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Institute for Geoinformatics
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Web-based assessment and decision support technology

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Contents

1) **The BALANCE project**
   - Vulnerabilities to climate change and common modelling framework
   - Online assessment and decision support system: The BALANCE ADSS

2) **Web-based impact and vulnerability assessment using MCE**
   - Quantification of impacts and vulnerability
   - Example use case

3) **Web service architecture and service chaining**
   - Service components
   - Service chaining
   - Conclusion and future work

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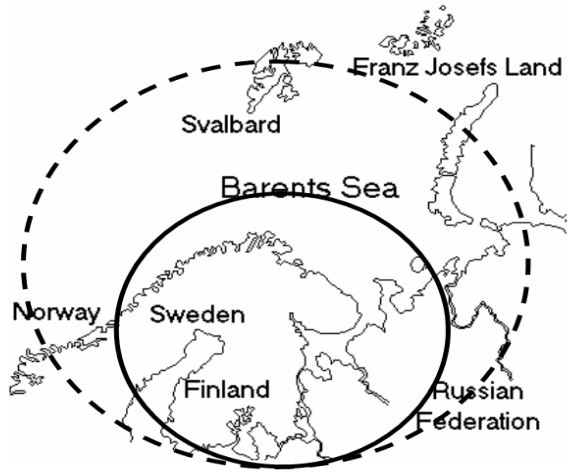
The BALANCE Project

*Global Change Vulnerabilities in the **Ba**rents Sea Region: **L**inking **A**rctic **N**atural Resources, **C**limate Change and **E**conomies (BALANCE)*

EU-Project
12/2002 - 11/2005
15 partners from 6 countries

It aims to assess the vulnerabilities of the Barents Sea system to climate change based on common modelling framework for major environmental and societal components



The BALANCE countries

The BALANCE study area

The BALANCE Project

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The BALANCE study area

Vulnerabilities to climate change and common modelling framework

Sensitivity (S) **is the degree to which a system will respond to a given change**	***(Potential) Impact (PI)*** **is a function of the sensitivity for a certain change and the actual exposure**
Adaptive Capacity (AC) **is the degree to which adjustments can moderate, offset or invert the potential for damage created by a given change**	***Vulnerability (V)*** **combines the sensitivity of a system with systems' adaptive capacity**

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Vulnerabilities to climate change and **common modelling framework**

Spatial Data and Service Infrastructure (SDI)
for data dissemination
and distribution

Online Assessment and Decision Support System (ADSS)

Goal
Online system to raise awareness among stakeholders in the arctic

Toolbox
For flexible quantification and combination of factors

User groups
Sectoral interest groups and policy makers
International scientists
interested laymen

- Flexibility -
- Quantification -
- Combination -

Service infrastructure
information management and geoprocessing services

Stakeholder interviews
Sensitivities,
adaptation and mitigation strategies

Potential impact and vulnerability maps
from sensitivities
and adaptive capacities

Areas of interest

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UNIVERSITY OF LAPLAND
LAPIN YLIOPISTO

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   - Quantification of impacts and vulnerability using multi-criteria evaluation
   - Example use case: Summer warming

3) Service architecture and service chaining
   - Service architecture
   - Service chaining
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Quantification of impacts and vulnerability using multi-criteria evaluation

Sensitivities and adaptive capacities: reindeer herding

Sensitivities

- Icing up of ground and snow in winter
- Rising summer mean temperature (°C)
- Temperature instability during calving period

Adaptive capacities (AC)

- Availability of forest in general
- And of old forest (>120 yrs) in particular

- Difficult to interpret for a user
- Not comparable
- Not combinable

Quantification of impacts and vulnerability using mce methodology

Attribute normalization and additive weighting

Potential Impact (PI) maps

- Attribute normalization (using threshold values)
- PI combination using simple additive weighting

Vulnerability maps

- Potential Impact (PI) – Adaptive Capacity (AC) = Vulnerability (V)

Example use case: Summer warming

Reindeer suffer from too much heat in the summer. The herd will start migrating. Forests are entered by reindeer to cool down.

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Service components I

OGC Web Coverage Server (WCS) for data access

- Time-variant and time-invariant information

OGC Web Map Server (WMS) for data portrayal

- Tightly coupled and loosely coupled

(Thin) Web Mapping Client

- WMS access
- Description (descriptionURL)
- Time-variant requests
- Save and load OGC context documents (“settings”)

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Service components II

Web Map Algebra Service (WMAS)

- Offers algebraic operations on Grid Coverages
- Data sources: WCS, as well as any other online resource

Statistics Calculation Service (WPS)

- Offers statistics calculations on Grid Coverages
- Data sources: WCS, as well as any other online resource

(Thick) ADSS Client

- service chaining, display and user interaction
- request statistics calculation service, interpret and display result
- generate request for WMAS

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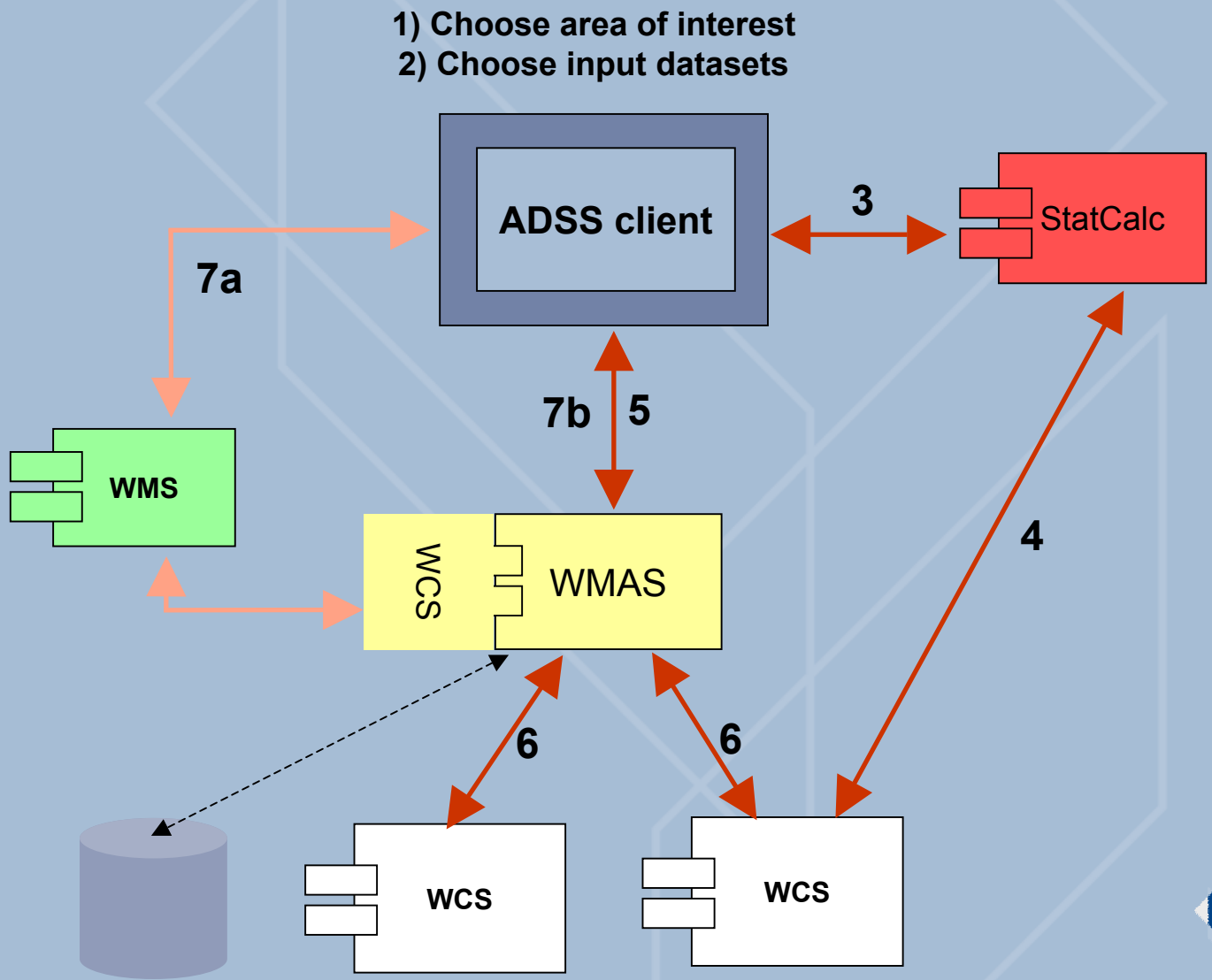
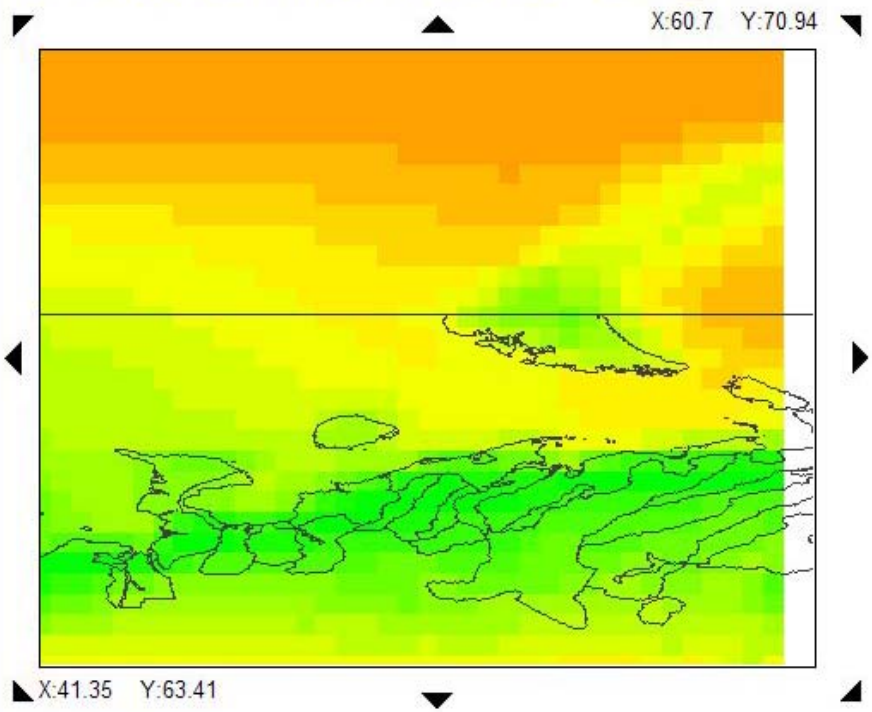
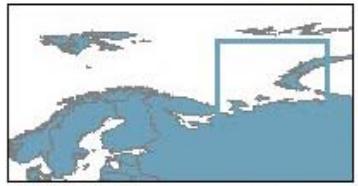
Service chaining



BALANCE

Map Viewer





Layer | Legend | Time | Abstract

possible impact (PI) of July mean temperature change

- [x] City
- [x] Town
- [x] Settlement
- [x] Reindeer herding communities
- [ ] possible impact 2010
- [ ] possible impact 2002
- [ ] possible impact 2020
- [ ] possible impact 2030
- [ ] possible impact 2040
- [ ] possible impact 2050
- [ ] possible impact 2060
- [ ] possible impact 2070
- [ ] possible impact 2080
- [x] possible impact 2090

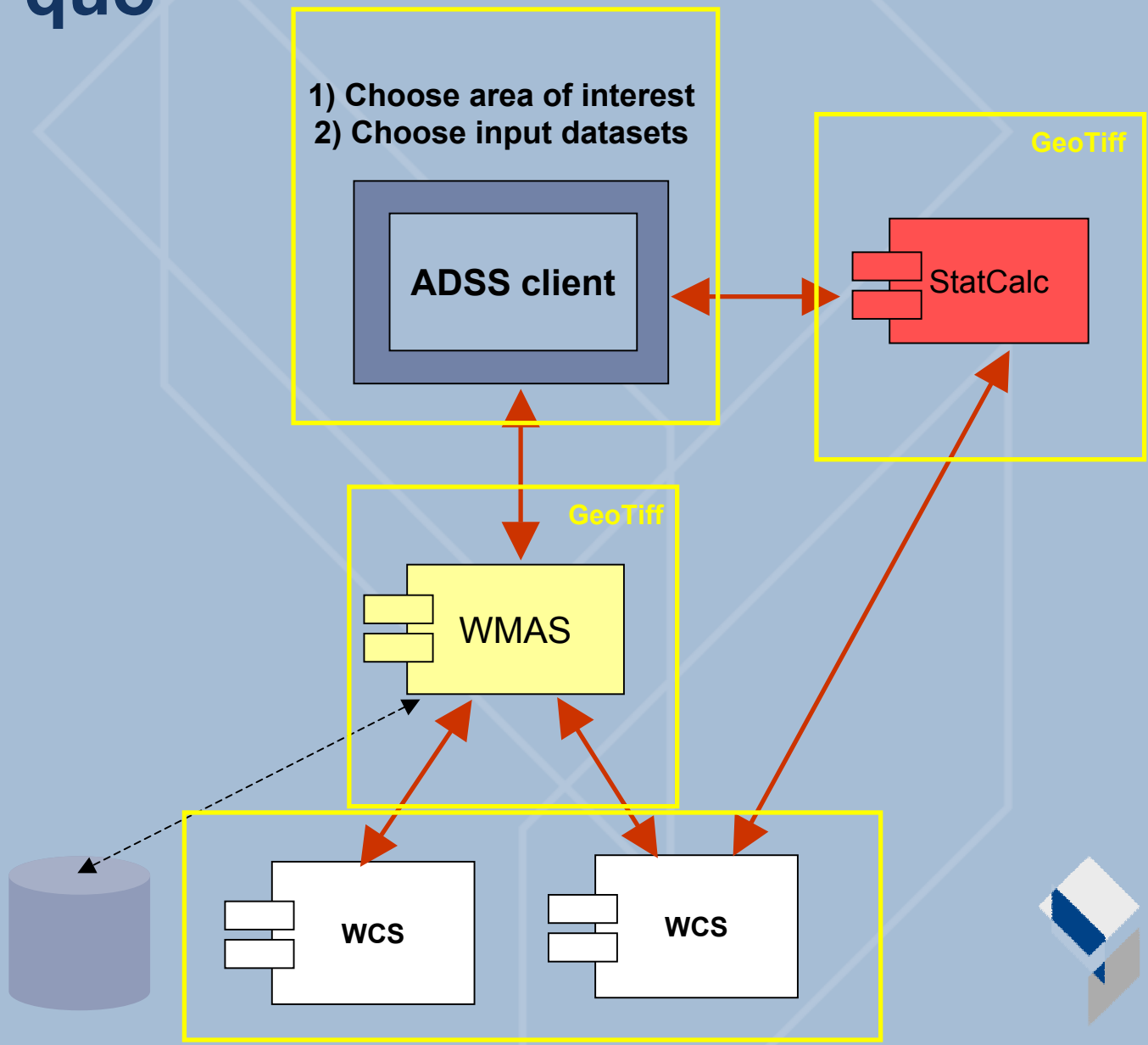
Apply

Potential impact due to the change of the mean July temperature

What does the map show?

You see how the change in summer temperature might impact your profession. Red means high impact and green means low or no impact. We considered a monthly mean temperature of 18 degreee celsius as optimal, while everything above 22 degree celsius is too hot and everything below 18 is considered as increasingly negative (please don't forget: the mean also includes the night temperature, so it is lower than the daily temperature you experience).

Status quo


1) Choose area of interest
2) Choose input datasets
ADSS client
GeoTiff
StatCalc
GeoTiff
WMAS
WCS
WCS

Conclusions and future work

Benefits

- Repeatable and transparent process description
- Concept can be transferred to other use cases
- Simple processing possible that helps to gain information (NDVI, Uom conversion)

Challenges

- Processing times and data volume
- Semantics (e.g. Metadata about scales)
- Usability
- ..

Conclusions and future work

Future work

- Visualisation of geoprocessing results
- Toolbox creation: Client will hold a number of tools (blueprints for requests)
- Service Chaining Experiment using BPEL4WS
- User feedback

Thank you very much
for your attention