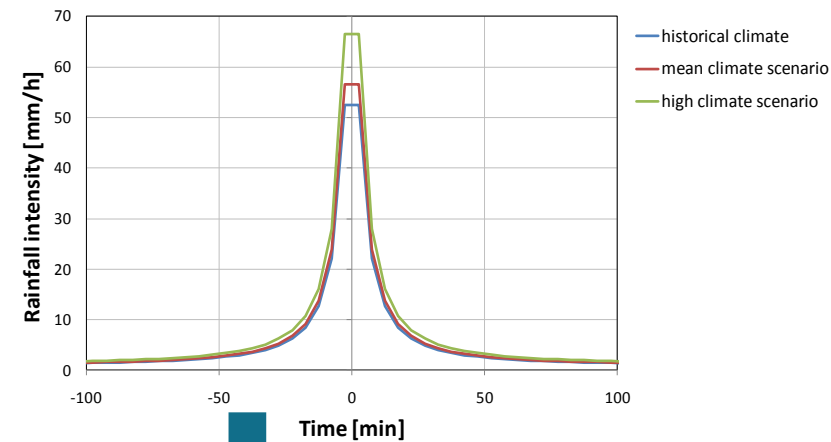
Climatic change signals



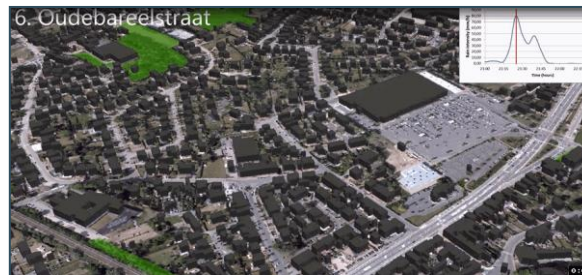
Changes to IDF-statistics:



Changes to design storms:



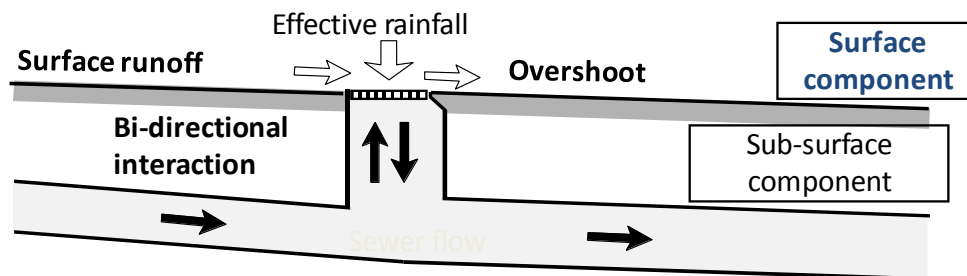
Impact results (e.g. pluvial flooding):



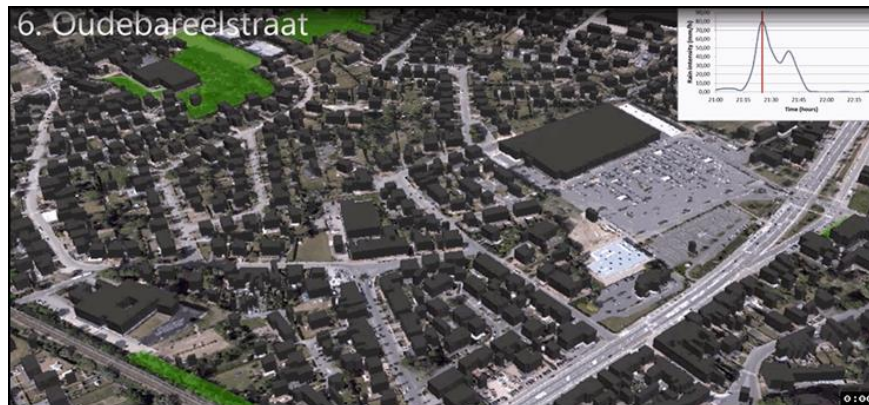
# Climate change tools for impact analysis

## Impact analysis on urban drainage

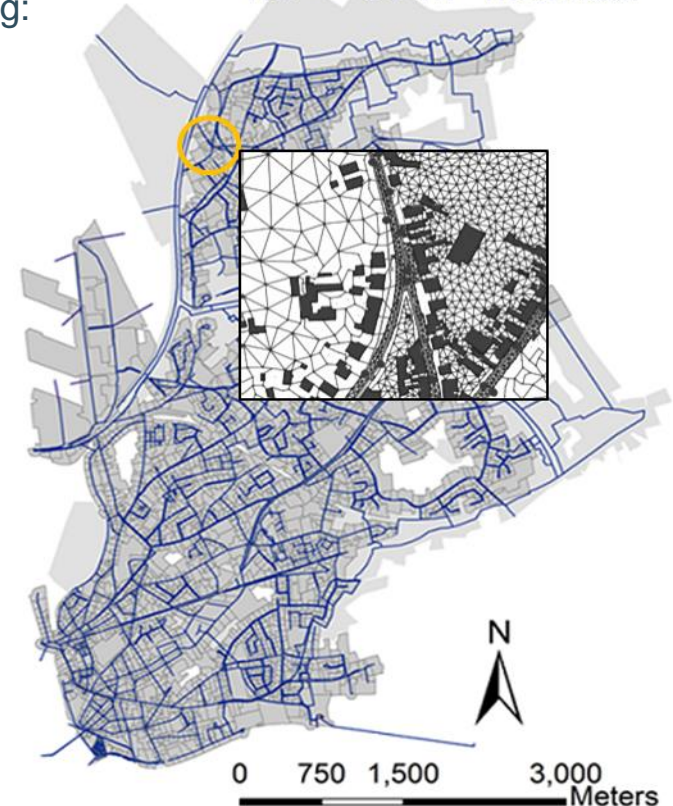
Dual drainage approach incl. 2D surface inundation modelling:



High resolution 1m DEM:



1.5 -> 30 m<sup>2</sup> meshes:

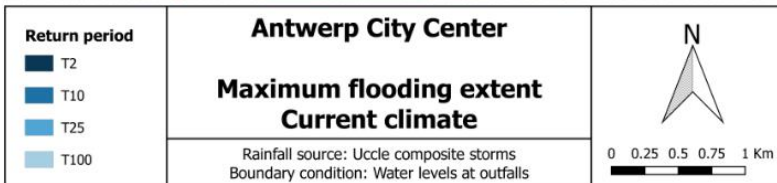
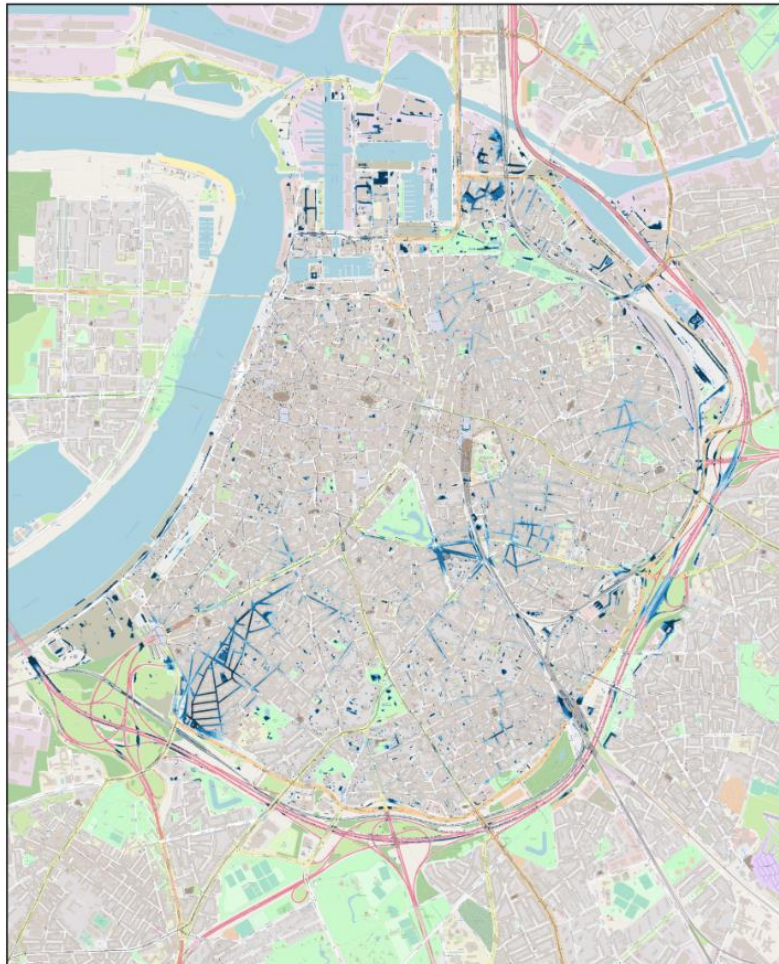




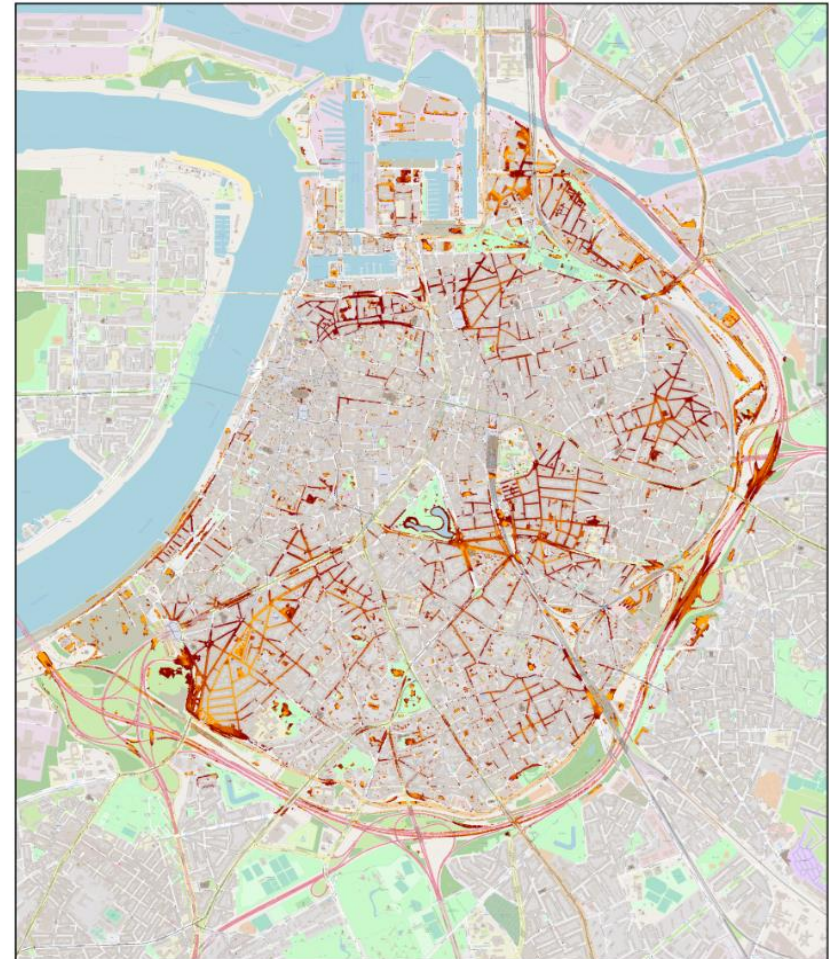
# Climate change impacts

Example: city of Antwerp

Current climate:

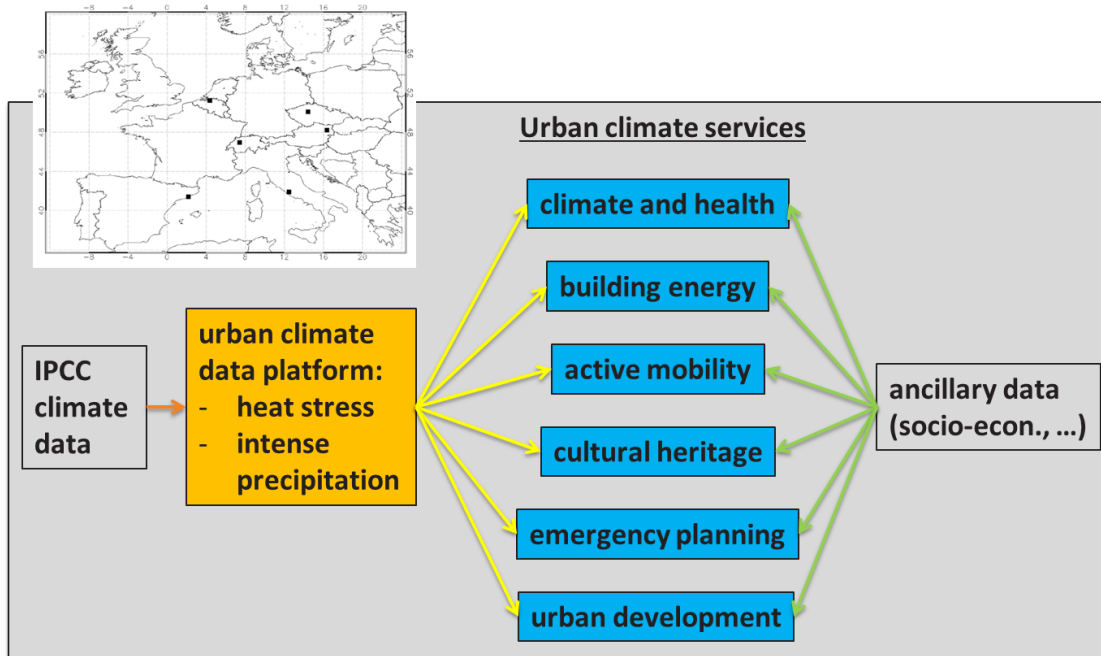


Future climate, high climate 2050 scenario:



# Climate -fit.city

Experience  
the benefits of  
climate services



# Climate adaptation & improving disaster resilience



**BRIDGING THE GAP FOR  
INNOVATIONS IN DISASTER  
RESILIENCE**



HORIZON 2020



**FROM PROTOTYPE TO MARKET READY INNOVATION**  
ADAPTING TO: FLOODS, DROUGHTS & EXTREME WEATHER



**PROTOTYPE**

STOCKTAKING OF INNOVATIONS  
INNOVATOR INCUBATOR



**END USERS**

MARKET READY INNOVATIONS  
LARGE SCALE MARKET UPTAKE

**VALLEY OF DEATH**



# Climate adaptation & improving disaster resilience

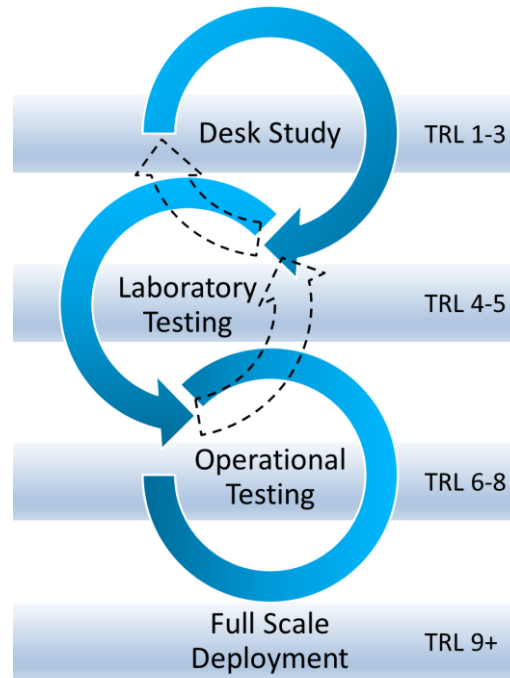


**BRIDGING THE GAP FOR INNOVATIONS IN DISASTER RESILIENCE**



## Testing of innovations:

### Testing Framework



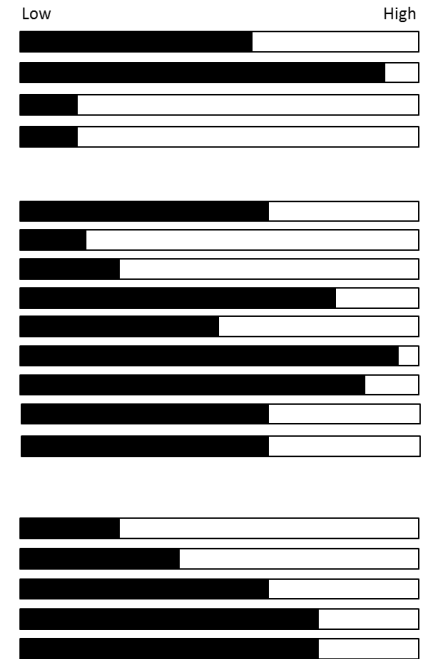
### Technical, Societal & Market Readiness

#### Innovation A

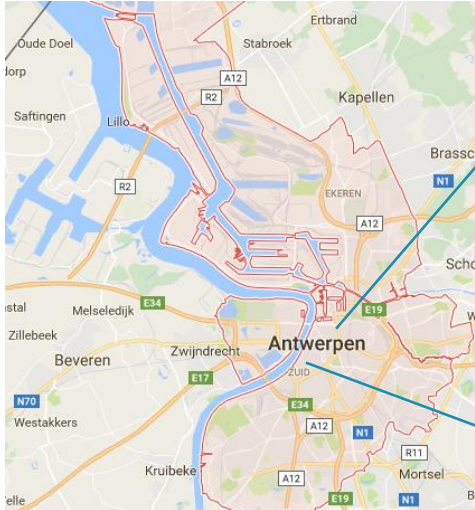
**Technical**  
*Technical Effectiveness*  
*Durability*  
*Reliability*  
*Flexibility*

**Impacts**  
*Sustainable Design*  
*Environmental Impact*  
*Ecological Impact*  
*Agriculture*  
*Energy*  
*Forestry*  
*Health*  
*Infrastructure*  
*Tourism*

**Societal**  
*Psychometric Risk Factors*  
*Inflexibility Indicators*  
*Sociocultural Preferences*  
*User Acceptance Constructs*  
*Responsibility Dimensions*



# Living Lab



**Workshop February '17:**  
How to make our district climate proof?

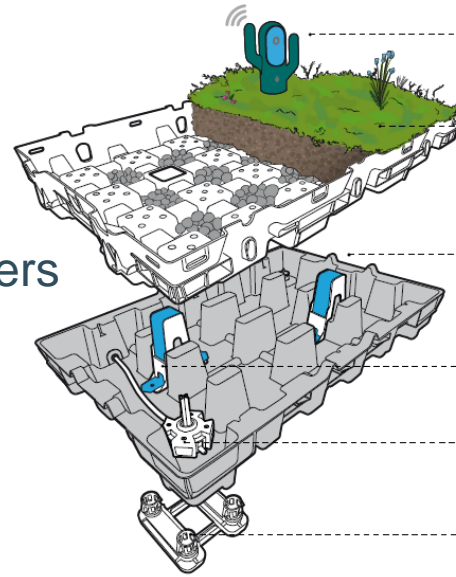




# Smart green roof

## Smart green roof

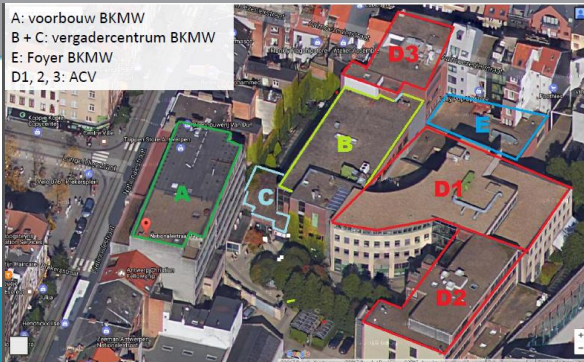
Impact on floods & ecological parameters



Installation ongoing at this moment (Nov. 6-10, 2017):

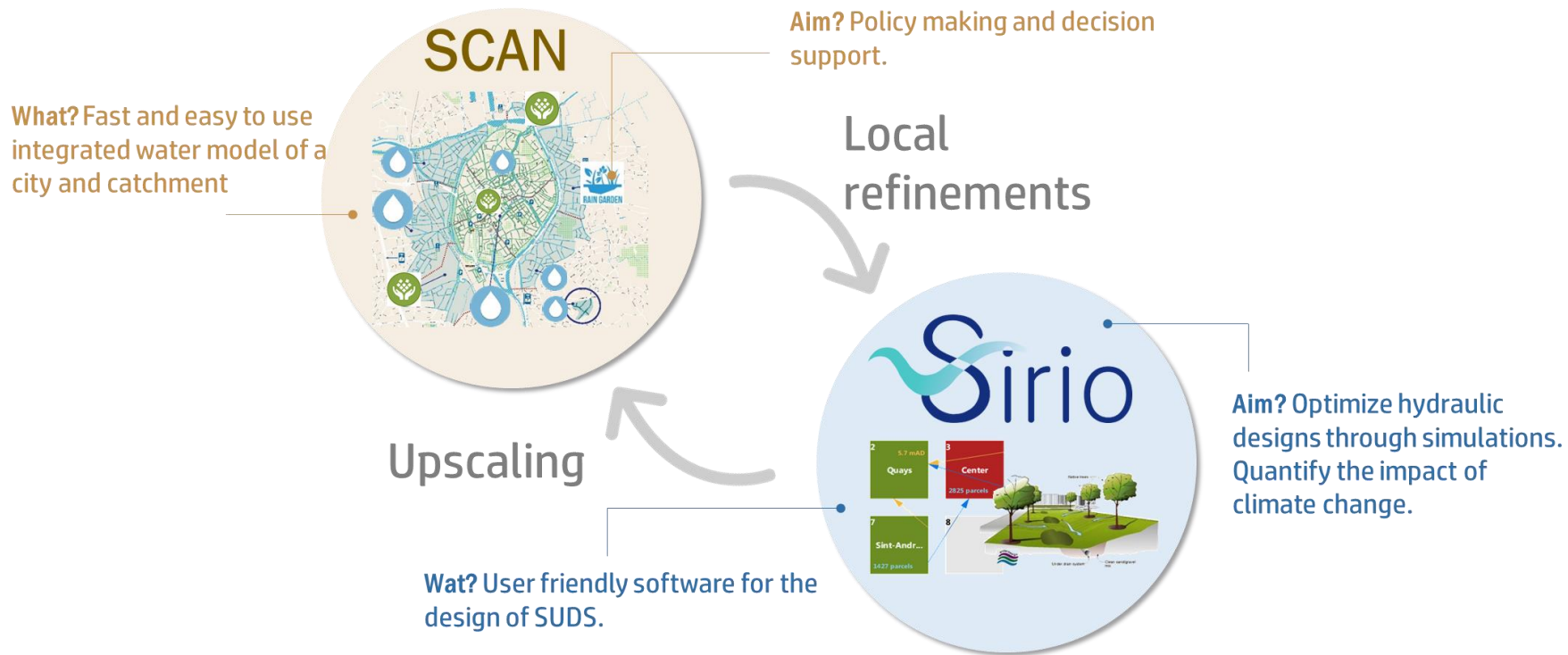


A: voorbouw BKMW  
 B + C: vergadercentrum BKMW  
 E: Foyer BKMW  
 D1, 2, 3: ACV





# Integrated water planning tools

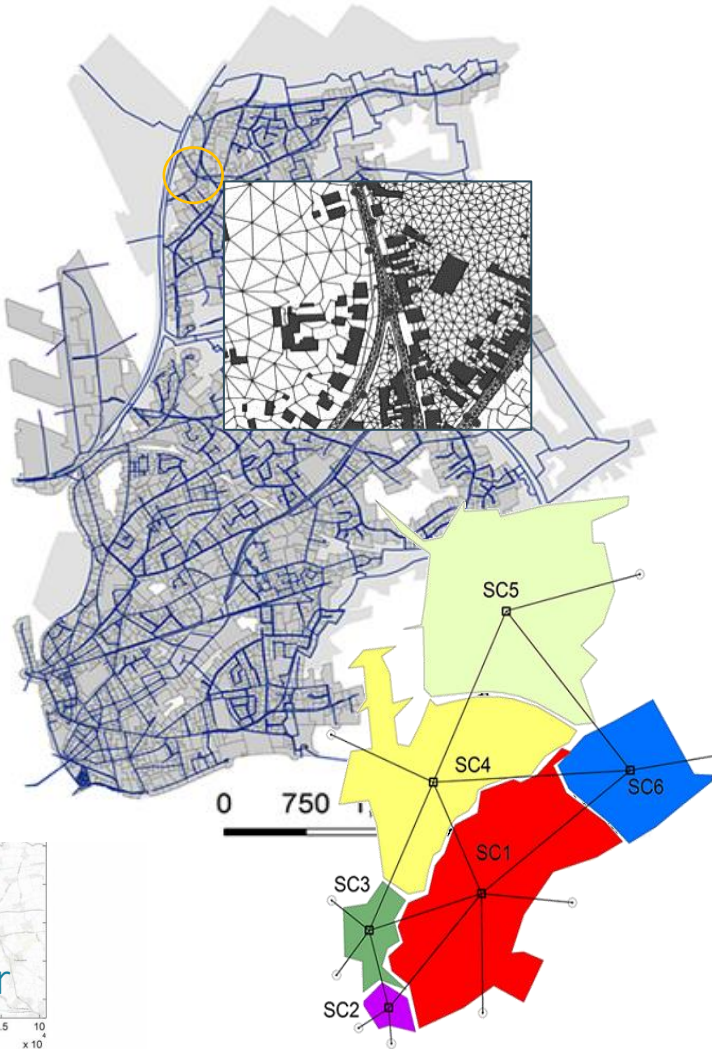
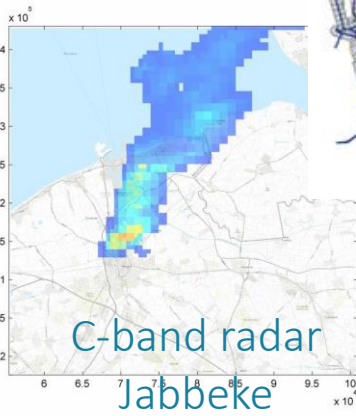
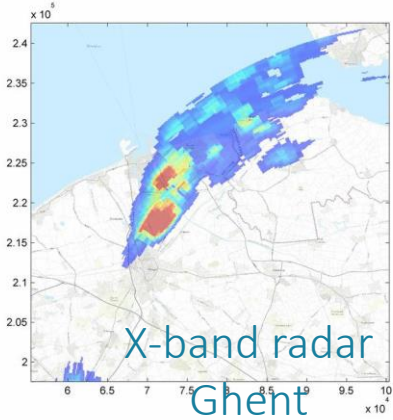
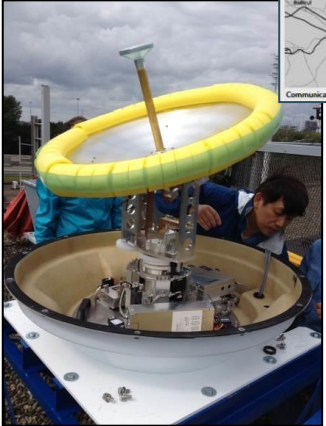
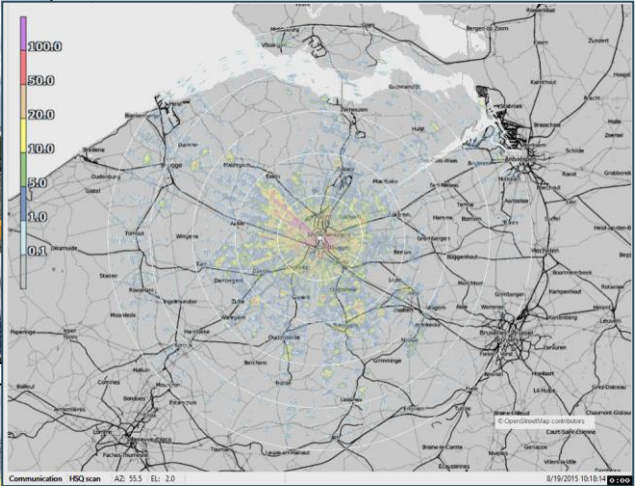
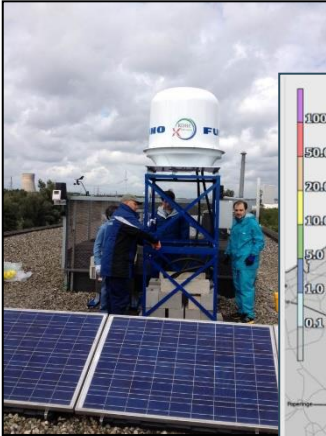


## Designed for cities & industry

- Design SUDS & quantify their effect
- Simulate 100 years in seconds
- See the impact of climate change
- Created with VLARIO & industry

<https://www.sumaqua.be/sirio>

# Forecasting & real-time control





# Other promising innovations??

- ✓ Prototype available (TRL 4-5-6-7-8)
- ✓ (Support for) further testing needed
- ✓ Support on market analysis & business development needed
- ✓ EU support welcomed

Submit your innovation to : [climate-innovation@brigaid.eu](mailto:climate-innovation@brigaid.eu)

More info : <http://brigaid.eu/>



# Climate innovation window

<http://climateinnovationwindow.eu/>



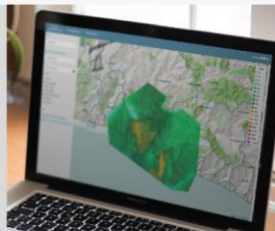
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SHARE AND DISCOVER CLIMATE INNOVATIONS

## INNOVATIONS FOR CLIMATE CHANGE ADAPTATION

the EU-reference marketplace where end-users and innovators can meet

Share your innovation



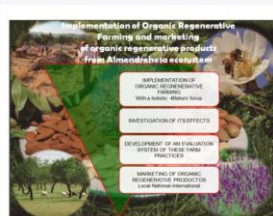
Disasters and ICT

Smart Rainfall System



Nature Based Solutions

Futureproof peat meadow polder



Agriculture

Holistic soil restoration by means of organic regenerative



Agriculture

AquaTag Remote



Water Safety

FLUTSCHUTZ DeichKADE



Water Safety

FLUTSCHUTZ Alignment Protection

# Climate adaptation needs

## Different types of solutions:

- smart technology
- robust infrastructure
- well-thought (multi-functional, creative) use of available space
- behaviour (<- sensitization, self-coping capacity, shared responsibilities )



LAAG 1  
PREVENTIE



LAAG 2  
RUIMTELIJKE ORDENING  
& INRICHTING



LAAG 3  
RAMPENBESTRIJDING

Prevention  
Protection  
Preparedness  
Response

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