

TACTIC, EGU General Assembly 2020, Online 8. May 2020

TACTIC

- Tools for Assessment of Climate change Impact
on Groundwater and Adaptation Strategies

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731166



TACTIC consortium

- Partners:
 - 20 partners
 - 17 countries
- Budget:
 - Total: 1,799,979€
 - Partners: 1,265,385€
 - EU: 534,594€ from EU
- Coordinator:
 - GEUS, Denmark



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Climate change challenges

“...observed climate changes are already having widespread impact on ecosystems, economic sectors and human health and well-being in Europe.” - European Environmental Agency

“More extreme weather conditions are anticipated...and the impact is expected to increase in the future .” - JRC

- Impacts of climate change experienced today
 - Impacts expected to increase in future
 - The cost is immense
- Improved knowledge and tools to assess climate change impact are needed to support EU policy

“Cost of climate change in Europe could reach 4 % of GDP if no policy measures are adopted” – Horizon, the EU research and innovation Magazine

“The Greatest Threat To Global Security: Climate Change Is Not Merely An Environmental Problem” – UN Security Council

TACTIC contribution

- Numerous CC studies already
 - But most ignores the groundwater system
 - Impact on groundwater
 - A freshwater buffering system
 - Can enhance or dampening impacts from extreme weather events and vital for assessment of the CC impacts

TACTIC Vision

Improve **use and access** to data and knowledge acquired by the GSOs of the subsurface system in CC impact assessments and adaptation



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TACTIC impacts

Advance

Advance scientifically sound climate change impact assessments

- Local/national assessments
- Support EU policy on member state actions

Experiences varies among GSOs

Harmonise

Harmonise assessments and results – prerequisite for EU policy-making

- Common approaches
- Cross-comparison

Multiple tools and approaches available

Access

Make data and results available for future assessments and applications

- Assessments by GSOs
- Third parties “on-top” services
- New research and innovation

Data, results and knowledge currently difficult to access



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TACTIC objective and approach

TACTIC will develop an ***infra-structure among European Geological Survey Organisations*** for collaboration to advance and harmonise climate change assessments within the GSOs.

TACTIC Toolbox and guidelines

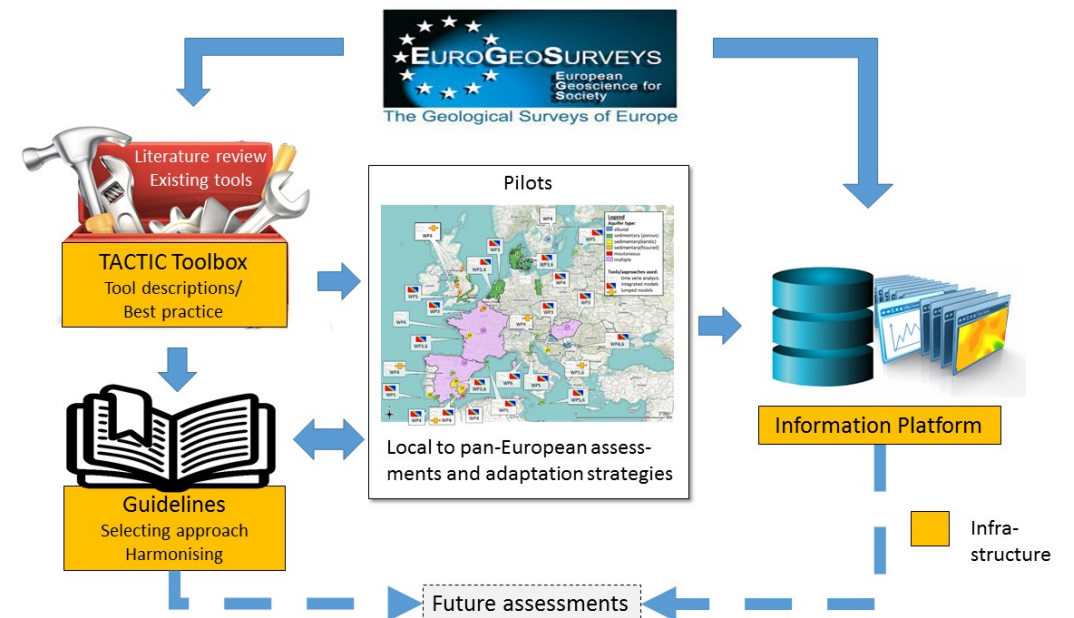
- TACTIC Toolbox
 - Identify usable tools
- Guideline
 - Selecting approach and Harmonising

Pilots

- Demonstrate in pilots (41 pilots)
- Different challenges
- Facilitating knowledge sharing

Interaction with GIP

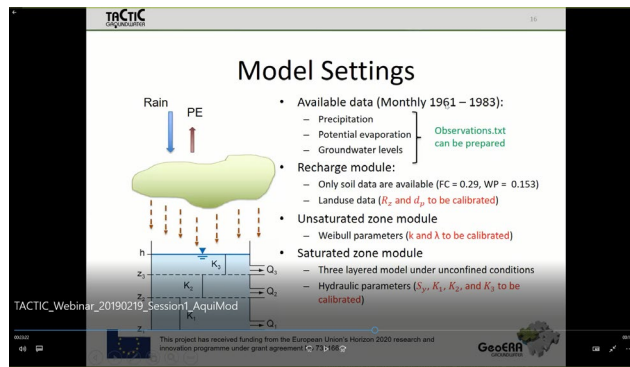
- Collect and harmonise data
- Provide easy access to data and results in GIP



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TACTIC Toolbox

- 53 tools collected
- Selected tools presented at webinars



- Shared among GeoERA partners and external universities/institutions
- A work in progress



Tool overview

TACTIC tool template for assessment of CCA and CCA effects		Functionality	Tool type	Intended users / user friendliness	Scale	User rights and access	Extent of documentation	Relevance for TACTIC	Transferability to other data																				
Partner	Tool name	Impact assessment	Adaptation assessment	Climate projection and base condition	Supporting tool	Physical based integrated CCA tool	Lumped numerical model	Analytical model	Conceptual model	Process based	Index based	Scenario based	Professional (e.g. consultants)	Water managers – CCA – DRR	Stakeholders	Downstream users / external public	Author	Worldwide tool	Priority codes	Open source	Transferability to other data	Extent of documentation	User guide and online	Groundwater dependent floods and droughts	Groundwater surface water interaction	Changes in groundwater recharge	Groundwater depletion	Groundwater storage	Transferability to other data
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Structured overview

- Functionality
- Type
- User
- Scale
- Access
- Documentation
- Relevance TACTIC
- Transferrable

Tool description

TACTIC tool factsheet	AquMod
Description of tool	AquMod is a simple, lumped-catchment groundwater model. It simulates groundwater level time-series at a point by linking simple algorithms of soil drainage, unsaturated zone flow and groundwater flow. It takes time-series of rainfall and potential evapotranspiration as input, and produces a time-series of groundwater level. Hydrographs of flows through the outlets of the groundwater store are also generated, which can potentially be related to river flow measurements.
Required data	Rainfall Potential evaporation Groundwater level time-series
Strength	Fast simulation of groundwater level time-series. User defined time stepping for flexibility. Monte Carlo parameter sampling. Modular structure with multiple process representations. Choice of objective functions to evaluate model efficiency.
Weaknesses	Lumped (not distributed) groundwater model Point calculation Over all representation of catchment characteristics
Examples of uses of	Monthly Hydrological Summary "National Hydrological Monitor" "logical Summary of the UK." "during the preceding" "and National G" "re (NHMP) produces the month" "rt describes the hydrologi" "ta holdings of the Nar" "https://nhs.uk"

Fact sheet

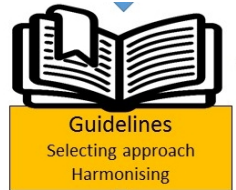
- Brief description
- Required data
- Strengths
- Weaknesses
- Examples
- Links



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TACTIC guidelines



- When to use what, data availability
- How to use/analyse
- What to use for harmonisation
- How to store in GIP

Building on

- Existing guidelines
- TACTIC experiences

Guideline topics

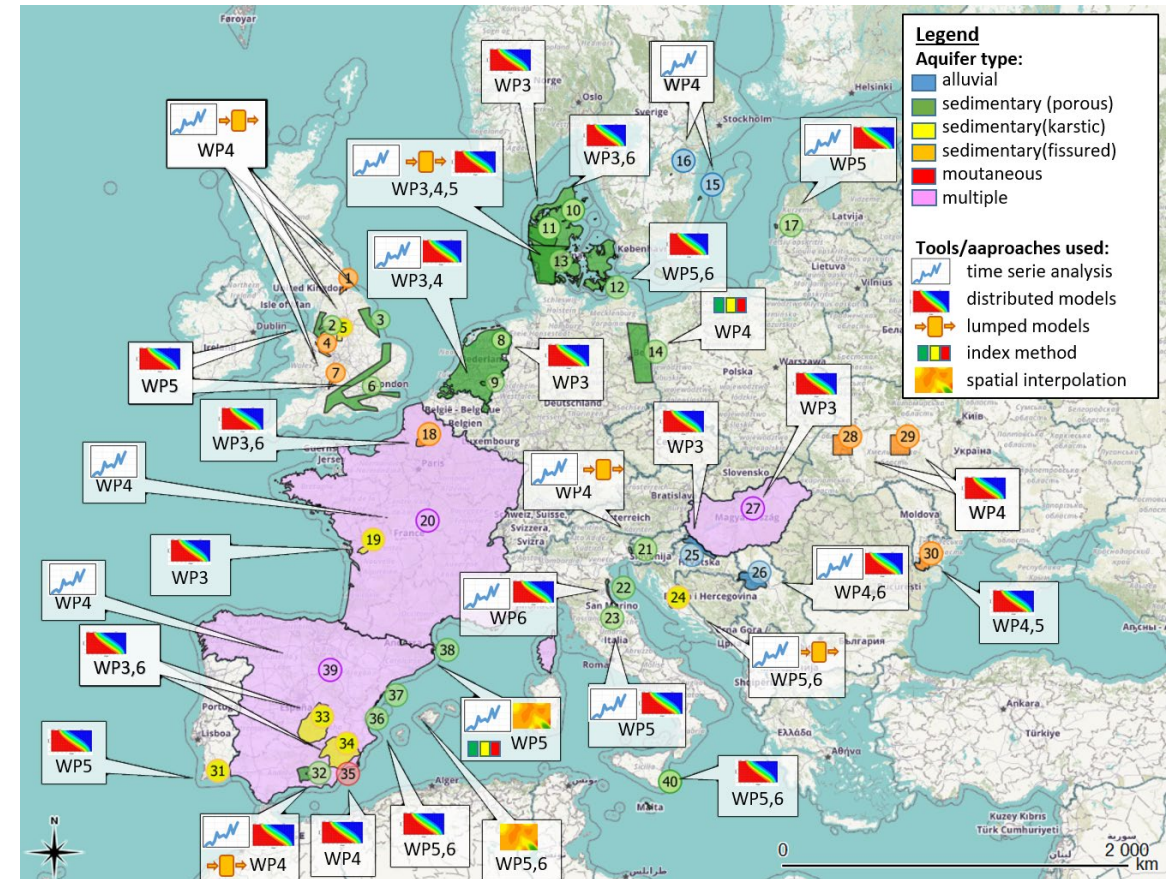
- Assessing surface water – groundwater interaction and change
- Definition of recharge
- Climate change scenarios
- Downscale-bias correct climate data
- Natural background chloride concentrations
- ...
- ...



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TACTIC pilots

- TACTIC partners active in 41 pilots across Europe
 - 7 < 100 km²
 - 23: 100-1000 km²
 - 11 > 10.000 km²
- Assessments
 - Reproduce historical conditions
 - Assess impact of future climate
 - Evaluate adaptation strategies
- Results reported for each pilot



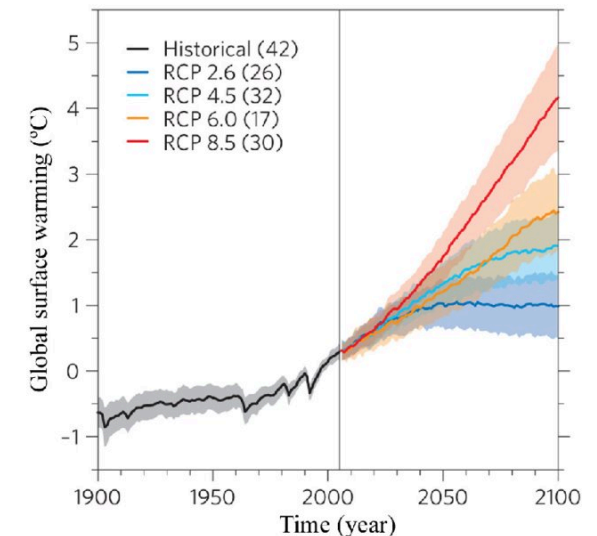
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Climate change scenarios

- Developing common climate change scenarios
 - Reference period
 - Future conditions
 - +1 (+3) degree temp increase from present conditions
 - Metrics and indicators
 - Change in recharge, change in groundwater levels, etc.
- Climate change scenarios from ISIMIP (Inter-Sectoral Impact Model Intercomparison Project)
 - Monthly delta-change values from ensemble of global models
 - Selection of 2nd highest and 2nd lowest precipitation for each pilot

Model ensemble

- 15 models (3 RCP x 15 GCM)
- GCM biascorrected



New Tool

- Calculate local delta change factors
- Calculated for all pilots
- Can be used outside TACTICs



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Climate change assessments

- Assessing impacts on groundwater
 - Propagation by
 - Complex physically based, integrated and fully distributed hydrological models
 - Lumped and conceptual models
 - Statistical models
- Harmonising assessments
 - Multiple tools applied in 13 pilots
 - Common tools in most pilots

Multiple tools

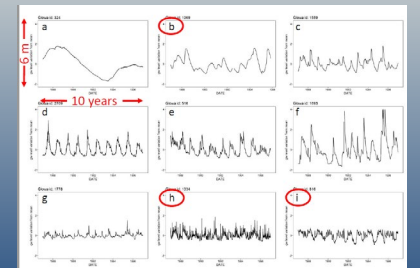
- Partners apply several tools in pilot
- Statistical + Lumped + ?

Statistical tool

- Same statistical tool applied in most pilots

Similarity test/vulnerability

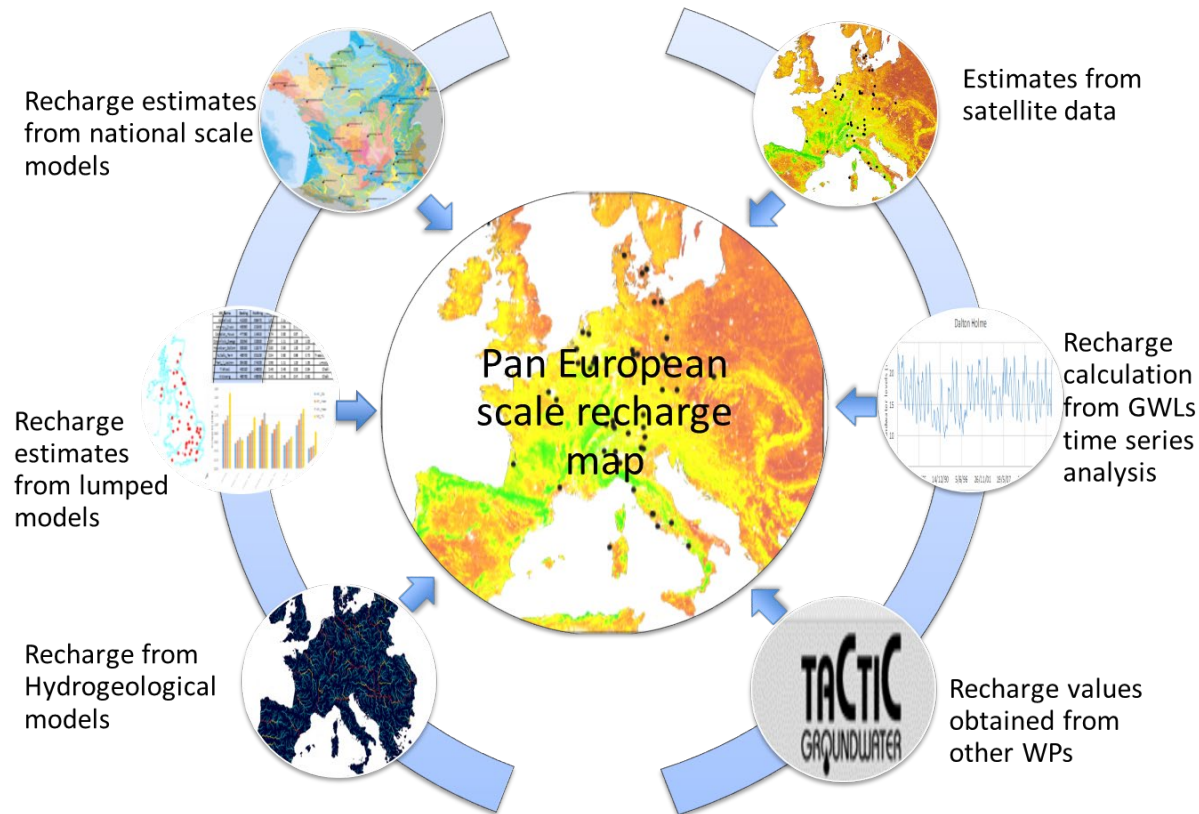
- Collaboration with Gothenburg university
- Tests in selected pilots
- All Pilots?



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European recharge map and satellite data

Combining pilot assessments and satellite data for recharge estimate at EU-scale



Utilising satellite data

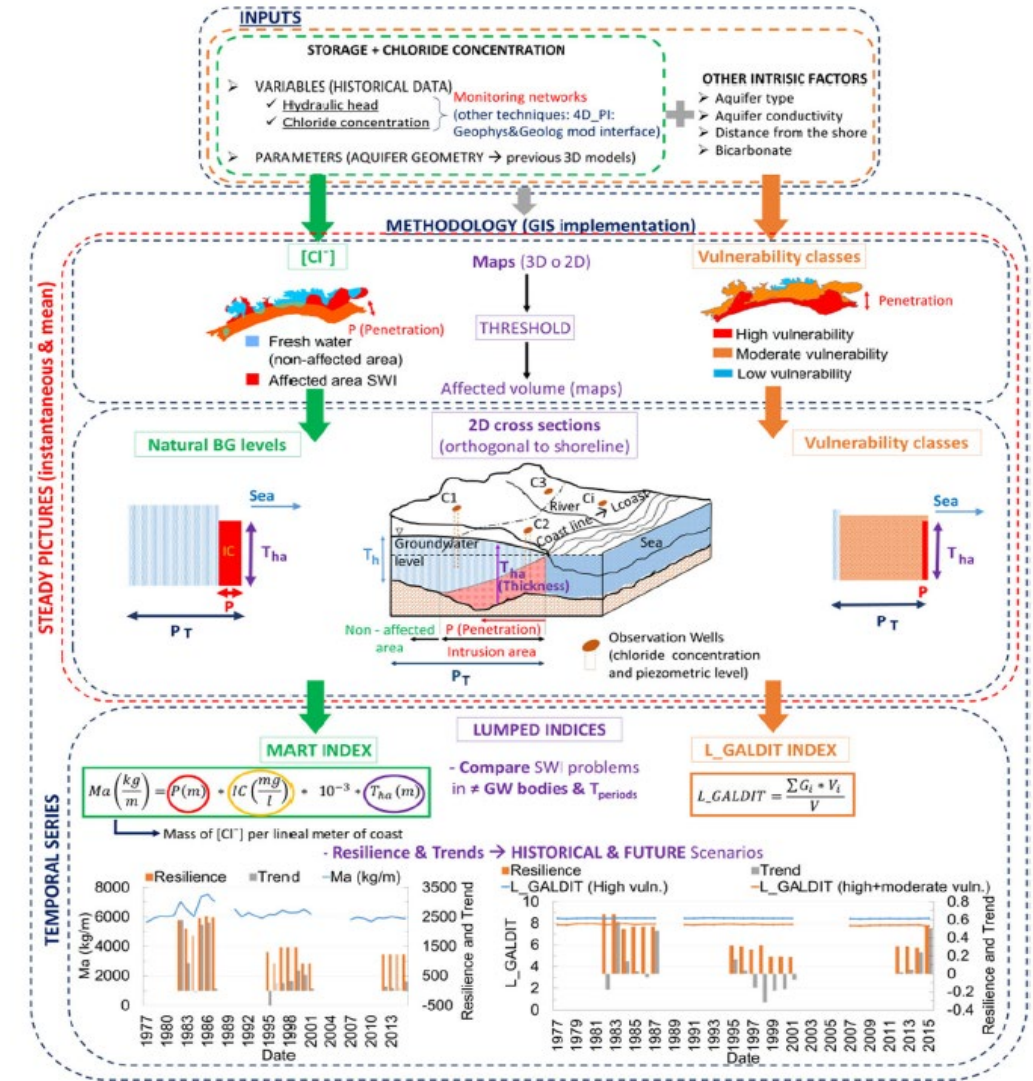
- EU-recharge map
- Subsidence by overexploitation of aquifers
- Estimation of land use
- Calculating lake areas – monitor water budget



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Salt/sea water intrusion

- Index based approach for harmonised assessment of status and vulnerability towards climate change
- Further development for islands
- Identification of natural background concentrations



More info @

<https://geoera.eu/projects/tactic9/>
<https://www.researchgate.net>



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