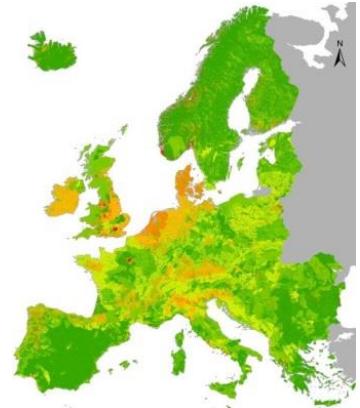
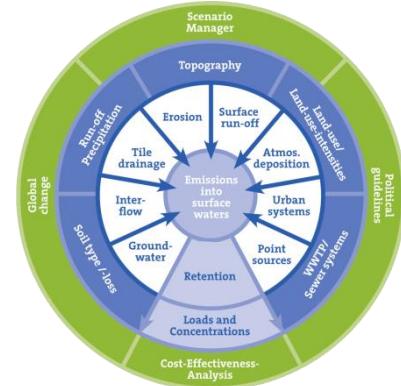


Modelling of nutrient fluxes in the Hampshire Avon catchment with MONERIS

Elena Wenz

Student Research Colloquium, Eberswalde, 23.04.2015



Context

Joint research project between IGB Berlin and BGS (England):

- Leibniz Institute for Freshwater Ecology & Inland Fisheries (www.igb-berlin.de)
- British Geological Survey (<http://www.bgs.ac.uk/>)

Purpose:

- **Modelling of nitrogen and phosphorus fluxes in the Hampshire Avon catchment using MONERIS**
- (Model comparison of three different models (MONERIS, INCA, Feflow))

Short Introduction

Why model nitrogen and phosphorus fluxes in rivers?

- Eutrophication = harmful effects on river ecosystems
- Europe: about 56% of rivers in moderate / poor conditions
- Research needed to improve management



Source: Wikipedia
Commons [1]



The IGB logo consists of the letters "IGB" in a bold, white, sans-serif font, set against a green rectangular background. Below this is a blue wavy horizontal bar.

Research
for the future
of our freshwaters

Some basic terms

Sub-catchments (AUs)

N & P Emissions /
Input
minus retention

nutrient load

tributaries

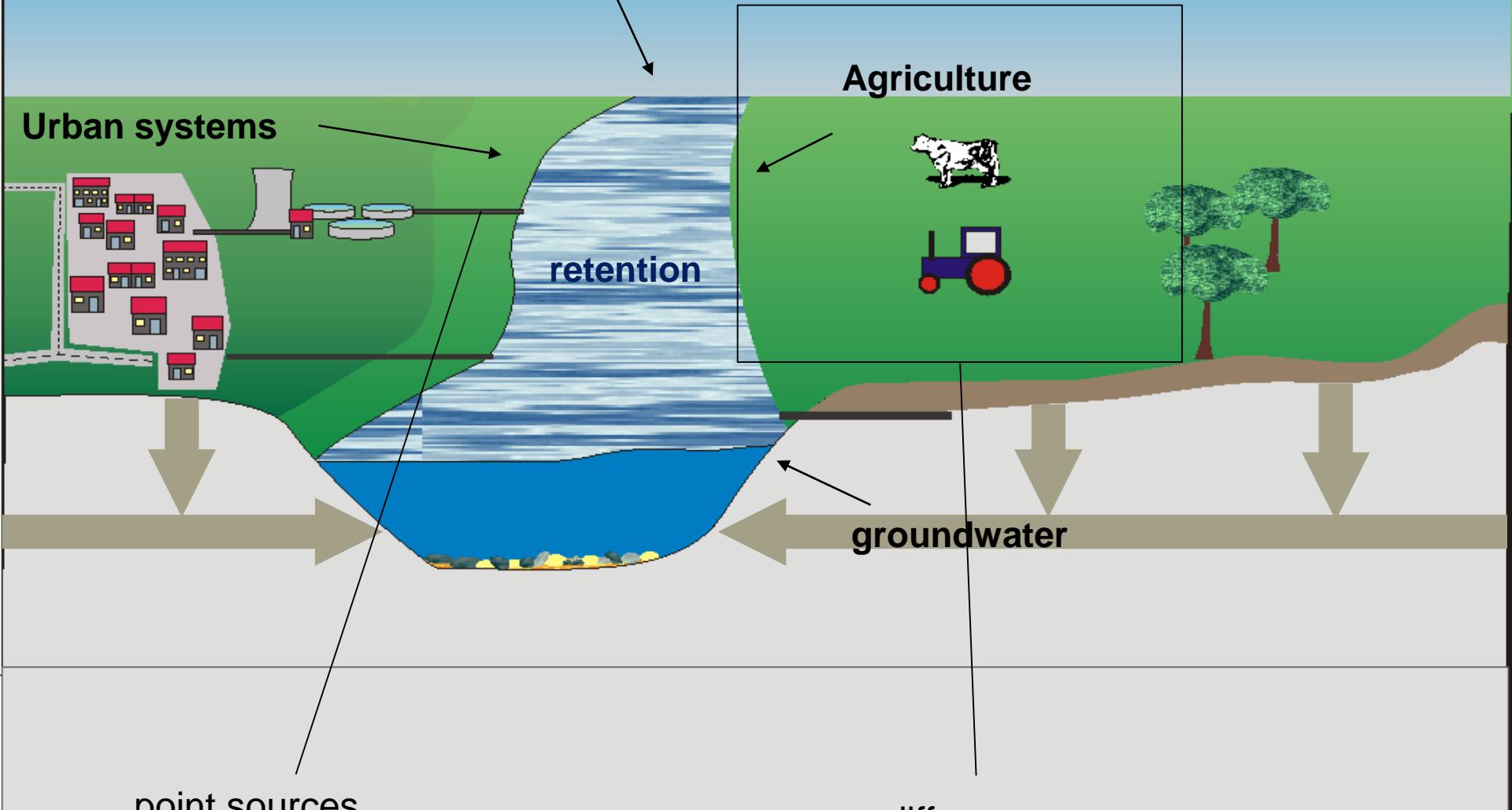
main river

river catchment

Source: modified after Venohr et al. [2]

Atmospheric deposition

N & P emissions to
the river



point sources

diffuse sources

Source: modified after Venohr et al. [2]

MONERIS :

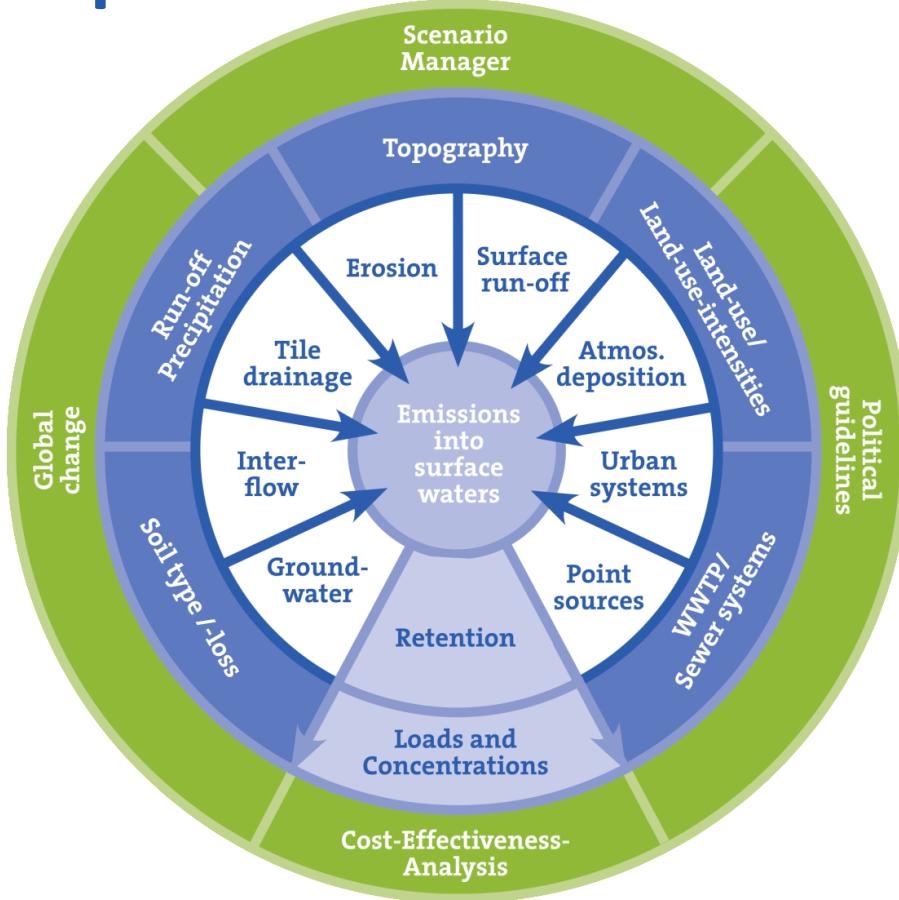
MOdelling Nutrient Emissions in RIver Systems

- Fully documented & published
- open software product



Website: model description, methods, projects
<http://www.moneris.igb-berlin.de>

Model Concept



External framework

Catchment characteristics

Pathways

Surface waters

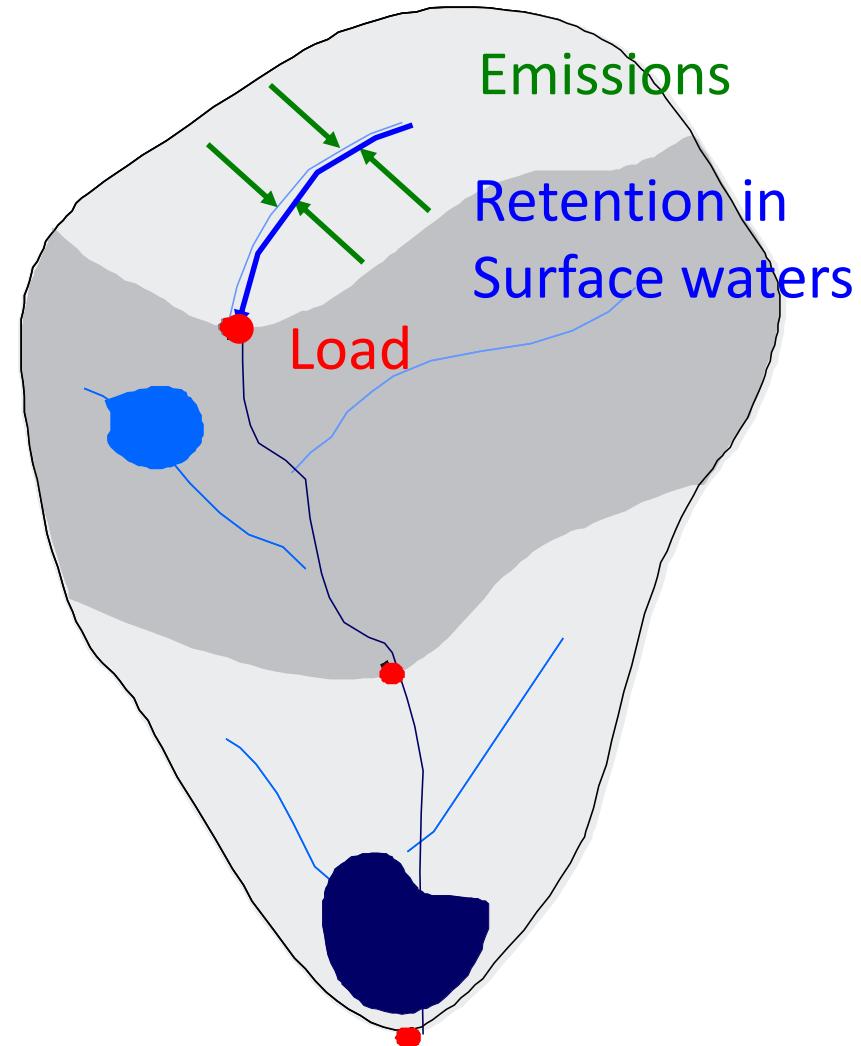
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Model concept

Purpose:

Calculate on a monthly & annual basis:

- emissions from different pathways for each analytical unit
- resulting loads in surface waters
- (scenarios, e.g. on effects of climate change and different management options)

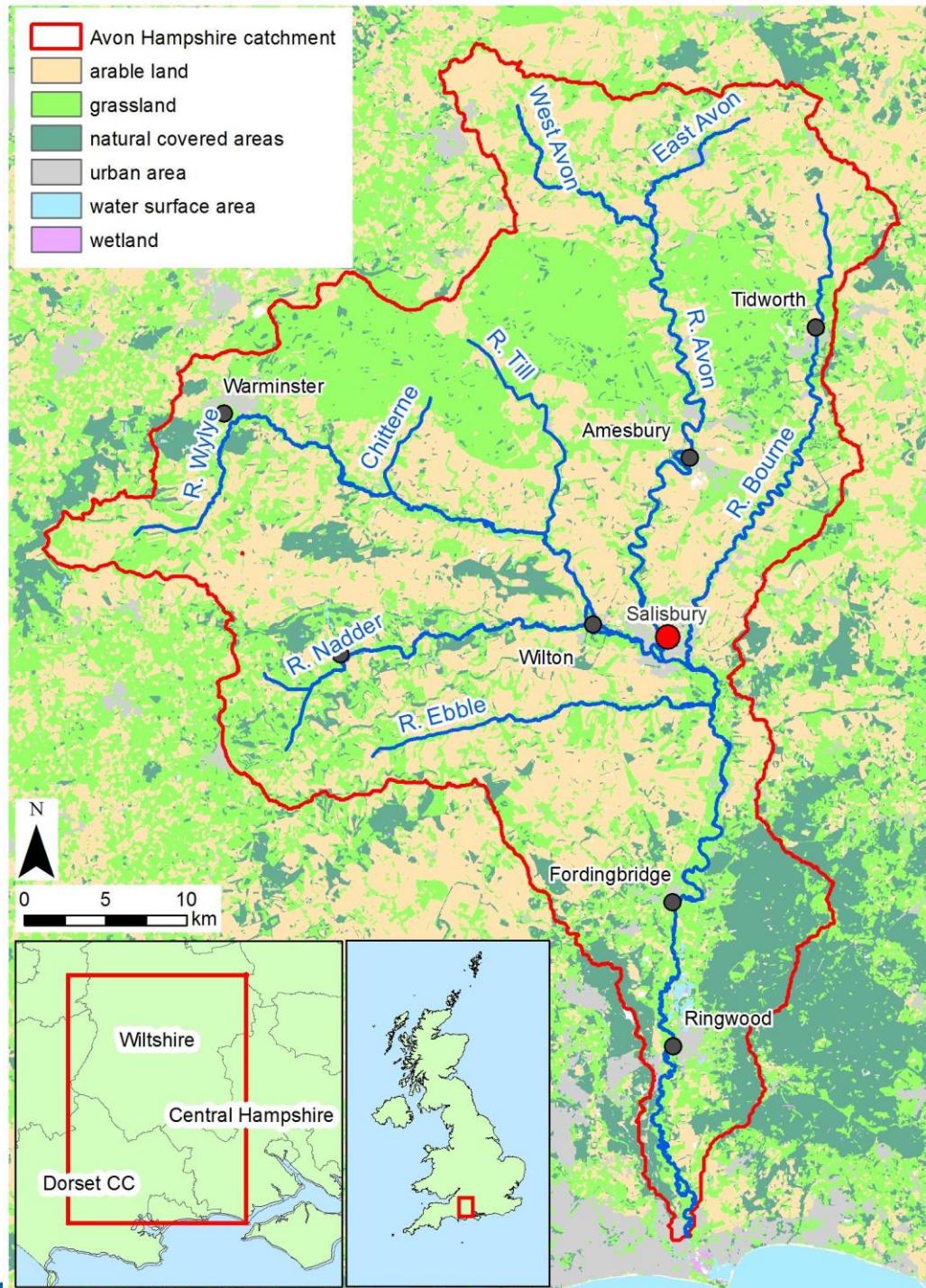


Hampshire Avon Modelling

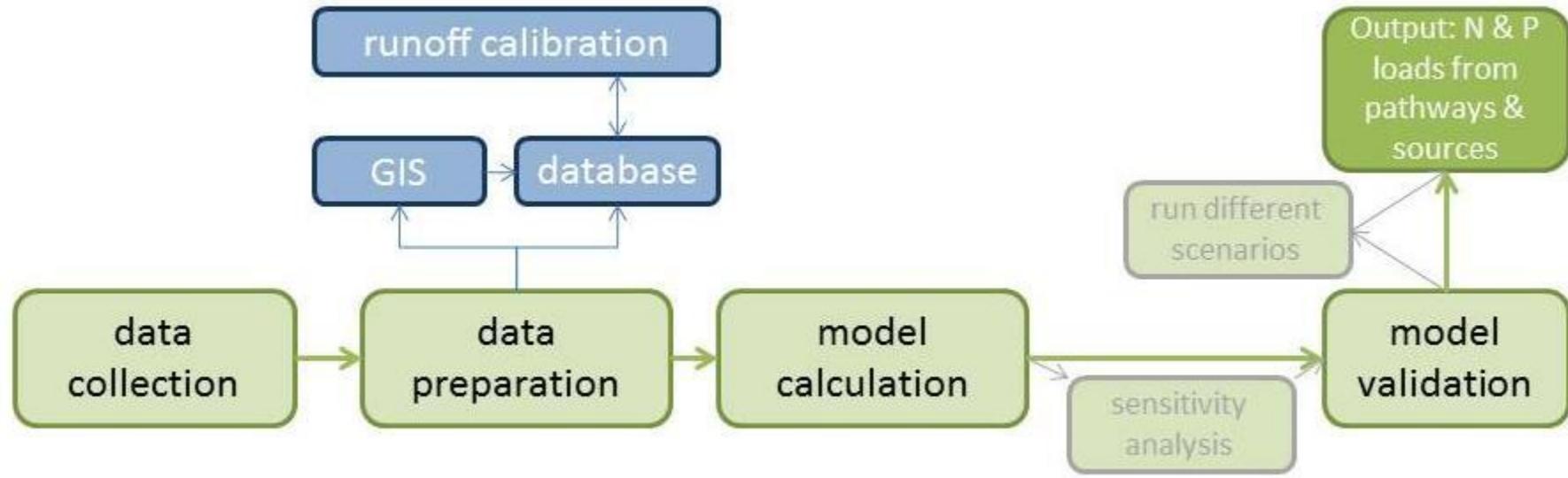
River Avon

Hampshire Avon catchment,
South-West England

2000 - 2010



Workflow



data collection



internet research on available data

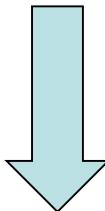
literature research

mails, mails, mails

data processing

GIS

assembling the database



river flow

population numbers

River course

soil data

Catchment
boundaries

soil erosion

time series data

global radiation

landcover

Atmospheric N & P
deposition

sewage data

Research
for the future
of our freshwaters

Model input data



Workflow

DATEI START EXTERNE DATEN DATENBANKTOOLS FELDER TABELLE

Ausschneiden Einfügen Kopieren Format übertragen Filtern Aufsteigend Auswahl Erweitert Absteigend Sortierung entfernen Filter ein/aus Alle aktualisieren Neu Summen Speichern Rechtschreibung Löschen Weitere Optionen Suchen ac Ersetzen Gehe zu Markieren Suchen

Benutzerdef...

Suchen... SubCatchment Administrative TimeSeries TimeSeriesValue SurfaceWaterStat...

ID	GisID	ScenarioID	Date_	Value_	TimeSeriesID
1165700	1	1	01.01.2000	1096,5108	140
1158188	1	1	01.01.2000	1096,5108	140
1164388	1	1	01.01.2000	930,096	129
1143957	1	1	01.01.2000	930,096	129
1164348	1	1	01.01.2000	898,615380434	123
1143677	1	1	01.01.2000	898,615380434	123
1165740	1	1	01.01.2000	654,9268	141
1158628	1	1	01.01.2000	654,9268	141
1164468	1	1	01.01.2000	100	136
1144717	1	1	01.01.2000	100	136
1164428	1	1	01.01.2000	37	135
		1	01.01.2000	37	135
		1	01.01.2000	30,6813	183
		1	01.01.2000	30,6813	183
		1	01.01.2000	1,95	172
		1	01.01.2000	1,95	172
		1	01.01.2000	1	149
		1	01.01.2000	1	147
		1	01.01.2000	1	147
		1	01.01.2000	1	149
		1	01.01.2000	0,5	189
		1	01.01.2000	0,5	189
		1	01.01.2000	0,2	173
		1	01.01.2000	0,2	173
		1	01.01.2000	0,115	169

Kein Filter Suchen

Monitoring... WasteWate... Hydrogeol... Hydrology CoordinationArea RiverBasinDistrict DischargeP... SurfaceWaterStat...

SubCatchment Analyt Uncor Uncor ConRc NConc PConc

Administrative CoordinationArea Country RiverBasinDistrict State TimeSeries TimeSeriesValue SurfaceWaterStat...

Hydrogeol... Hydrology Analyt Precip Precip Evapo

Soil SoilLoss SurfaceWater AnalyticalU...

Analyt Sandy CFactr Arable Arable Arable

Urban Arable Arable Arable Arable

Sandy Loamy Fen

Scenario ObjectID Name

Country GisID Name

State GisID Name Description

Soil Analyt Sandy Loamy Fen

SoilLoss Analyt CFactr Arable Arable Arable

SurfaceWater Analyt AreaM AreaTr AreaD AreaSl

AnalyticalU... ID Type Montl AtmoElev SlopeGisID ToMoi SplitN Count StateID

TimeSeriesValue ID TimeSeriesID GisID ScenarioID Date_ Value_

TimeSeries ID Name Frequency FrequencyFactr Unit

Workflow

The image displays a complex geospatial workflow environment with multiple windows open, illustrating a multi-step data processing and analysis process.

Top Right: A screenshot of a desktop environment showing a sunset over water. Overlaid on the bottom right is a small window titled "summerPrec.py" containing Python code for ArcGIS:

```
# precipitation_annualSum.py - H:\1_Moneris\avon\Geodaten\tbx\Skripts\BGS
File Edit Format Run Options Windows Help
# script.py
# Created on: 2015-03-04 16:48:29.00000
# (generated by ArcGIS ModelBuilder)
Usage: script <foldername> <Name> <Monat>
Description:
#
# Import arcpy module
import arcpy, os.path
from arcpy import env

def getyear(rastername):
    return int(rastername[1:5])

# Check out any necessary licenses
arcpy.CheckOutExtension("spatial")

# Script arguments
foldername = os.path.abspath(arcpy.GetParameterAsText(0))
out_folder = arcpy.GetParameterAsText(1)
if out_folder == "":
    out_folder = foldername
else:
    out_folder = os.path.abspath(out_folder)

env.workspace = foldername
rasterlist = arcpy.ListRasters("*") # alle Raster in Liste
lists = () # speichert die Rasternamen nach Jahr
for raster in rasterlist:
    try:
        if True:
            y = getyear(raster)
            if y not in lists:
                lists.append(y)
            else:
                print raster + " ist kein passendes Raster."
    except:
        print raster + " ist kein passendes Raster." # alle Raster in foldername als Liste
lists = () # speichert die Rasternamen nach Jahr
for raster in rasterlist:
    try:
        if True:
            y = getyear(raster)
            m = getmonth(raster, y)
            if y not in lists:
                lists[y] = []
            lists[y].append(raster)
    except:
        print raster + " ist kein passendes Raster." # Local variables
trial = "C:\Users\wenzl\avon\Geodaten\raster\precipitation\BGS\trial"
Ausgabewerte = "C:\Users\wenzl\avon\Geodaten\raster\precipitation\BGS\trial\summer"
sumer = "C:\Users\wenzl\avon\Geodaten\raster\precipitation\BGS\summer"

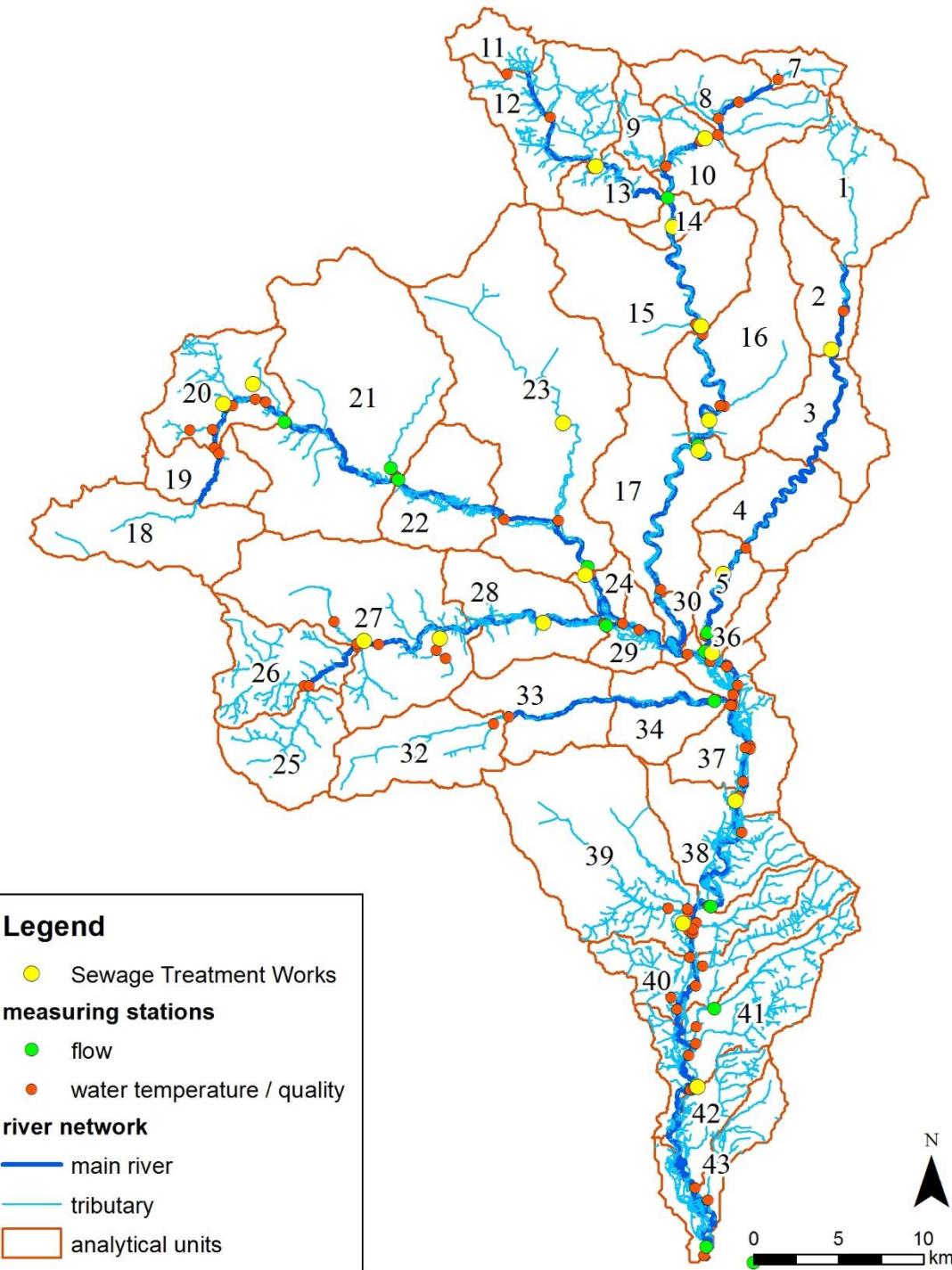
# Process: Raster iterieren
arcpy.IterateRasters_mb(trial, "", "", "NOT_RECURSIVE")
```

Bottom Right: A large watermark at the bottom right reads: "Research for the future of our freshwaters".

Windows Open in the Environment:

- Monitoring Data:** Shows a map of monitoring sites and a table of data.
- Geostatistical Analyst:** Shows a flowchart for "Raster_SummerPrec_Sub" with nodes: monthly_res 100m, Raster iterieren, Wert berechnen, Ausgabewerte, ASCII zu Raster, Dateien iterieren, File.ASC, and %name%.
- Table Add Field:** Shows a flowchart for "Table_Add_field" with nodes: dBase, Tabellen iterieren, Tabelle, Feld hinzufügen, and y2000m1.dbf.
- Table Calculate Field:** Shows a flowchart for "Table_Calculate_Field" with nodes: dBase, Tabellen iterieren, Tabelle, Feld berechnen, and y2000m1.dbf.
- Basemap:** Shows a map with various layers selected, including "ihdm_50m" and "Prec_monthly_ZonalStats".
- Script Windows:** Three code editors showing Python scripts for ArcGIS:
 - BGS_rainfall_CellStats.py:** A script for calculating rainfall cell statistics based on day numbers.
 - precipitation_annualSum.py:** A script for extracting precipitation data by year.
 - summerPrec.py:** A script for iterating through raster files to extract summer precipitation data.

Some Results



Outlook

- Stay in Oxford at the BGS, 05 / 2015
- MONERIS application
- Master Thesis

Sources

Images:

[1] http://upload.wikimedia.org/wikipedia/commons/3/36/Potomac_green_water.JPG,
accessed: 04/04/2015

[2] Venohr et al. 2014: Modelling Nutrient Emissions with MONERIS (PP-Presentation at TU Berlin)

Literature:

[3] <http://www.monteris.igb-berlin.de>

[4] Venohr, M., Hirt, U., Hofmann, J., Opitz, D., Gericke, A., Wetzig, A., Natho, S., Neumann, F., Hürdler, J., Matranga, M., Mahnkopf, J., Gadegast, M., Behrendt, H., 2011: *Modelling of Nutrient Emissions in River Ecosystems – MONERIS – Methods and Background*. Intern. Rev. Hydrobiol. 96, 435 – 483.

**Thank you very much
for your attention**

<http://www.moneris.igb-berlin.de/>

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... any further questions?