

Project Meeting: 17.12.2013, BOKU, Vienna

Spatial Implementation of Drought Monitoring

Vojko Daneu and Andreas Schaumberger

Department Geoinformation
Agricultural Research and Education Centre Raumberg-Gumpenstein





Work Package WP4 – Time Table and Objectives

Kick-off meeting: March 2013

Start / end of WP4: October 2013 / October 2015



Spatial interpolation of weather data for the period before INCA data are available – format change from ArcGIS to netCDF



Development of platform independent software that integrates existing models (SpatialGRAM, SoilClim)



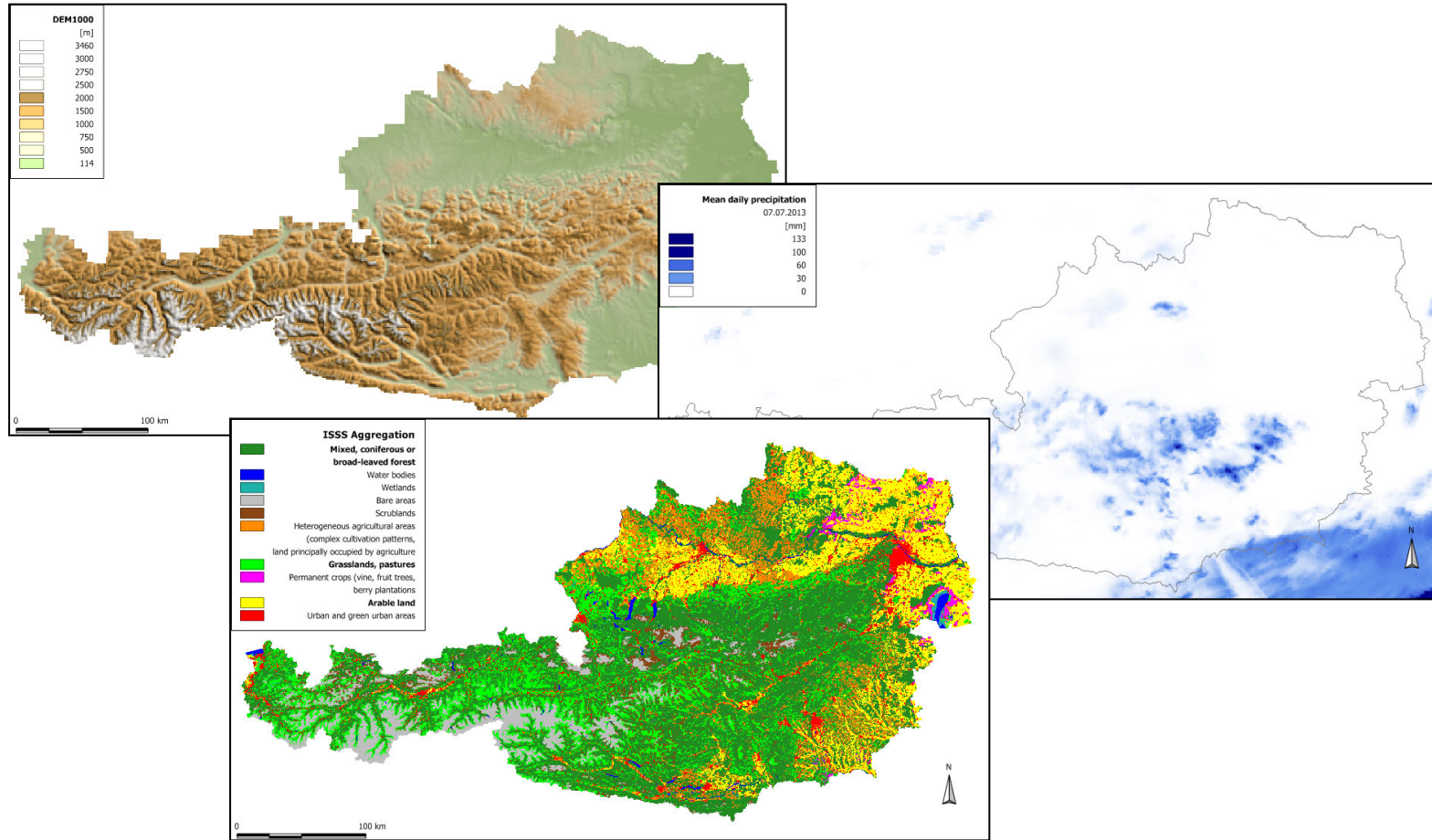
Forecast: Implementation of new developed and/or adapted methods to monitor and forecast agricultural drought for main crops cultivated in Austria



Web interface to publish our results mainly by maps (delivery of images – netCDF, png, jpg, tiff ...)

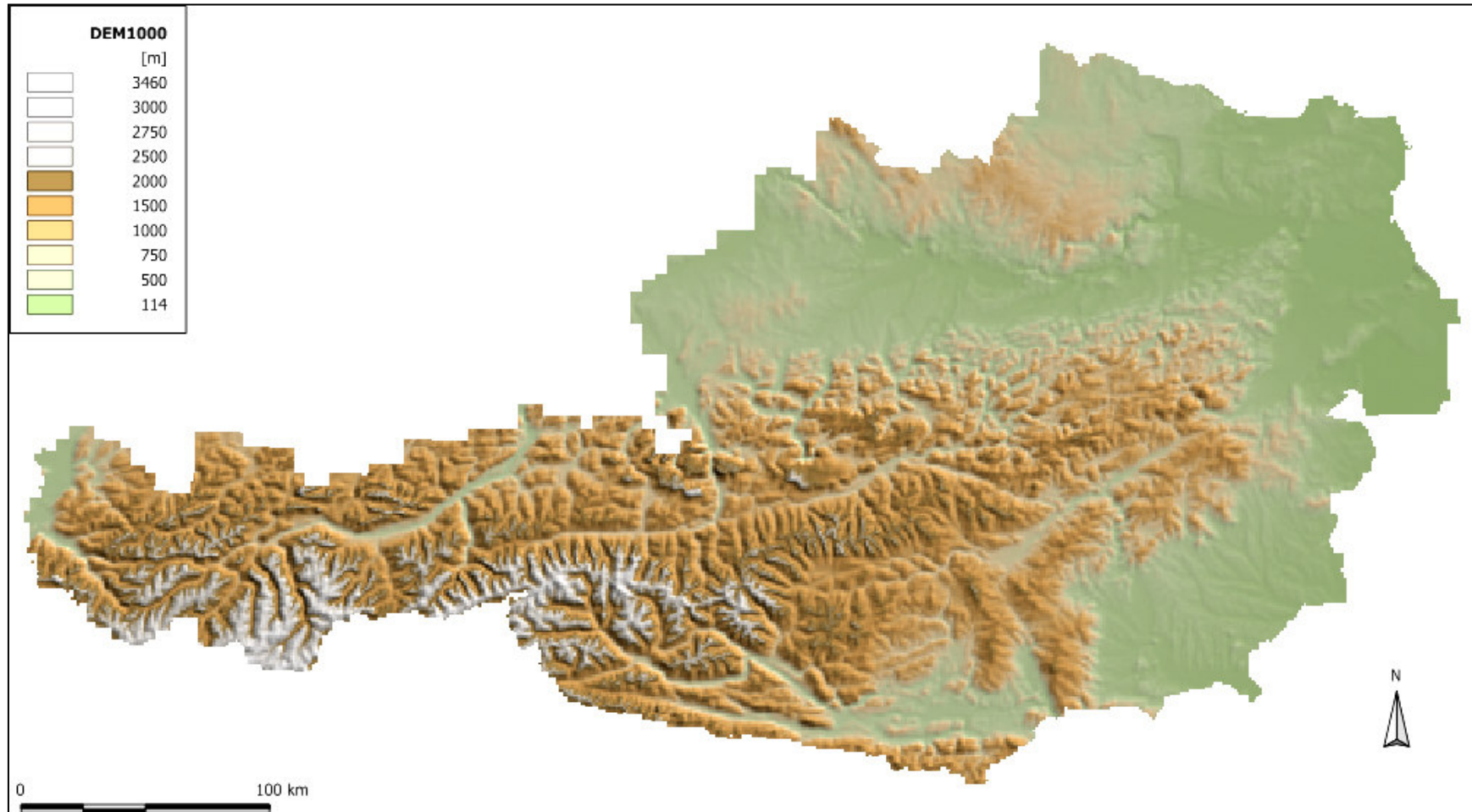


Data for the ADA program



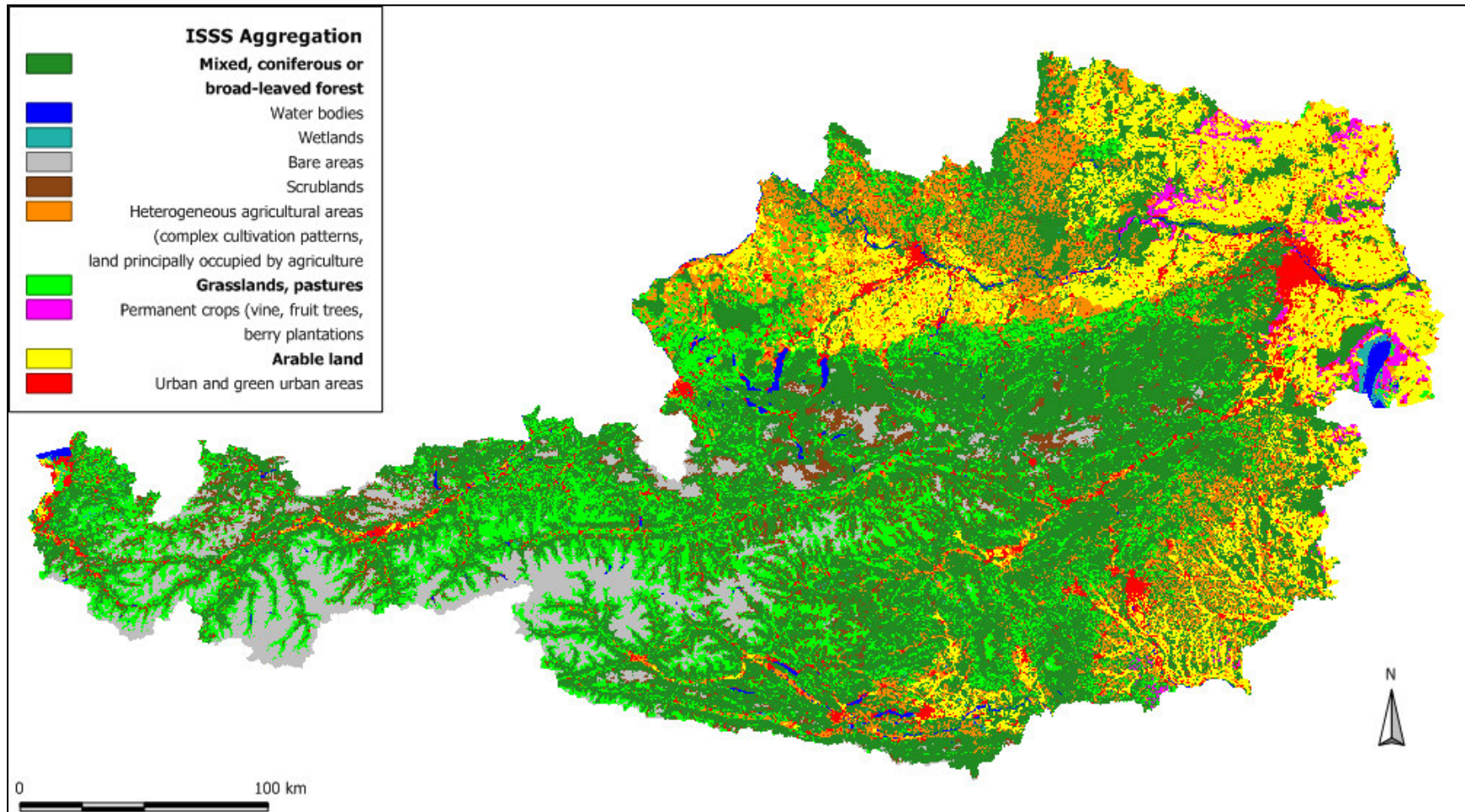


Data Input – Elevation Data DEM

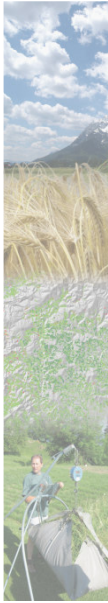




Data Input – Land Use Data CLC 2006 / ISSS / ADA Crops (500 x 500m)



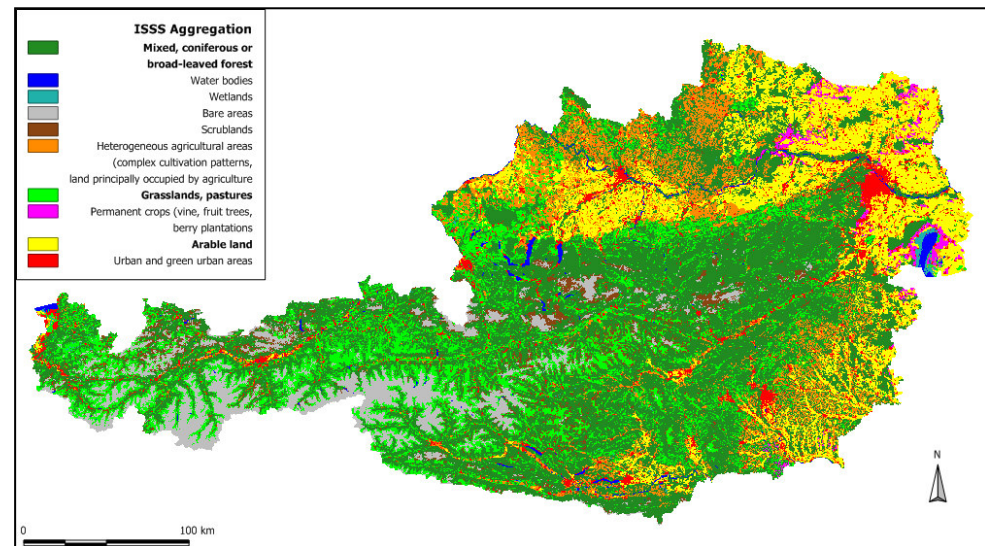
LandCover-Classification from MENDELU University



Data Input – Land Use Data CLC 2006 / ISSS / ADA Crops (500 x 500m)

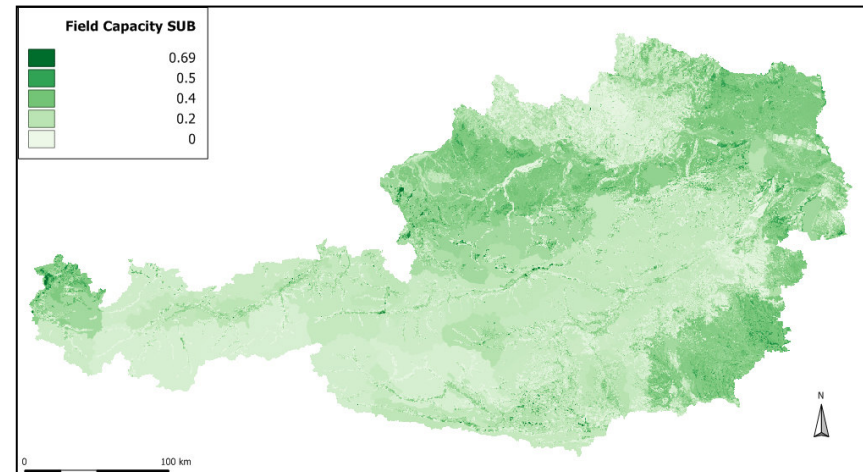
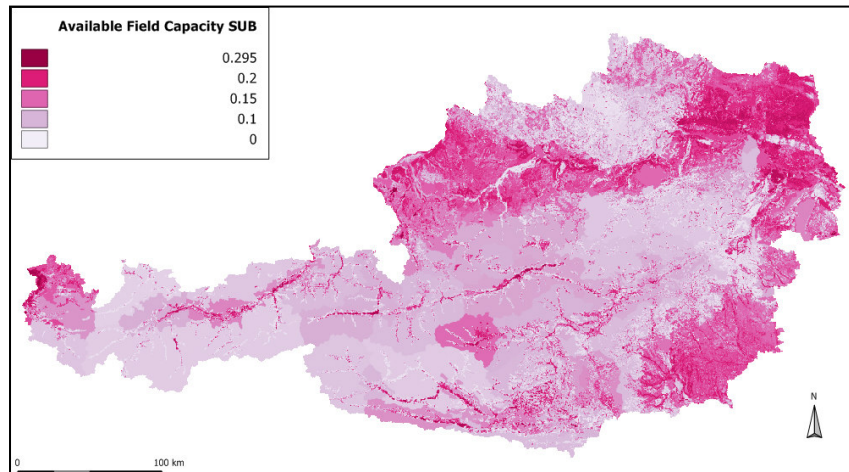
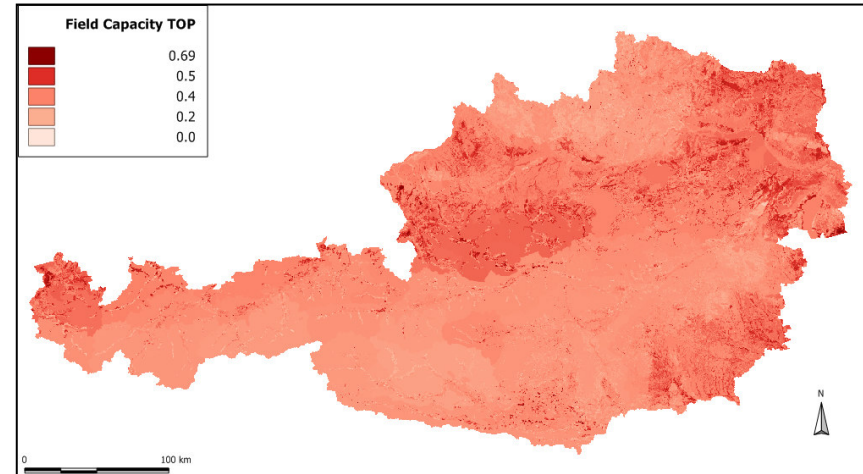
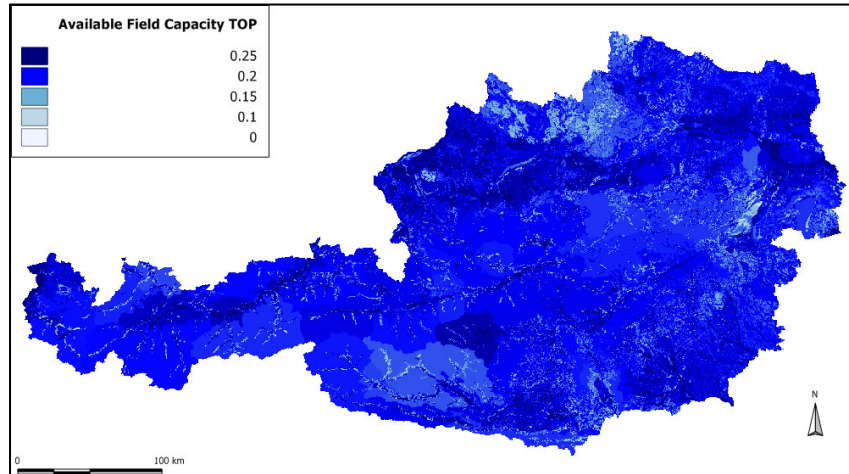
CLC 2006 arable land vs. ADA winter wheat,
ADA spring barley,
ADA spring maize,
ADA sugar beet

=> Up to 4 scenarios with different ADA crop types (used for the complete arable land area) and 1 scenario with average values





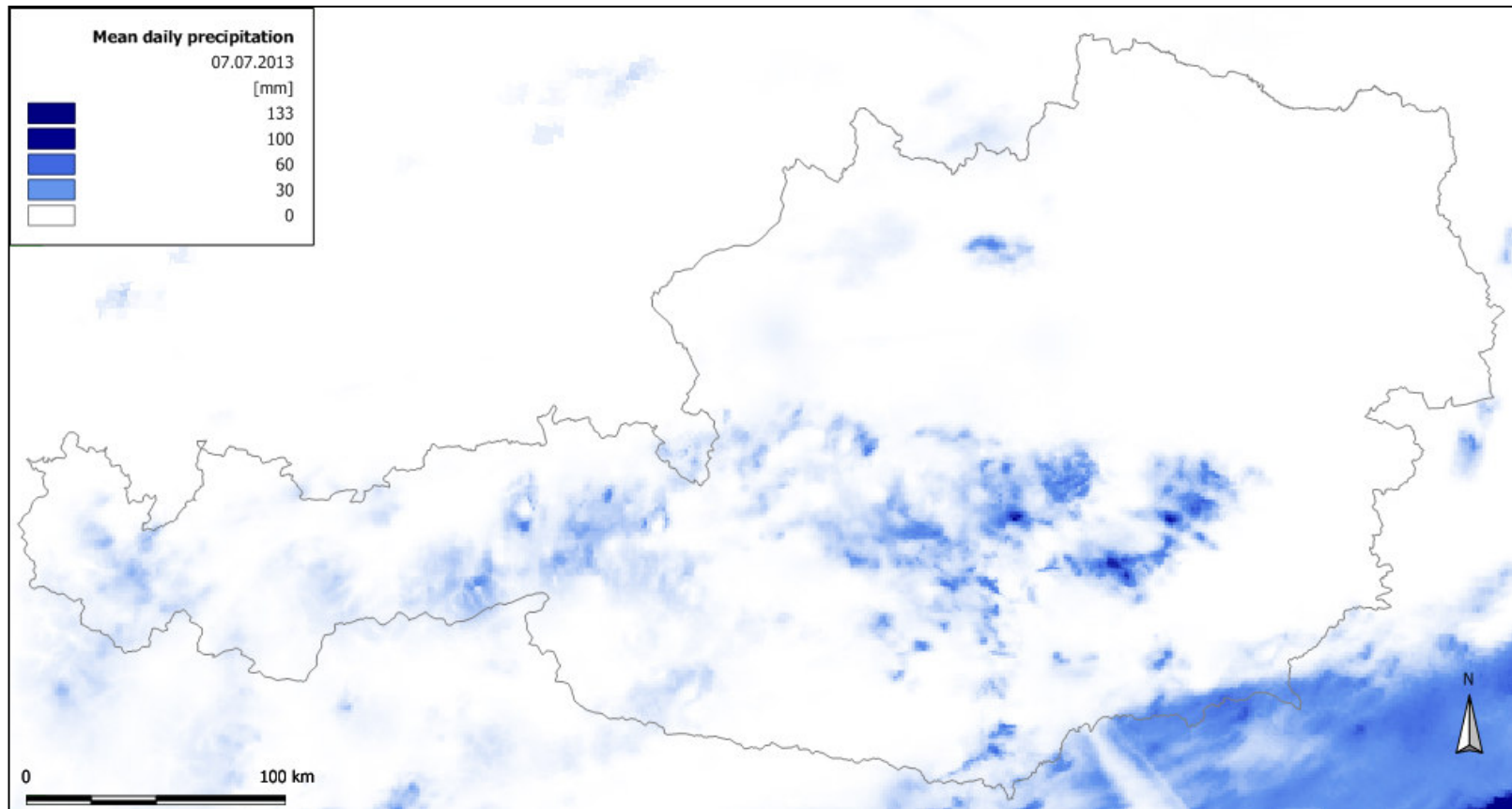
Data Input – Soil Data AFC and FC (500 x 500m)





Data Input – Meteorological Data (1000 x 1000m)

Met Data: Temperature - Precipitation – Radiation –
Relative humidity - Wind





Data Input – Meteorological data (1000 x 1000m)

Met Data: Temperature - Precipitation – Radiation –
Relative humidity - Wind

1980 - 2002: Spatial interpolation of weather data for the period before INCA data carried out. ArcGIS -> netCDF missing.

2003 – now (+ 3,10 days forecast): INCA weather data interpolated by ZAMG and supplied



Software – ADA Program

Agro Drought Austria 1.3.2 BETA

Utility ETO Water Balance Forecast Evaluation

Environment Settings

Main paths and directories

Main path = D:/Geoinformation/Projekte/AgroDroughtAustria/
Test path = D:/Geoinformation/Mitarbeiter/Daneu Vojko/Programmierung/TestFolder/
Meteorological files directory = InputData/WeatherData/
Basis data directory = InputData/netCDF-Basisdata/
Results directory = ResultData/

Computation period for the evaluation

Computation period = 01.01.2013 - 31.12.2013

HR Coordinates of Control

Points (Lat, Lon)

- 270250;110250
- 297250;499250
- 370750;579750
- 375250;147250
- 492250;590250
- 297250;499750
- 406750;425250
- 407250;425250

Parameters to EVALUate

<input type="checkbox"/> AFCTOP	<input type="checkbox"/> AFCSUB	<input type="checkbox"/> FCTOP
<input type="checkbox"/> FCSUB	<input type="checkbox"/> CLC2006	<input type="checkbox"/> DHM1000
<input type="checkbox"/> PRECIP	<input type="checkbox"/> PRECIP_DAY	<input type="checkbox"/> PRECIP_NIGHT
<input type="checkbox"/> RH2M_MAX	<input type="checkbox"/> RH2M_MEAN	<input type="checkbox"/> RH2M_MIN
<input type="checkbox"/> T2M_DAY	<input type="checkbox"/> T2M_NIGHT	<input type="checkbox"/> T2M_MAX
<input type="checkbox"/> T2M_MEAN	<input type="checkbox"/> T2M_MIN	<input type="checkbox"/> RAD
<input type="checkbox"/> WIND10M	<input type="checkbox"/> ETO	

KC INTERC ETC ETA WB

Mean	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Winter Wheat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spring Barley	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spring Maize	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SugarBeet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Select all Select none

Forecast

0% Ready!

ETA computation

Wind Measurement Height [m] = 10.0f
zTop [m] = 0.4f
zSub [m] = 0.6f
etcTopFactor = 0.6f
etcSubFactor = 0.4f

Start of Growing Season (SGS)

0% Ready!

Settings ETO

Main paths and directories

Main path = D:/Geoinformation/Projekte/AgroDrou...
Meteorological files directory = InputData/Weathe...
Basis data directory = InputData/netCDF-Basisdat...
Results directory = ResultData/

Computation period for all calculations

Computation period = 01.01.1980 - 31.12.1980

Constants

Albedo = 0.23f
Mean latitude [°] = 47.6f

Reference Evapotranspiration (ETO) value for December, January and February

ETOconst [mm] = 0.2f

0% Ready!

Soil water content at the start of each year:

Water Balance 100%
 Water Balance of 31.12.

Computation of averages - crops to include:

- Winter Wheat
- Spring Barley
- Spring Maize
- Sugar Beet

netCDF files to export:

- etc.nc
- interc.nc
- eta.nc
- kc.nc
- swc.nc

Evaluate computations



Work Packages ADA Program Overview

- ✓ I/O interface for netCDF data
 - Data format for reading/writing large scientific data files
 - Self describing (reducing the incidence of errors)
 - High performance
- ✓ Adapt I/O interface for netCDF data (daily gridded weather parameters) of the ZAMG
- ✓ Write graphical user interface
 - Allow data input by the user (environment settings)
 - Allow selection of various computation szenarios (SWC at the start of the year, „variable crops“, data export)
- ✓ Continue translate methods (ET0, SWC) from c# into Java (SpatialGRAM)
- ⚠ Translate and include methods (ET0, SWC, FC) from Delphi into Java (SoilClim)



Work Packages ADA Program Overview



Testing and debugging



Development of automated procedure for computation, I/O and distribution of results (netCDF, PNG) on the web server

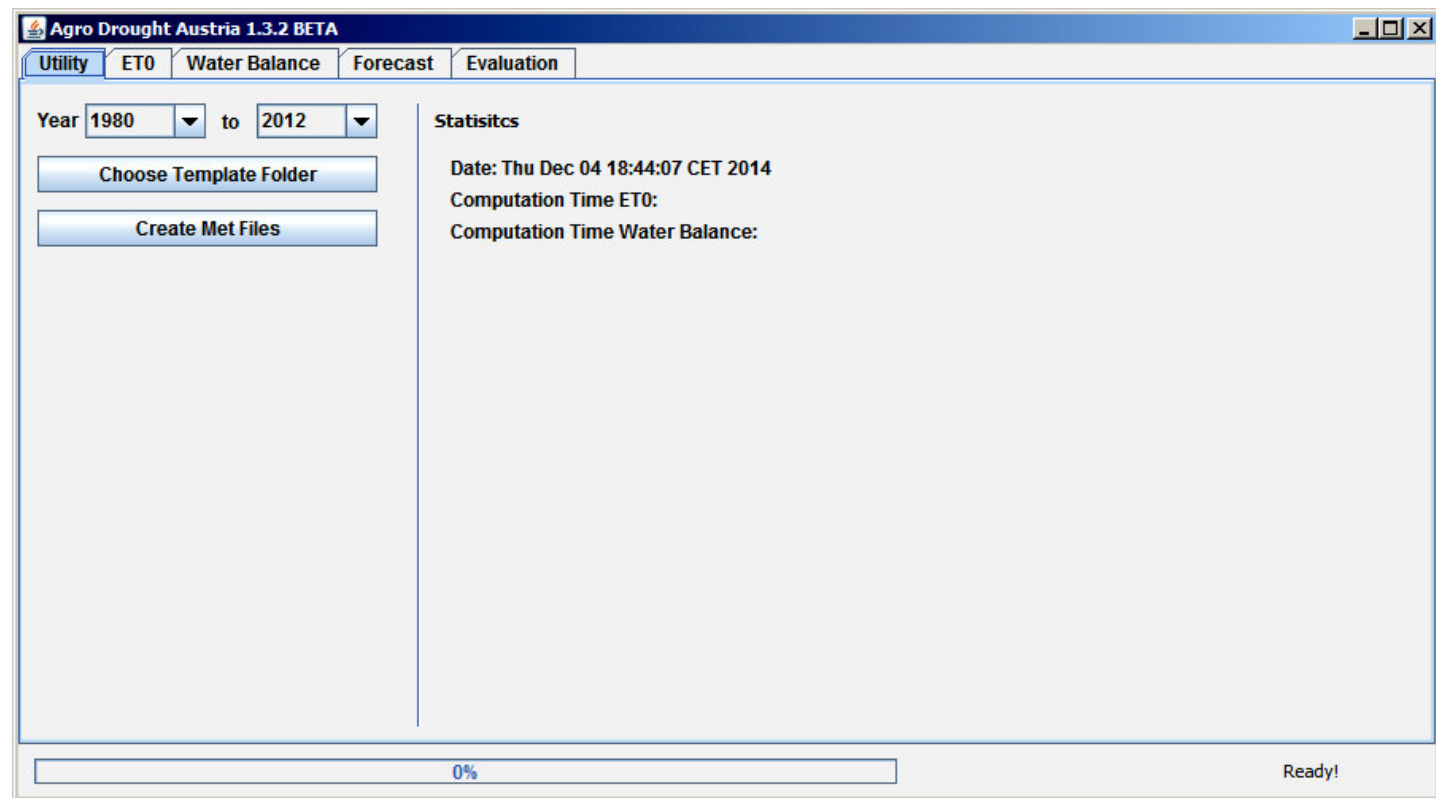


Final Testing and debugging



ADA Program – Tab Utility

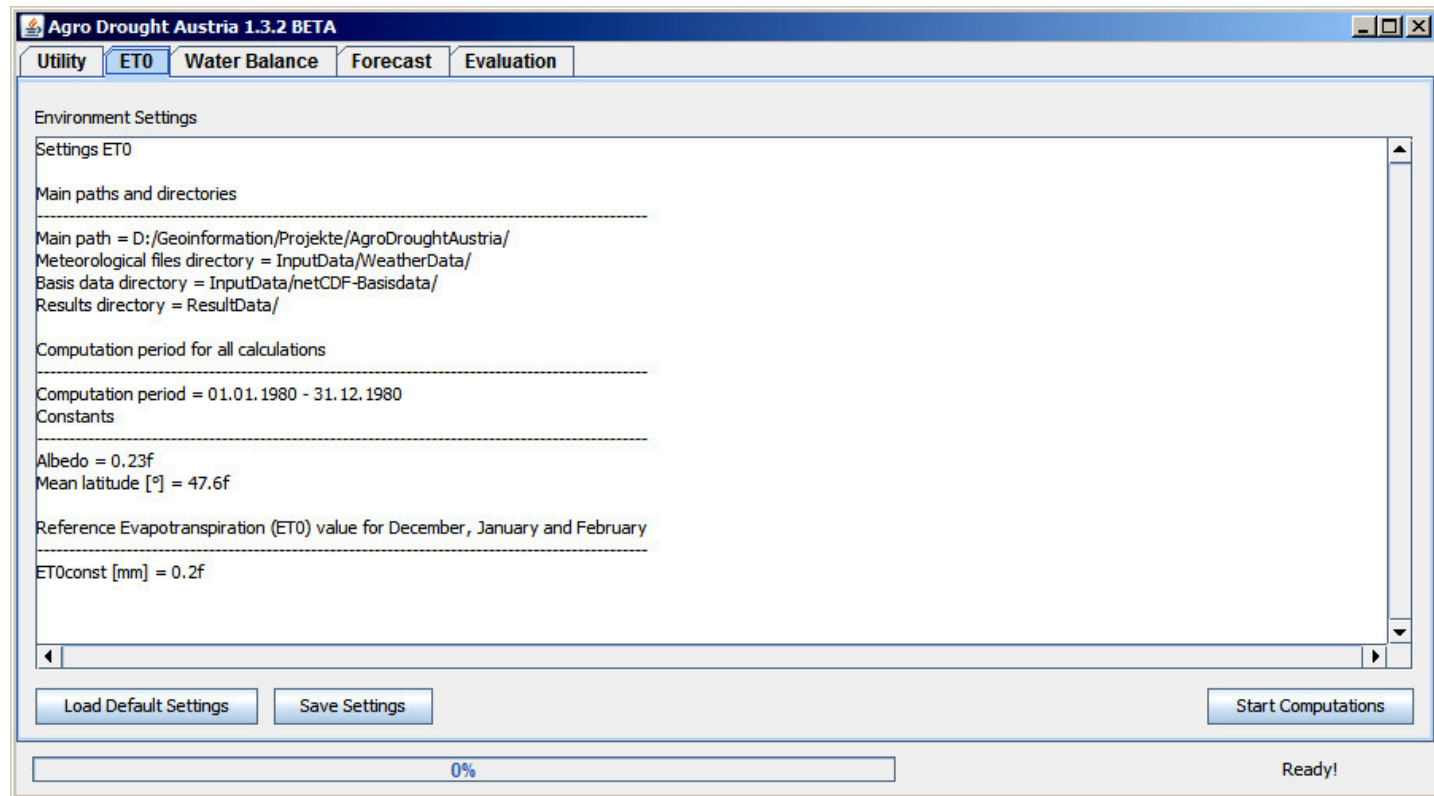
- Dummy file creation
- Computation time summary
- and whatever is of interest





ADA Program – Tab ET0

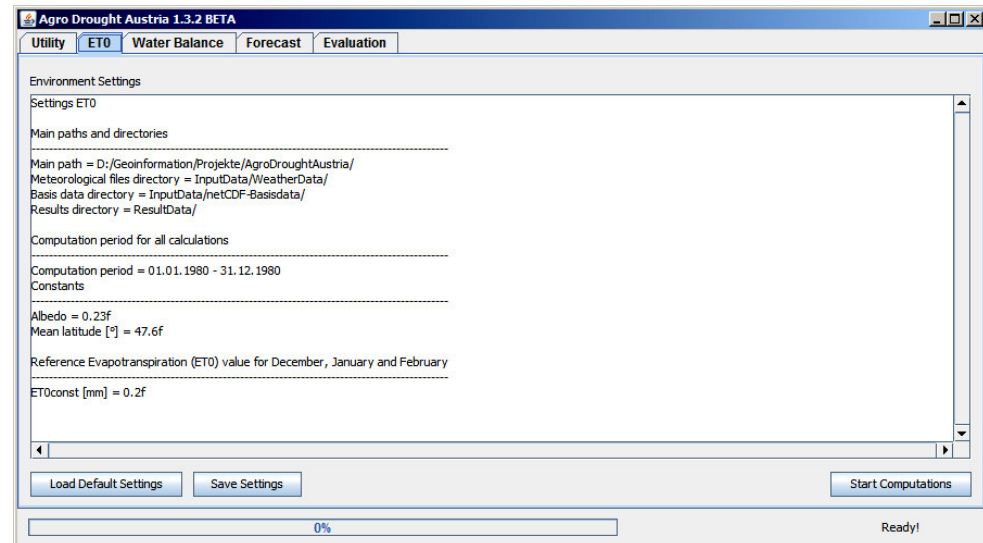
- Environment Settings
- Load Default Settings, Save Settings
- Compute ET0





ADA Program – ET0 Computation

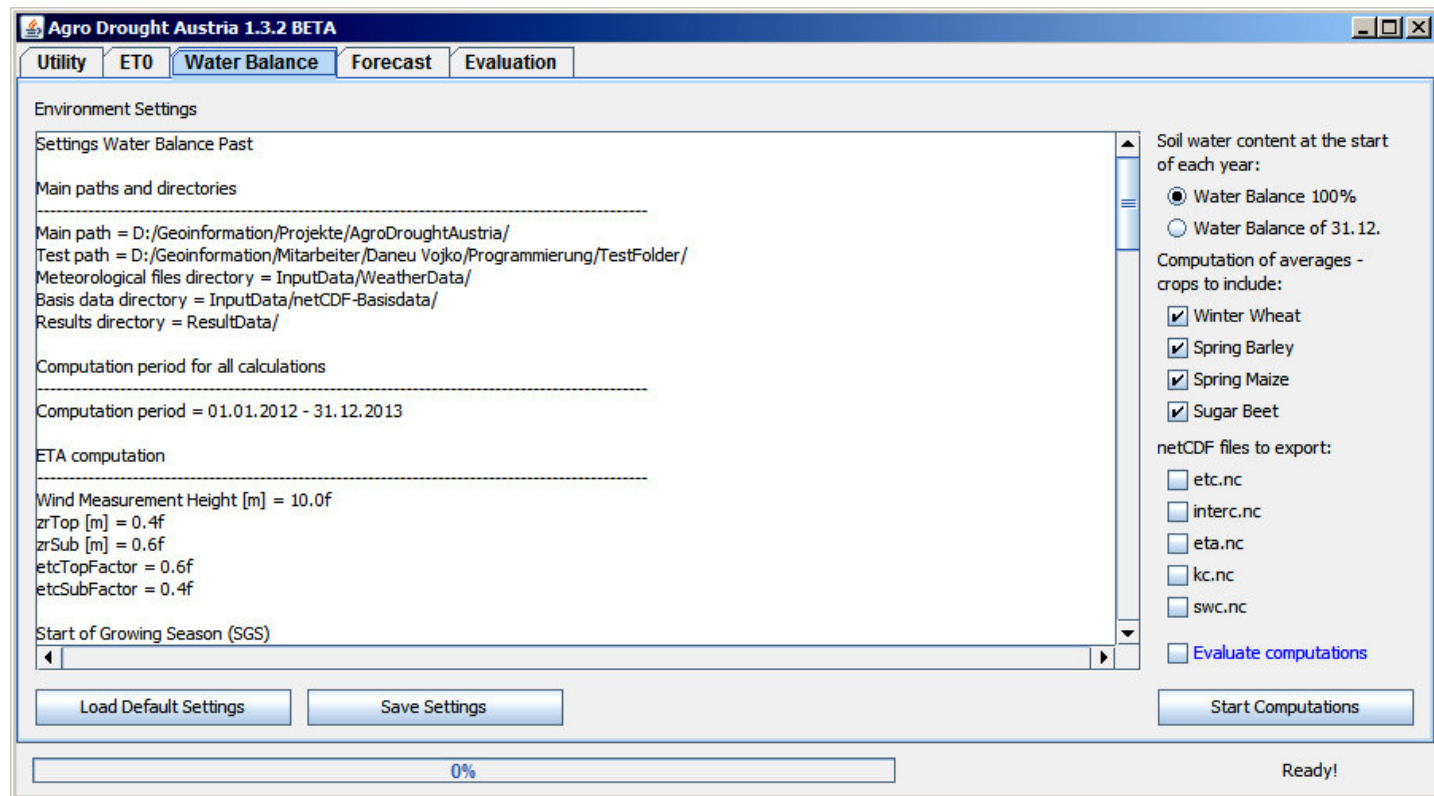
- Computation of ET0 for all past years from 1980 - 2014
- Methodology: FAO Penman-Monteith method
- Export as netCDF files
- Compute only once





ADA Program – Tab Water Balance (no forecast)

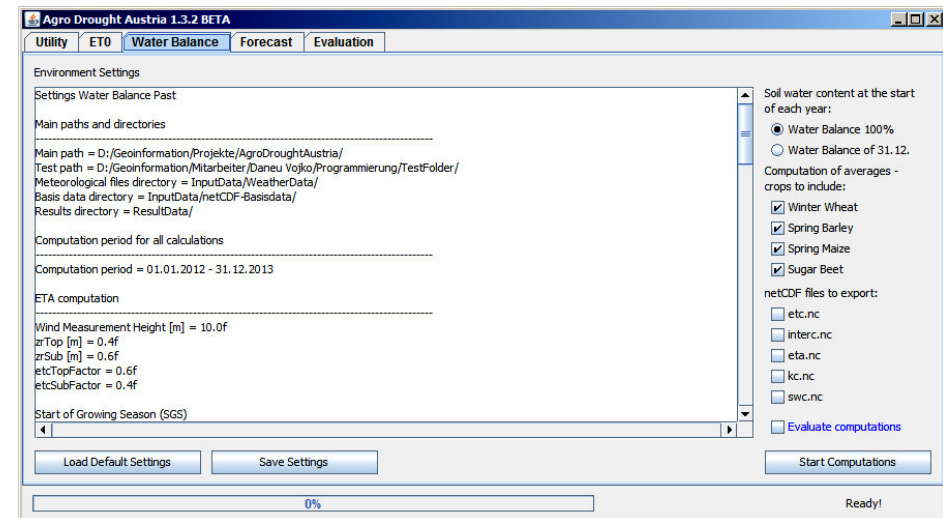
- Environment Settings
- Load Default Settings, Save Settings, Selections
- Compute KC, ETC, Interception, ETA, SWC





ADA Program – Water Balance Computation

- KC, ETC, Interception, ETA, SWC for all past years (max. from 1980 – 2014) for the top and sub soil using „past“ met data
- Selection: Root zone depletion value
Dr = 0 or Dr = Dr (31.12) => export Dr as netCDF files
- Selection: “variable crops” (wWheat, sBarley, sMaize, sugBeet) - select at least one!
- Selection: export KC, ETC, Interception, ETA, SWC as netCDF files
- Selection: evaluate on the fly





ADA Program – Tab Evaluation

- Environment Settings, CP Settings
- Load Default Settings, Save Settings, Selections
- Evaluate

Agro Drought Austria 1.3.2 BETA

Utility ETO Water Balance Forecast Evaluation

Environment Settings

Main paths and directories

Main path = D:/Geoinformation/Projekte/AgroDroughtAustria/
Test path = D:/Geoinformation/Mitarbeiter/Daneu Vojko/Programmierung/TestFolde
Meteorological files directory = InputData/WeatherData/
Basis data directory = InputData/netCDF-Basisdata/
Results directory = ResultData/

Computation period for the evaluation

Computation period = 01.01.2013 - 31.12.2013

HR Coordinates of Control

Points (Lat, Lon)

270250;110250
297250;499250
370750;579750
375250;147250
492250;590250
297250;499750
406750;425250
407250;425250

Parameters to EVALUate

AFCTOP AFCSUB FCTOP
 FCSUB CLC2006 DHM1000
 PRECIP PRECIP_DAY PRECIP_NIGHT
 RH2M_MAX RH2M_MEAN RH2M_MIN
 T2M_DAY T2M_NIGHT T2M_MAX
 T2M_MEAN T2M_MIN RAD
 WIND10M ETO

	KC	INTERC	ETC	ETA	WB
Mean	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Winter Wheat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spring Barley	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spring Maize	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SugarBeet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Select all Select none

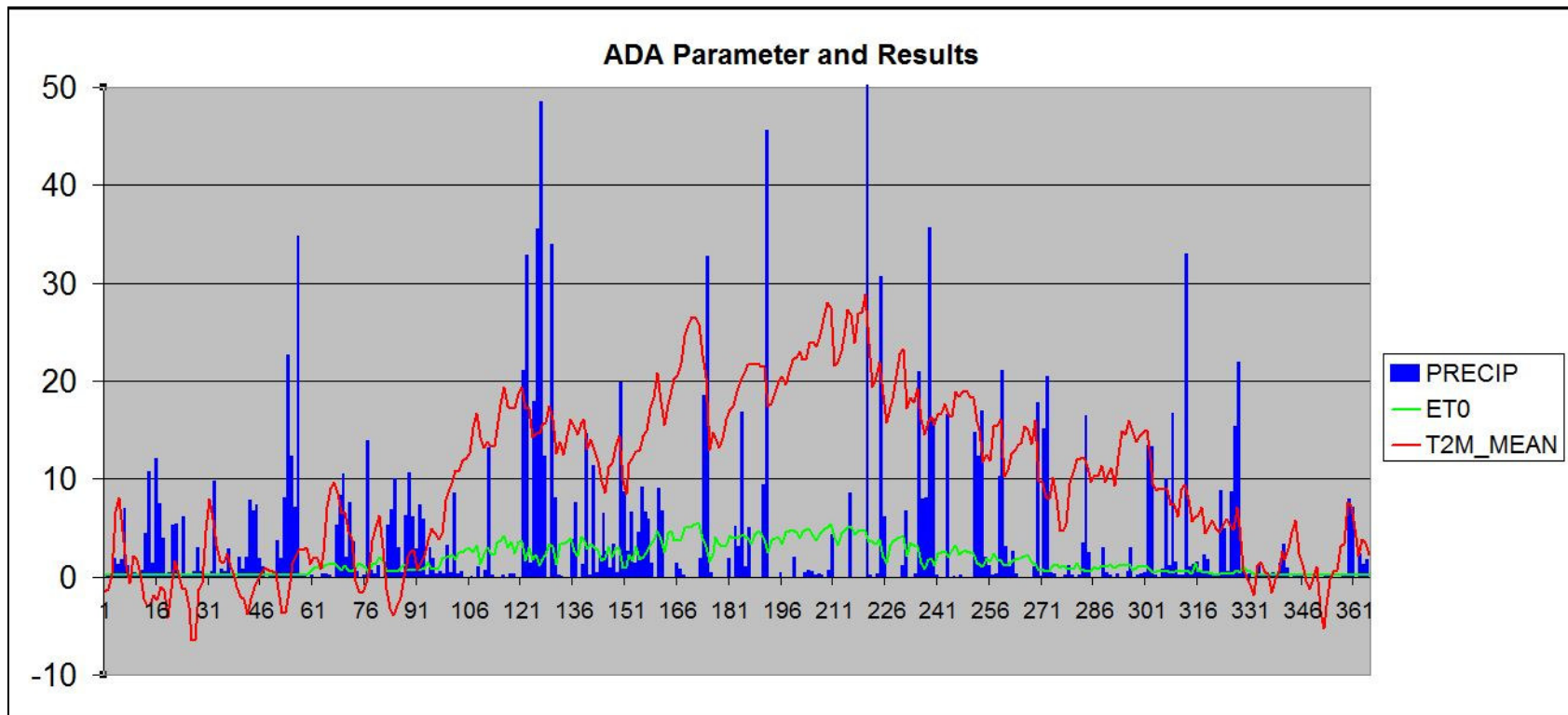
Forecast Evaluate

0% Ready!



ADA Program – Tab Evaluation

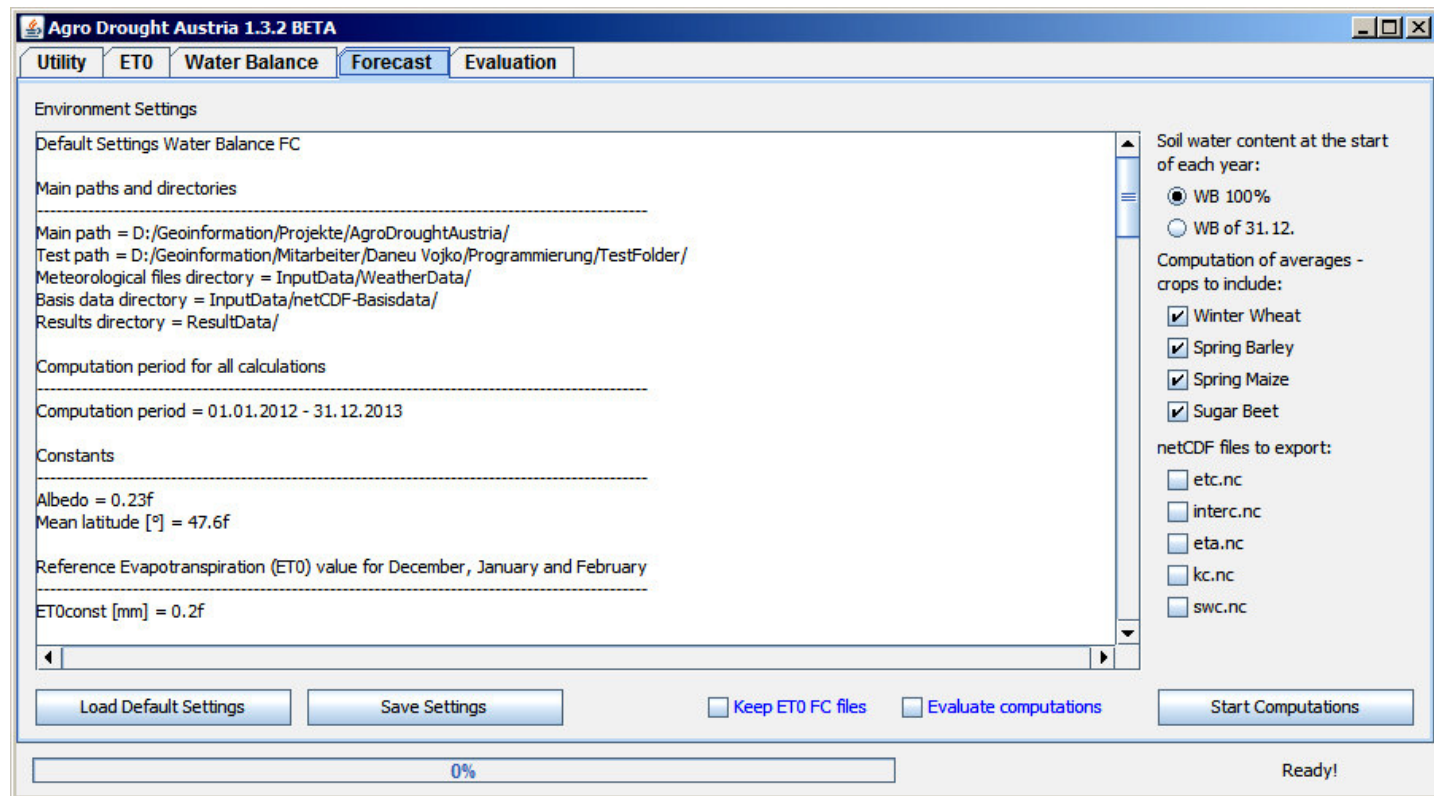
- Evaluation of various parameters and computation results at selected control points





ADA Program – Tab Water Balance Forecast

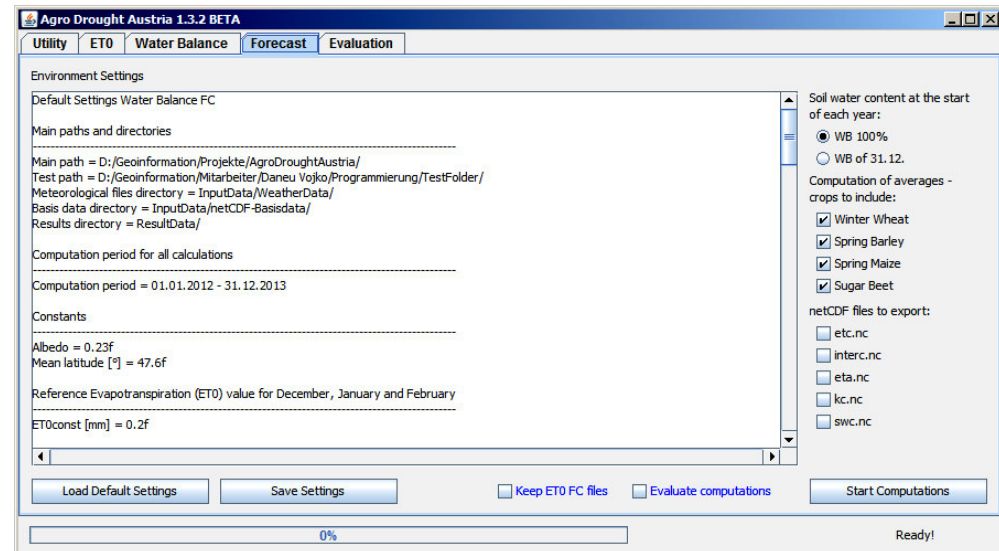
- Environment Settings
- Load Default Settings, Save Settings, Selections
- Compute KC, ETC, Interception, ETA, SWC, **FC**

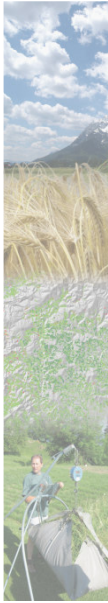




ADA Program – Water Balance Forecast Computation

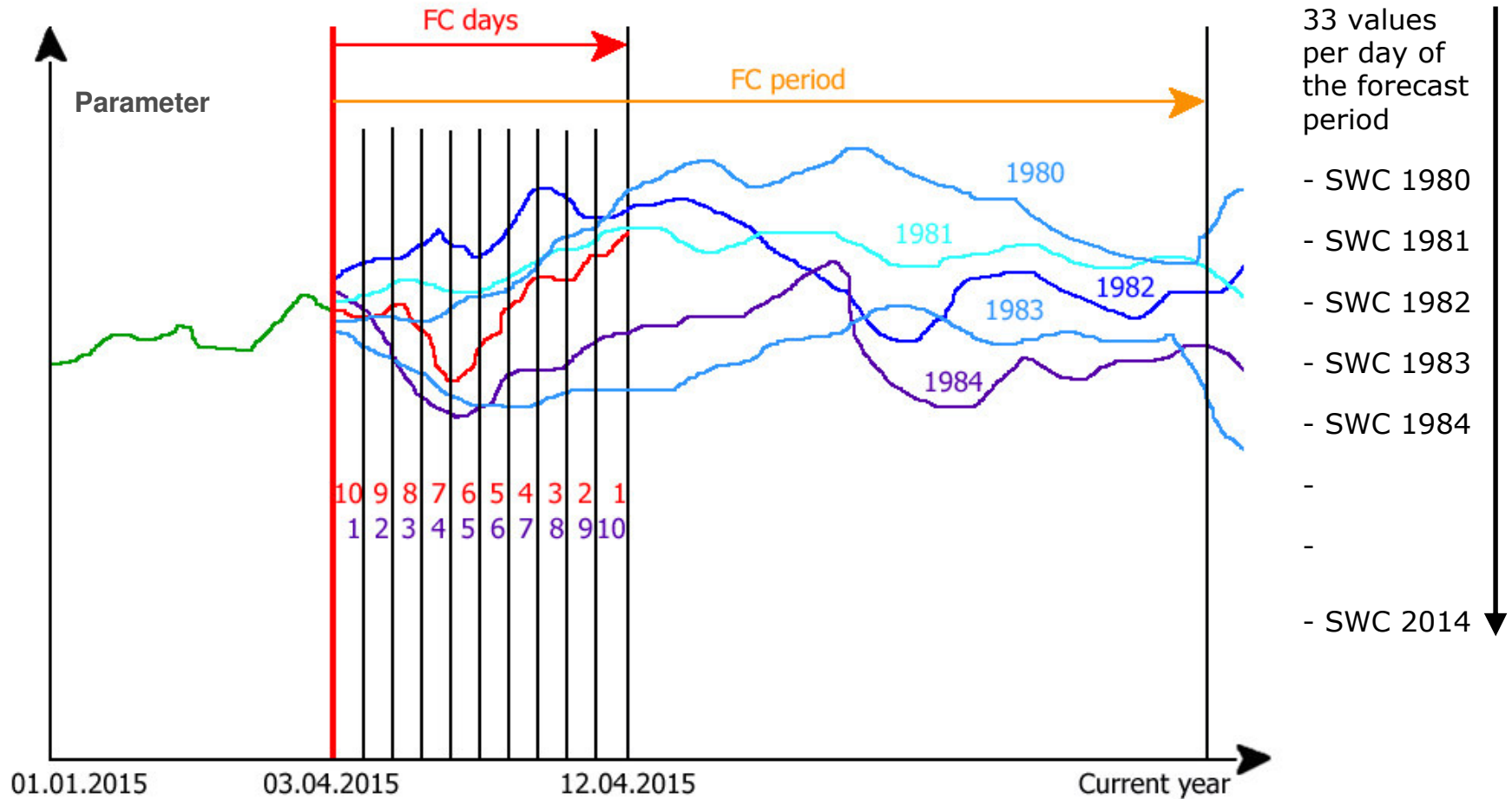
- KC, ETC, Interception, ETA, SWC for 2015 (using met data of 1980 – 2014 and forecast data) for the top and sub soil
- Selection: Root zone depletion value
Dr = 0 or Dr = Dr (31.12) => load Dr from netCDF files
- Selection: “variable crops”
- Selection: export KC, ETC, Interception, ETA, SWC as netCDF files
- Selection: evaluate on the fly





ADA Program – Water Balance Forecast Computation

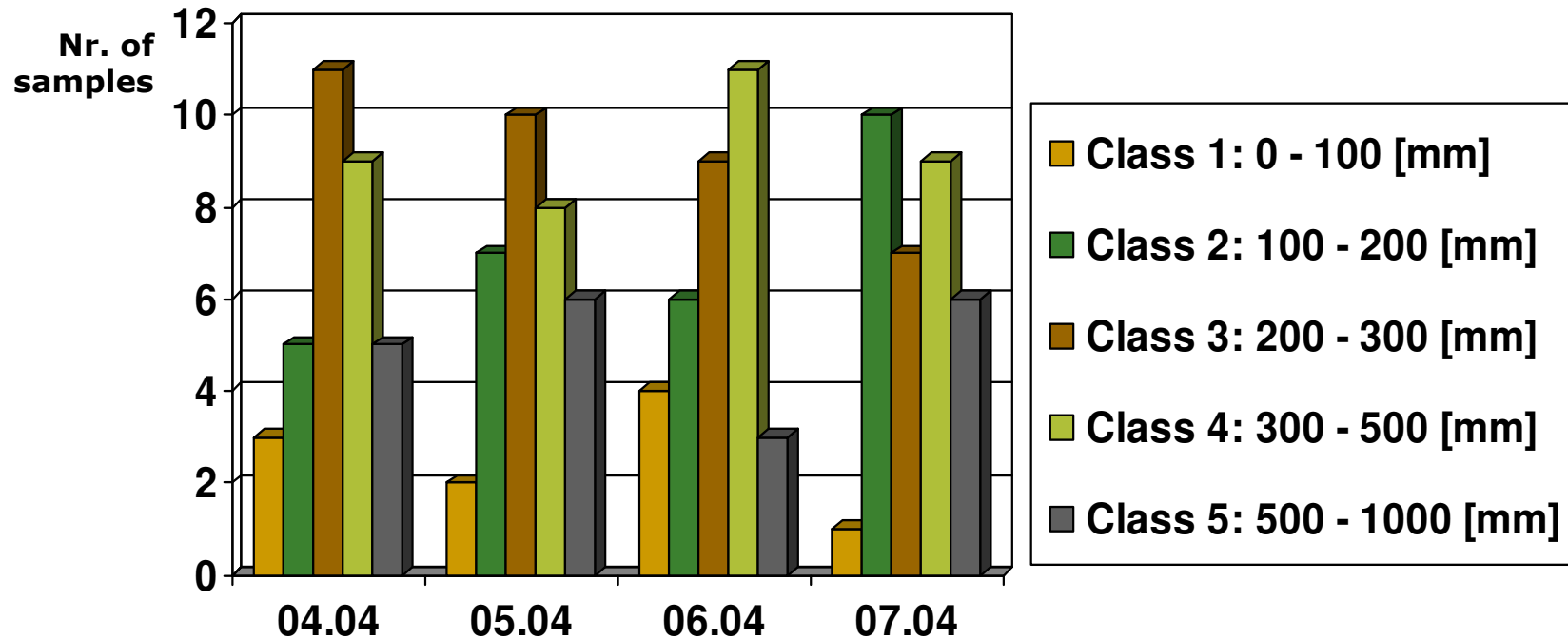
- Forecast using weighted meteorological data





ADA Program – Water Balance Forecast Computation






- Classify 33 SWC values for each day of the fc period



- export results as multidimensional netCDF files (for each day of the forecast period and for each „variable“ crop)



ADA Program / Source Data – Next steps

-  Translate SoilClim's forecast methods (ET₀, SWC, FC) from Delphi into Java and include the code or parts of it into the ADA program – MARCH 2015
-  Thorough testing and debugging – MARCH 2015
-  Development of automated procedure for I/O, computation and distribution of results (netCDF, PNG) on the web server – JUL 2015
-  Final Testing, debugging and adaptations – SEPT 2015
-  Format change of spatially interpolated weather data from ArcGIS to netCDF – JAN 2015



Questions that have to be answered

Heterogeneous agricultural areas -> arable land, grass or ignore?