International Institute for Applied Systems Analysis
IIASA www.iiasa.ac.at

Exercise 8: Changing input data

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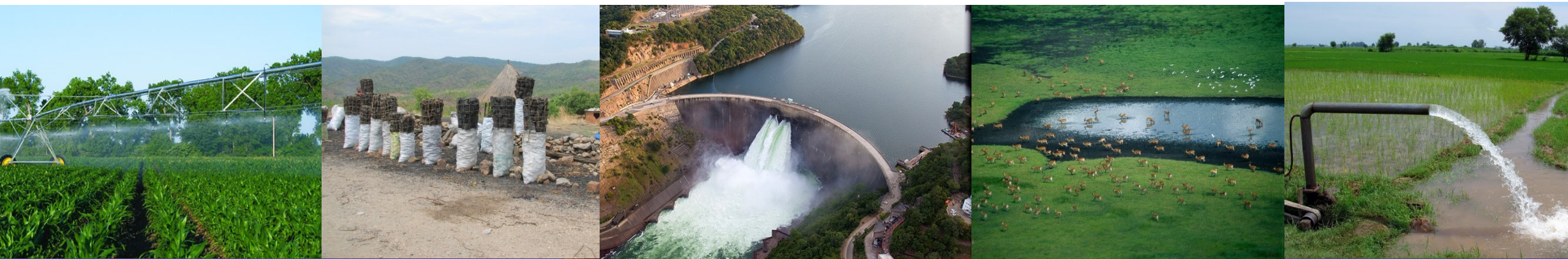


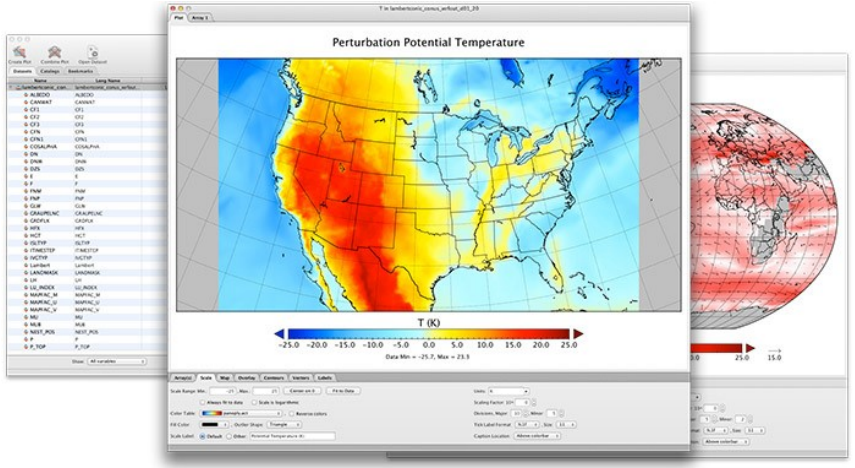
Changing input data

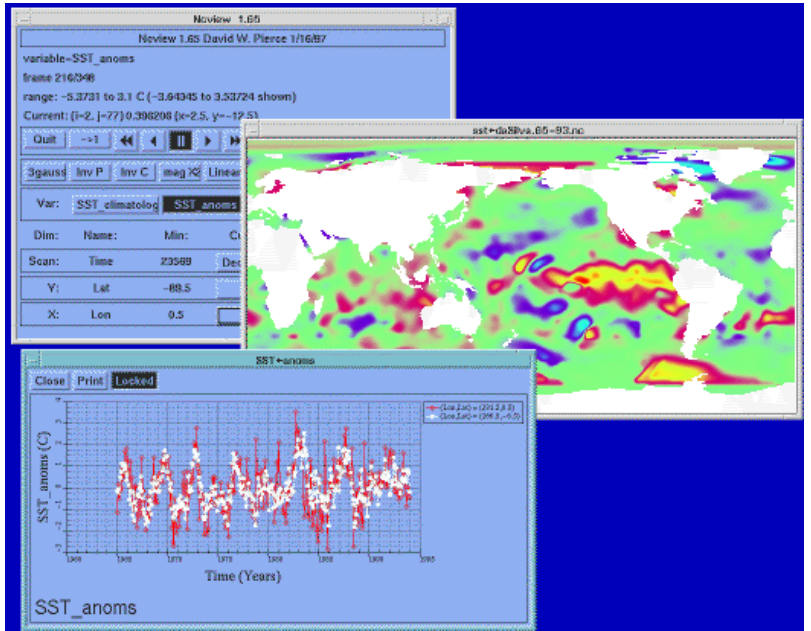
0. What you need
1. What is netCDF
2. Display netCDF files
3. Change ksat2 (saturated soil conductivity layer 2) in ArcGIS

Changing input data

0. What you need

- A Geoinformation System e.g. QGIS, ArcGIS
- A way to display netCDF files easily
  e.g.:
  PANOPLY on Windows
  https://www.giss.nasa.gov/tools/panoply/
  ncview on Linux:





Changing input data

What is netCDF

- **NetCDF** (**Network Common Data Form**) is a data format like .tif, .jpg
- **NetCDF** is a set of librariesand self-describing, machine-independent data formats that support the creation, access, and sharing of array-oriented scientific data
- Mainly used by the meteorological community

Advantage:

- netCDF is self-describing, portable, flexible
- netCDF is public domain, well documented and used by a growing number of organizations
- High efficiency in reading and processing netCDF files (it is fast)
- A netCDF file can contain timeseries of spatial data in a compressed way

Disadvantage:

- Not so easy to handle

Changing input data

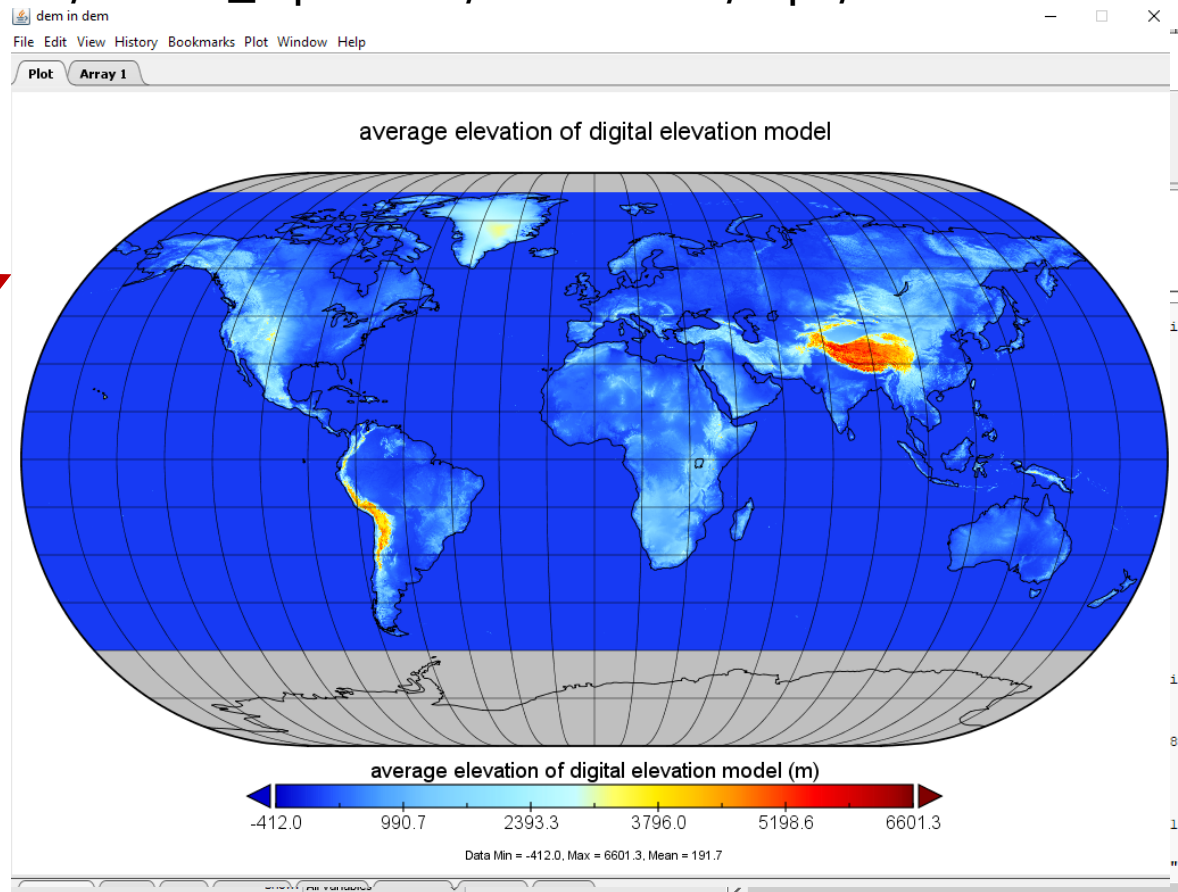
Examples of netCDF

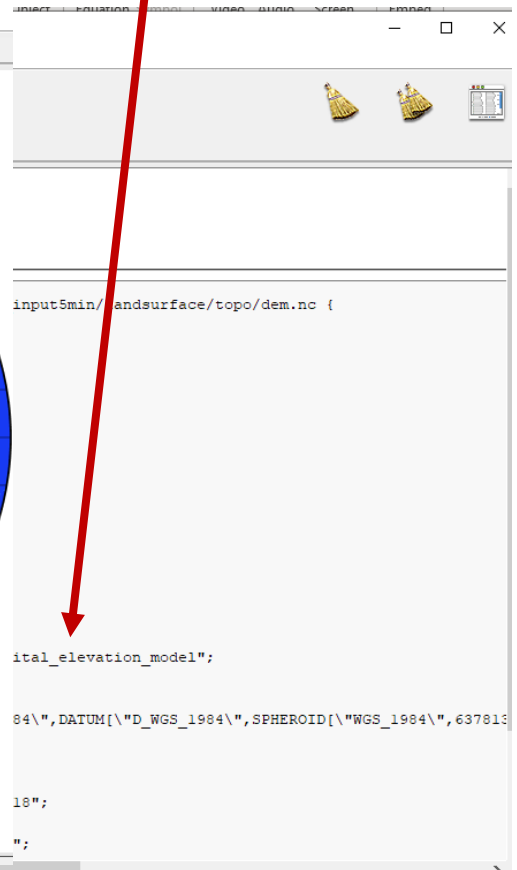
Digital elevation (source:SRTM)

../CWATM_data/cwatm_input5min/landsurface/topo/dem.nc

Metainformation e.g.
- dimension (here without time)
- unit
- description

Variables
- latitude
- longitude
- elevation





Changing input data

Examples of netCDF

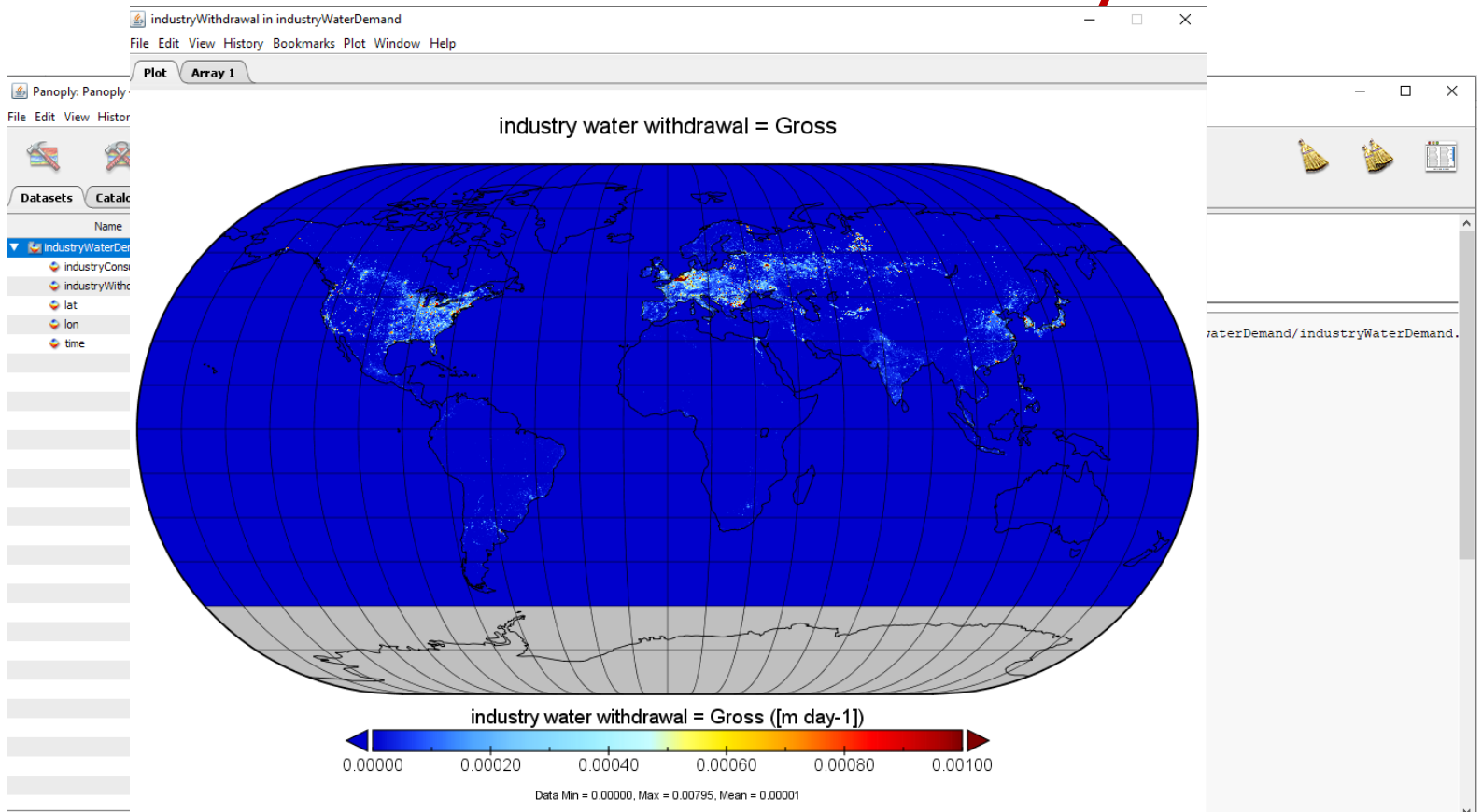
Metainformation e.g.
- dimension (here **with** time)
- unit
- description

Monthly industry water demand (calculation Wada et al. 2014)

../CWATM_data/cwatm_input5min/landsurface/waterDemand/industryWaterDemand.nc

Variables

- latitude
- longitude
- **time**
- **2 variables**



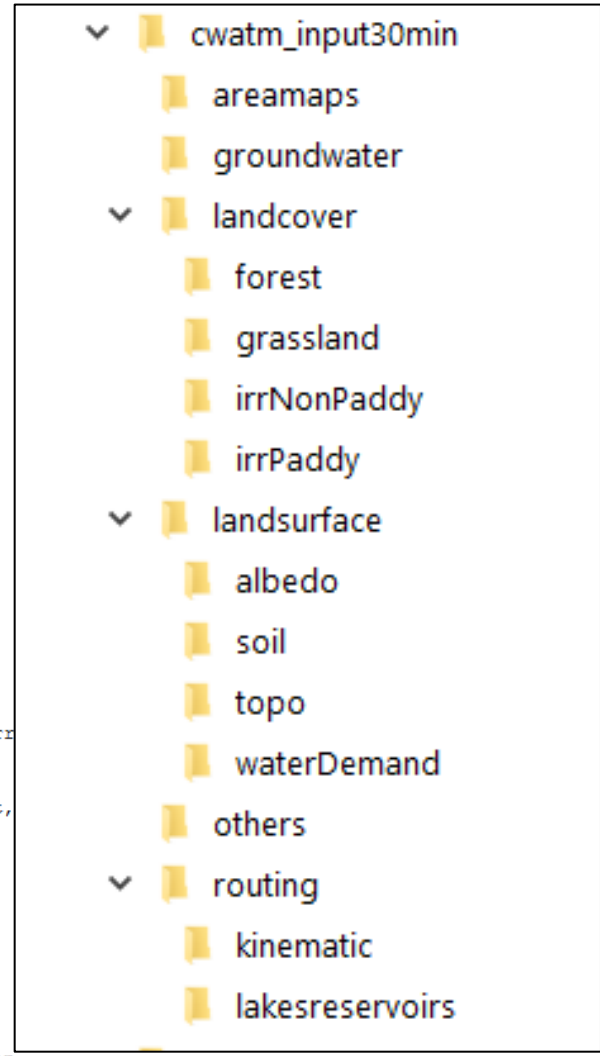
Changing input data

Take a look at dataset

- Take a look at:
  https://cwatm.iiasa.ac.at/data.html
- Take a look at
  ../CWATM_data/cwatm_input30min

Data storage structure

```
project
├── README.txt
│
├── areamaps
│   └── maskmap, stationmap
│
├── landcover
│   ├──forest
│   │   ├── cropCoefficientForest_10days
│   │   ├── interceptcapForest10days
│   │   ├── maxRootdepth, minSoilDepthFrac
│   │   └── rootFraction1, rootFraction2
│   │
│   ├── grassland (same var as forest)
│   │
│   ├── irrNonPaddy (same var as forest)
│   │
│   └── irrPaddy (same var as forest)
│
├──landsurface
│   ├── fractionlandcover, global_clone
│   │
│   ├── albedo
│   │   └── albedo
│   │
│   ├── topo
│   │   └── dz_Rel_hydro1k, elvstd , tanslope
│   │
│   └── waterDemand
│       └── domesticWaterDemand, industryWaterDemand, irr
│
├── soil
│   ├── alpha, forest_alpha, lamdba, forest_lambda, ksat,
│   └── cropgrp
│
├── groundwater
│   └── kSatAquifer, recessionCoeff, specificYield
│
└── routing
    ├── ldd, catchment, cellarea
    │
    ├── kinematic
    │   └── chanbnkf, chanbw, changrad, chanleng, chanman
    │
    └── lakereservoirs
        ├── lakeResArea, lakeResDis,lakeResID, lakeResType, lakeResVolRes, lakeResYear,
        └── smallLakesRes, smalllakesresArea, smalllakesresDis, smallwatershedarea
```



Changing input data

Metainformation e.g.
- dimension (here **with** time)
- unit
- description

Changing values with CDO (Linux)

CDO (Climate Data Operators)

https://code.mpimet.mpg.de/projects/cdo/

CDO is a collection of command line Operators to manipulate and analyse netCDF data.

There are more than 600 operators available

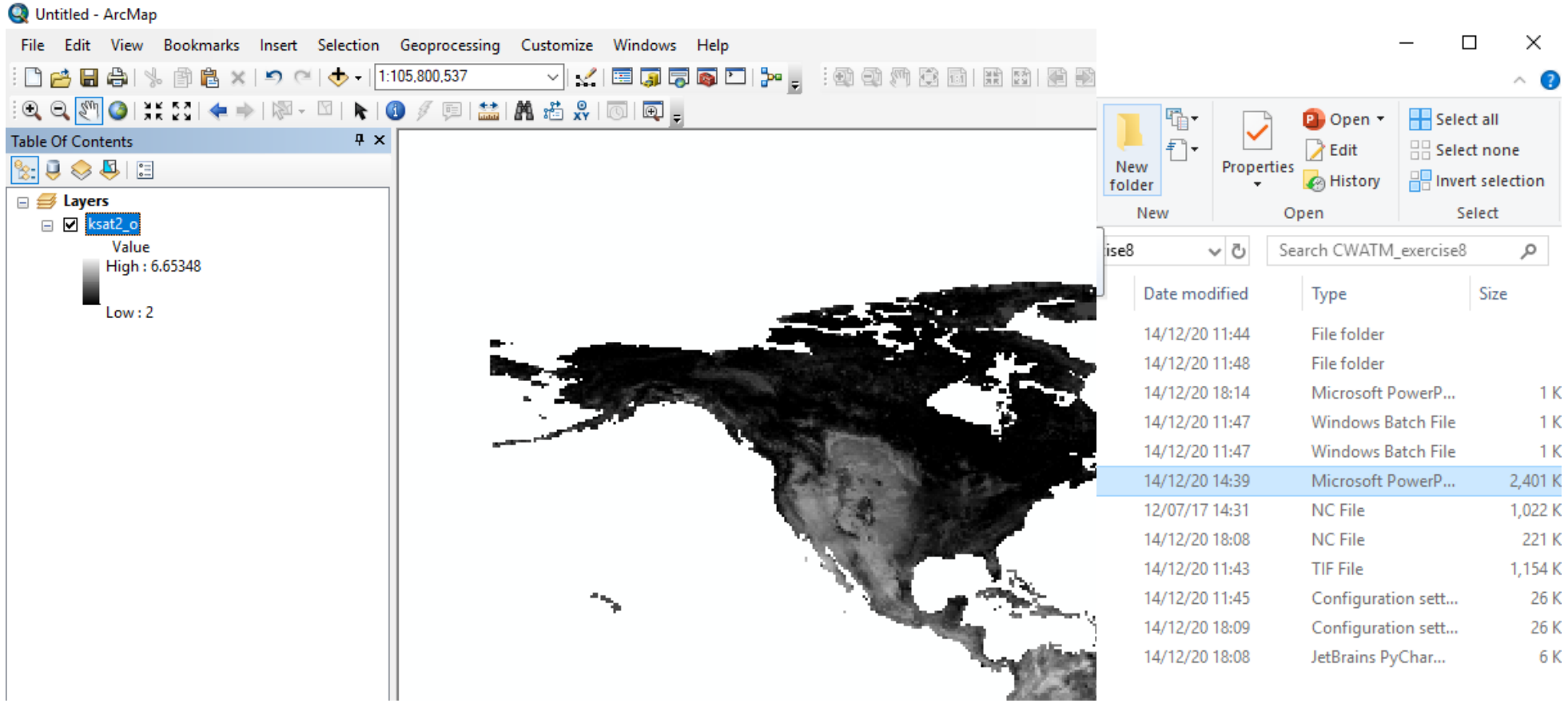
cdo expr, 'ksat2 = ksat2_o * 2' ksat2.nc ksat22.nc

Multiplying values by two

Changing input data

Changing values with ArcGis

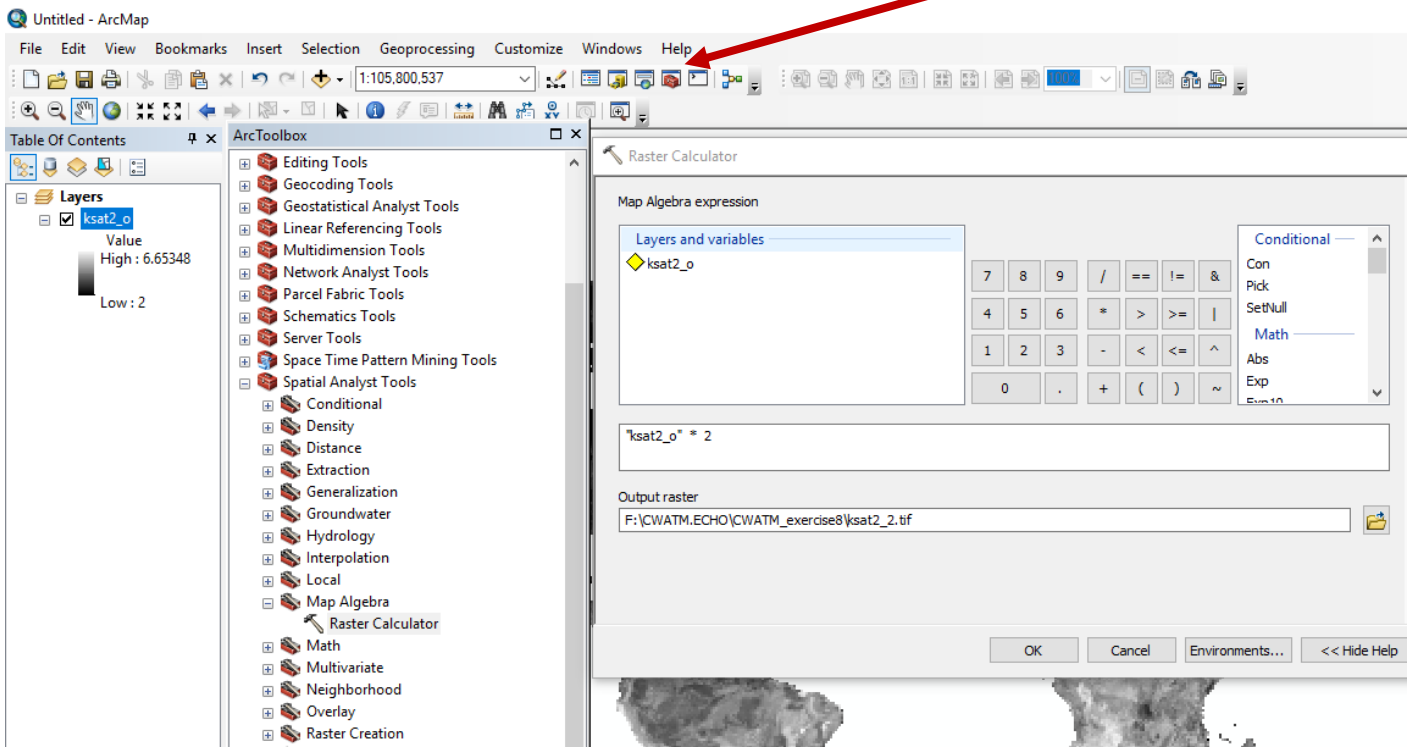
- Open Arcgis
- Drop ksat2.nc into “Table of content”



Changing input data

Changing values with ArcGis

- Open toolbox – Spatial Analyst Tool – Map Algebra – Raster calc.
- Put in: “ksat2_o” *2
- Put in output raster – into the folder of CWATM_exercise8



You have to choose a different name than ksat2_2.tif if there is already a ksat2_2.tif in this folder

Changing input data

Convert file from .tif to netcdf

- Run tif2nc.bat
- This will run python tif2netcdf.py
- Output is ksat2_2.nc

tif2netcdf.py

```
115
116
117 # ----------------------------------
118 # ----------------------------------
119 # ----------------------------------
120
121 inDir = "./"
122 outDir = "./"
123 netcdfOut = outDir + "ksat2_2.nc"
124 inNamel = inDir+"ksat2.tif"
125 timeattr = False
126
127 varShortNames = ['ksat2']
128 varLongNames = ['saturated soil conditivity layer2']
129 # We have to standardize units based on  the CF convention.
130 varUnits = '[cm]'
131
```

Changing input data

Convert file from .tif to netcdf

- Run tif2nc.bat
- This will run python tif2netcdf.py
- Output is ksat2_2.nc

Changing input data

Run CWatM twice to see the difference

- Run 81_python_example.bat

  or python ../CWATM_model/CWatM/run_cwatm.py settings_rhine30min1.ini -l

- Output in output1

- Run 82_python_example.bat

  or python ../CWATM_model/CWatM/run_cwatm.py settings_rhine30min2.ini -l

- Output in output2

```
88
89    PathOut = ./output2
90    PathMaps = $(PathRoot)/c
```

```
338   KSat1 = $(PathSoil)/ksat1.map
339   #KSat2 = $(PathSoil)/ksat2.map
340   KSat2 = ./ksat2_2.nc
```

Difference settings_rhine30min2.ini vs. settings_rhine30min2.ini

Changing input data

Have a look at rhine8.xlsx to see the difference