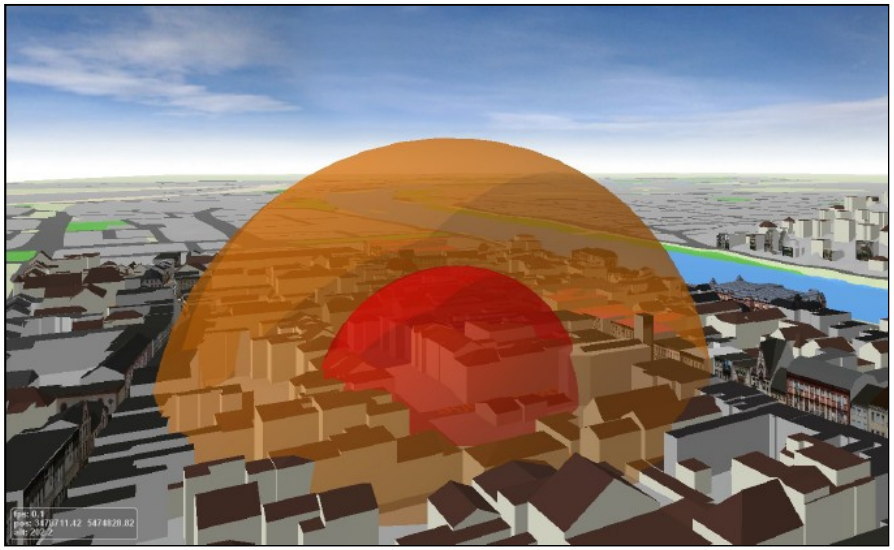
TOWARDS ANALYSIS AND PROCESSING IN SDI 2.0

USING OGC-WPS FOR RESEARCH IN GEOGRAPHY & CARTOGRAPHY



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universitätbonn Geographie

Outline

Deegree based Web Processing Service

1) Introduction
2) **Generic WPS-client**
3) **WPS categories**
   a) Basic
   b) Raster
   c) Complex
   d) 3D
4) **WPS for environmental research**
5) Summary

Web Processing Service – Basics

Supply of geospatial functions employed for: Processing, conversion and analyzing.

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Applied to

→2D or 3D source data.

→Different input data types e.g. GML, Geo-TIFF and more.

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Applied to

→2D or 3D source data.

→Different input data types e.g. GML, Geo-TIFF and more.

Presented by

→Several processes, affiliated to different projects based on a deegree [9] WPS.

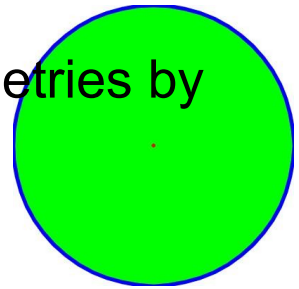
→A selection of those is available via the following generic WPS-client: www.opengeoprocessing.org

Fig. 3: www.opengeoprocessing.org [10]

Web Processing Services – WPS profiles

1) Basic processes

Specialized for handling vector data e.g. buffering of GML geometries by *Buffer*, or joining of points inside polygons by spatial predicate “contains” in *PointInPolygonJoins*.



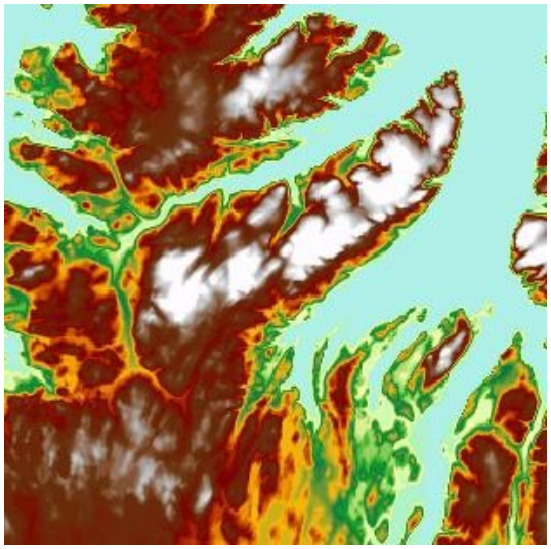
Web Processing Services – WPS profiles

1) Basic processes

Specialized for handling vector data e.g. buffering of GML geometries by *Buffer*, or joining of points inside polygons by spatial predicate “contains” in *PointInPolygonJoins*.

1) Raster based processes

Aspect or *Slope* estimation of a GeoTIFF based on a DEM, or estimation of the annual direct solar radiation via *SolarRadiation*.



Input GeoTIFF DEM

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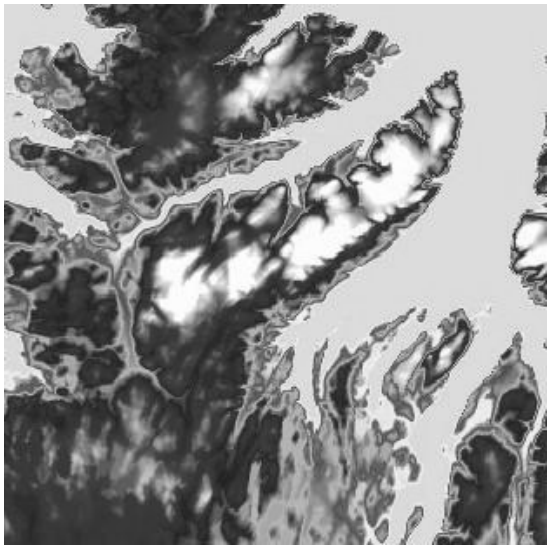
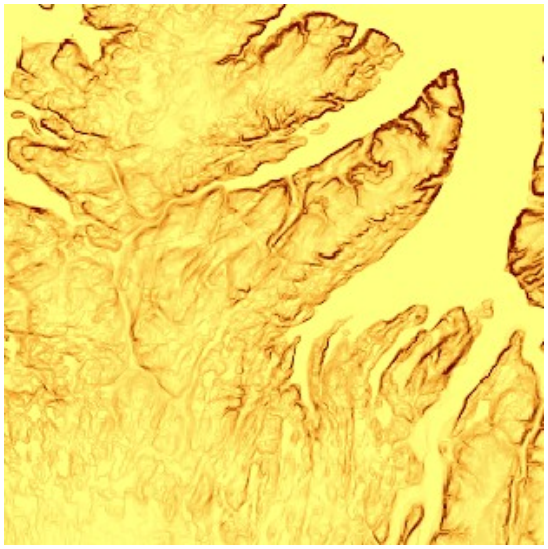


Input GeoTIFF DEM

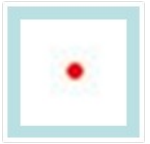


Output GeoTIFF Slope

Web Processing Services – WPS profiles

1) Complex processes

Project-specific services e.g. the consecutively chaining of a point buffering and point in polygon join by *ChainBufferPointInPoly*.



Web Processing Services – WPS profiles

1) Complex processes

Project-specific services e.g. the consecutively chaining of a point buffering and point in polygon join by *ChainBufferPointInPoly*.

1) 3D processes

ToxicGasScenario3D is calculating a 3 dimensional sphere, on the basis of a gas leakage location (Please Note no modelling is done here: *Windspeed [m/s] + Winddirection queried from a wheather server = form of emission cloud*).

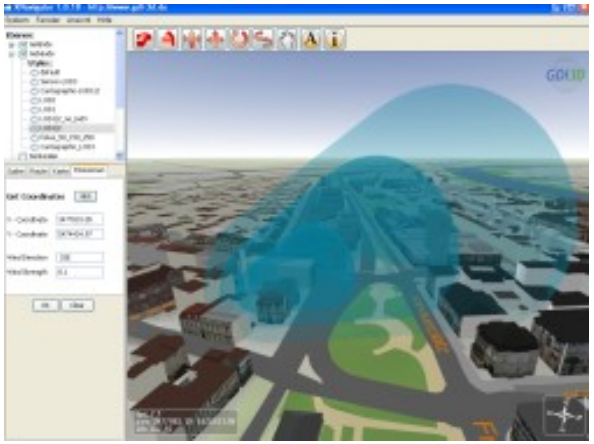


Fig. 5: Visualization of a toxic gas scenario in 3D.

Web Processing Services – WPS profiles

1) Complex processes

Project-specific services e.g. the consecutively chaining of a point buffering and point in polygon join by *ChainBufferPointInPoly*.

1) 3D processes

Bomb-ThreatScenario3D similarly computes a 3 dimensional sphere as process result.

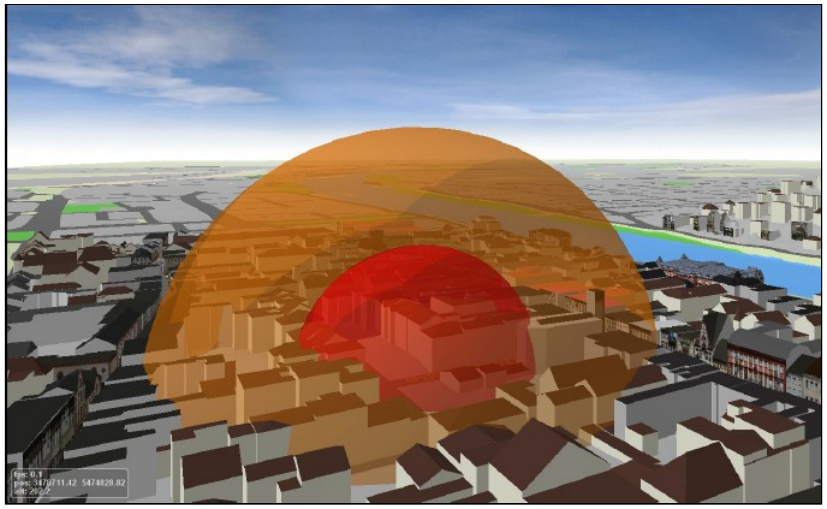


Fig. 4: Visualization of the bomb threat scenario in 3D. [2]

WPS client – Example processing

Fig. 3: www.opengeoprocessing.org [10]

Welcome to OpenGeoProcessing.org at Research Group Cartography

The Research Group Cartography at the University of Bonn has set up a deegree2 based *Web Processing Serive* (WPS) including several generic and complex processes. Furthermore a generic WPS-client has been developed following beneath.

WPS-client

URL to WPS: http://services.giub.uni-bonn.de/deegree/all

GetCapabilities

Cartography Research Group

Here is a list of available processing services supported by selected WPS.

Listing of available WPS Processes:

Get WPS XML file containing it's capabilities.

DescribeProcess

Process Identifier **Aggregation**

Title Aggregation

Abstract Aggregation of GML data. Available aggregate functions: count, sum, max and min.

Process Identifier **Aspect**

Title Aspect

Abstract An aspect estimation based on a digital elevation model is processed. The process is an implementation of Horn's (1981) algorithm, which is also used by GRASS and

Home WPS-client

Information

Example Input Data

Available WPS processes

Contact

Research Group Cartography

Cartography Research Group

Here is a list of available processing services supported by selected WPS.

Listing of available WPS Processes:

Get WPS XML file containing it's capabilities.

DescribeProcess

Process Identifier **GML2WMS**

Title GML2WMS

Abstract Creation of a jpg-Image of GML data. The process is sending the GML data as an InlineFeature to a Web Map Service (WMS). The WMS is creating a map (jpg-file) from the data.

Process Identifier **GeometryMetrics**

Title Geometry Metrics

Abstract Calculates basic metrics of Features depending on the FeatureType. If the Input

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Detailed process description of selected process

WPS Process listing

http://localhost:8080/deegreeWPS/all?SERVICE=WPS&REQUEST=DescribeProcess&Version=0.4.0&Identifier=GML2WMS

Input	Identifier	GMLReferenceAsString
	Title	GMLReferenceAsString
	Abstract	Reference to GML as String.
	Datatype	LiteralData - Type: urn:ogc:def:dataType:OGC:1.0:String
	Value	

Select Output(s):

Output	Identifier	Map
	Title	Map of GML data
	Abstract	Map of the GML data in jpg-format.
	Datatype	ComplexData - Default Schema: jpg

Store process result(s) at a web-accesible resource?

Execute

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Raster Processes

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Aspect

An aspect estimation based on a digital elevation model is processed. The process is an implementation of Horn's (1981) algorithm, which is also used by GRASS and ESRI ArcGIS.

Input Parameter	Example Value
InputGrid	http://karto.giub.uni-bonn.de:8080/testdata/dem_peninsulas.tiff

GML2WMS

Creation of a jpg-Image of GML by sending the GML to a WMS as InlineFeature.

Input Parameter	Example Value
Input Feature	http://karto.giub.uni-bonn.de:8080/testdata/schools.gml.xml

RouteProfile

Detailed process description of selected process

WPS Process listing

http://localhost:8080/deegreeWPS/all?SERVICE=WPS&REQUEST=DescribeProcess&Version=0.4.0&Identifier=GML2WMS

Input	Identifier	GMLReferenceAsString
	Title	GMLReferenceAsString
	Abstract	Reference to GML as String.
	Datatype	LiteralData - Type: urn:ogc:def:dataType:OGC:1.0:String
	Value	http://karto.giub.uni-bonn.de:8080/testdata/schools.gml.xml

http://karto.giub.uni-bonn.de:8080/testdata/schools.gml.xml

Select Output(s):

Output	Identifier	Map	☑
	Title	Map of GML data	
	Abstract	Map of the GML data in jpg-format.	
	Datatype	ComplexData - Default Schema: jpg	

Store process result(s) at a web-accesible resource? ☑

Execute

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Detailed process description of selected process

Executed Process

Request: request1243355475.xml

Response: response1243355475.xml

Output Identifier Map

Title Map of GML data

Abstract Map of the GML data in jpg-format.

Datatype ComplexData - Schema:

Result http://localhost:8080/wps_results/GML2WMS_results/1243355474656map.jpg

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Detailed process description of selected process

Executed Process

Request: request1243355475.xml

Response: response1243355475.xml

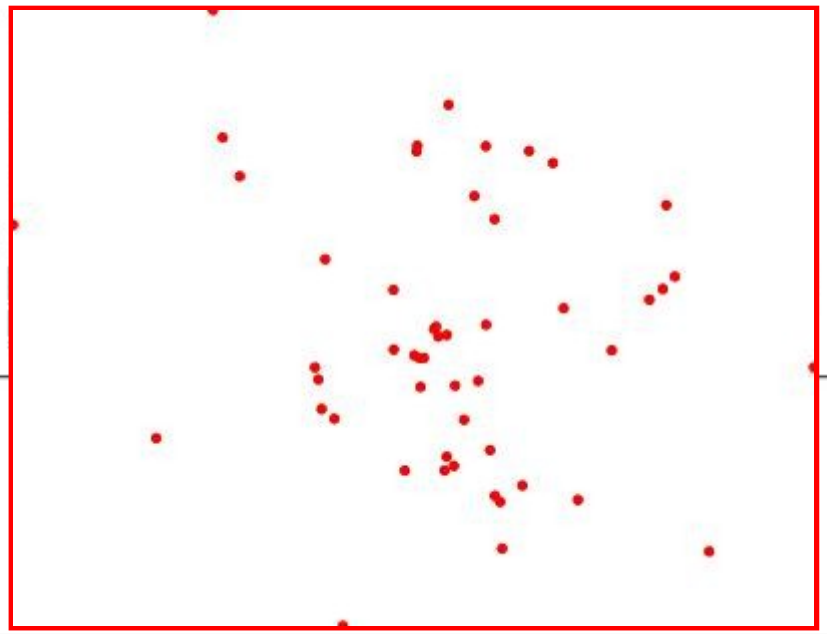
Output Identifier

Title

Abstract

Datatype

Result



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Web Processing Services – Outlook

Outlook

Environmental modeling is a very common methodology in geo-sciences. Because of more accurate sensors and also increasing available computing power, the goal is:

- Integrate atmospheric models into an OGC based SDI-infrastructure.

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Environmental modeling is a very common methodology in geo-sciences. Because of more accurate sensors and also increasing available computing power, the goal is:

- Integrate atmospheric models into an OGC based SDI-infrastructure.

→We consider this approach as the next logical step towards “Web Processing 2.0”.

Web Processing Services – Practical

What are the benefits?

- WPS allows coupling of different OWS services.
- WEB GIS is evolving.
- Complex web based processing operations in the field of Geoinformation science.

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WPS in the Future?

- Process Profiling will be necessary (actually we offer 20 processes).
- Raster-processing will be made by the new OGC standard: *WebCoverageProcessingService* (WCPS-24.03.2009)

Web Processing Services – Summary

Summary

•The OGC WPS specification enables the application of a broad range of Geo-processing functionalities.

→Curious? Try www.OpenGeoProcessing.org ☺

Acknowledgements

We thank all current and former colleagues from our research group for their input towards the results presented here.

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Thank you for your attention.

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Questions?

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References

[1] OGC (2007): Web Processing Service. OpenGIS Std., Doc. Ref. Nr. 05-007r7, V. 1.0.0.

[2] Walenciak, G., Stollberg, B., Neubauer, S. and Zipf, A. (2009): Extending Spatial Data Infrastructures 3D by Geoprocessing Functionality --3D Simulations in Disaster Management and environmental Research. GEOWS 2009. Cancun. Mexico. BEST PAPER AWARD.

[6] Mayer, C., Stollberg, B. and Zipf, A. (2009): Providing near Real-time Traffic Information within Spatial Data Infrastructures. The International Conference on Advanced Geographic Information Systems & Web Services (GEOWS 2009). Cancun. Mexico.

[9] lat/lon GmbH: deegree, Internet: http://deegree.org, last access: 22.03.2009.

[10] www.opengeoprocessing.org

[13] Göbel, R. and Zipf, A. (2008): How to define 3D Geoprocessing Operations for the OGC WPS. (WPS)? Towards a Classification of 3D Operations. CompGeo 2008. ICCSA 2008. Perugia. Italy.

Appendix

Generic WPS client – Live Demo

Fig. 3: www.opengeoprocessing.org [10] **[Live Demo of WPS-client]**

OpenRouteService - TMC Service

- Live traffic information available for North Rhine-Westphalia and Bavaria
- Traffic Message Channel (TMC) service data shown in figure one. Integrated as WPS, which delivers dynamic sensor data by OGC SOS.

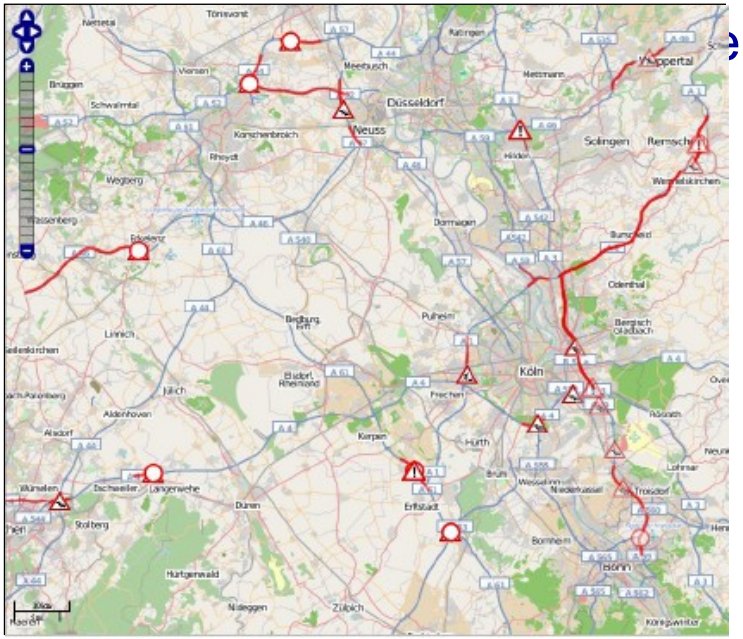

Fig. 1: Traffic Message Channel displayed in OpenRouteService [6]

Web Processing Services – GRID-WPS

GRID based WPS

Within the project *GDI-GRID* (www.gdi-grid.de) several similar WPS processes are distributed in a computing grid in order to speed up the processing time. This includes the processing of Digital Elevation Models (DEM) and in the future the calculation of evacuation simulations [13].

→After the grid-enablement of the individual components it is possible to send a request from a client to a WPS. The WPS instance will accomplish an authorization and execute the request by accessing the Grid infrastructure = Use Case `Flood Modeling´.

[14] Lanig, S., Schilling, A., Stollberg, B., Zipf, A. (2008): Towards Standards-based Processing of DEM for Grid Computing through WPS. ICCSA 2008. Perugia. Italy.