AgroDroughtAustria - ZAMG

Christoph Wittmann, Alexander Kann, Florian Weidle

klima+ energie fonds

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WP no. 4

Development of drought specific forecasting products

Objectives of the WP:

1. Developing now- and forecasting data sets for GIS input routine
2. Implementing input data flow into GIS system
3. Testing quality and estimating uncertainty of now- and forecasting data sets

Methodology:

- Interfaces for model data
- running/producing relevant data sets for project partners
- developing algorithms to assess the uncertainty of relevant forecast parameters (precipitation, temperature)
- apply verification methods

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Current / next steps

Objectives 1+2:

- Interpolator from various model grids to MGI Lambert Projection (done)
- Development of converter INCA / ALARO / ECMWF data to netcdf file format needed by ArcGIS (partly done) ~~open questions about header definition / grid?~~
- Provide test data set (INCA analysis) to LFZ (done)
- FTP server/account for data exchange between ZAMG and project partners (done)
- Provide 1 year data set (INCA analysis) for different parameters ~~(open)~~ (done) (available since 2003)
- Provide full data set of INCA analyses ~~(open)~~ (done)
- Provide forecasts (ALARO, ECMWF) test data set (open) -> see later
- Provide probabilistic information (what can be used in drought monitoring/forecasting tool?) (open) -> see later

Objective 3:

- Assessment of the quality and uncertainty estimation of the different forecasting models (ongoing / open questions) -> see later

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ZAMG input for AgroDrought

extracted from meeting minutes (LFZ – ZAMG)

Parameter	ab Jahr	Forecast (d)	Auflösung	Anmerkung
Minimumtemperatur (24 h) [°C d^{-1}]	2003	3 bzw. 10	1 km*)	
Maximumtemperatur (24 h) [°C d^{-1}]	2003	3 bzw. 10	1 km	
Mitteltemperatur (24 h) [°C d^{-1}]	2003	3 bzw. 10	1 km	
Tagesmitteltemperatur (12 h) [°C d^{-1}]	2003	3 bzw. 10	1 km	abhängig von Modellen
Globalstrahlung [MJ m^{-2} d^{-1}]	2003	3 bzw. 10	1 km	Umrechnung auf MJ m^{-2}
Relative Luftfeuchte [% d^{-1}]	2003	3 bzw. 10	1 km	oder Evapotranspiration
Wind [m s^{-1} d^{-1}]	2003	3 bzw. 10	1 km	oder Evapotranspiration
Evapotranspiration (PM) [mm d^{-1}]	2003	3 bzw. 10	1 km	
Schneebedeckung (SWE) [mm d^{-1}]	2003	3 bzw. 10	1 km	vorerst nur Ja/Nein (mit W. Schöner besprechen)
Niederschlag [mm d^{-1}]	2003	3 bzw. 10	1 km	

*) Die räumliche Auflösung der Wettermodelle liegt ursprünglich bei 4.8km für die nächsten 3 Tage (ALARO) und ca. 16.km für die nächsten 10 Tage (ECMWF). Die Daten werden jedoch auf das 1km INCA Gitter interpoliert und in dieser Auflösung zur Verfügung gestellt.

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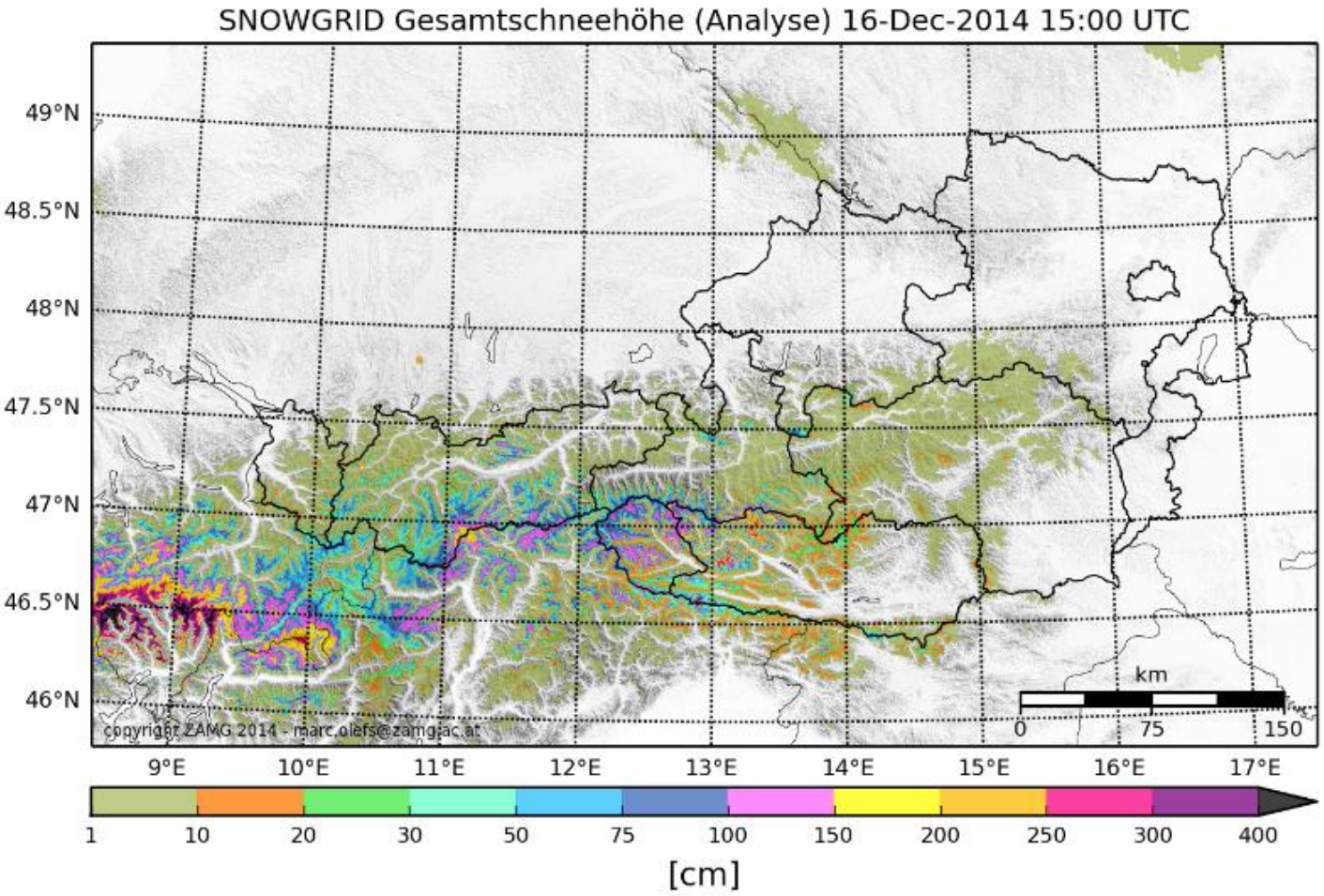
Snow analysis system (pre-operational version)



snow cover product needed? available starting with winter season 2013/2014

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Fact-sheet models

ECMWF Monthly/Seasonal Forecast System

ECMWF
16km, 00/12 UTC, +240h lead time, 6h time steps; ~8h after T0

ECMWF-EPS
32km, 00/12 UTC, +360h lead time, 50 members, 6h time steps; ~9h after T0

ALARO
5km, 00/06/12/18 UTC, +72h lead time, 1h time steps, ~3h after T0

LAEF
11km, 00/12 UTC, +72h lead time, 16 members, 1h time steps, ~4h after T0

AROME (~~experimental~~; operational since 01/2014, major upgrade in 08/2014)
2.5km, 8 runs, +48h lead time, 1h time step, ~3h after T0

INCA
1km, 5min/15min/hourly, +12h lead time, 5min/15min/1h time step, ~10 to 45min after T0

Ensemble INCA (experimental; operational by end 2013)
1km, 15min/hourly, +12h lead time, 15min/1h time steps, ~30 to 45min after T0

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Selection of the forecast models

Plan in the initial proposal:

- concentrate on (probabilistic) forecasts ranging from Nowcasting (next hours) to short term (3 days),
- medium range (up to 10 days) also mentioned, but less pronounced in the proposals

Suggestion for next steps:

- shift focus from nowcasting and short term range to medium and even long term range (monthly, maybe even seasonal) -> concentrate on ECMWF
- concentrate on evaluation of precipitation, temperature (and global radiation)
- keep short range inside (should not skip it) with sensitivity studies, but less pronounced (see next slides)
- we need to keep probabilistic approach
- INCA used for analysis and monitoring purpose, nowcasting seems to be not really interesting for the drought forecasting tool

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Probabilistic input for drought forecast system?

• deterministic forecast products available from different model systems (ECMWF, ALARO, INCA) for different forecast ranges

• probabilistic counterparts (ensemble systems) exist (ECMWF-EPS, LAEF, En-INCA)

To estimate forecast uncertainty ensemble system take into account:

• uncertainty in model initial conditions (observations, background errors,..)

• uncertainty in physical parameterizations for surface and upper air (multi-physics, stochastic physics,...)

• uncertainties in lateral boundary conditions (for LAM systems)

part of this work is done within AgroDrought ("*Assessment of the quality and uncertainty estimation of the different forecasting models*")

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Stochastic physics – sensitivity studies

modified tendency equation (by adding perturbation P')

$$\frac{\partial e_j}{\partial t} = A\left(e_j, t\right) + P'\left(e_j, t\right)$$

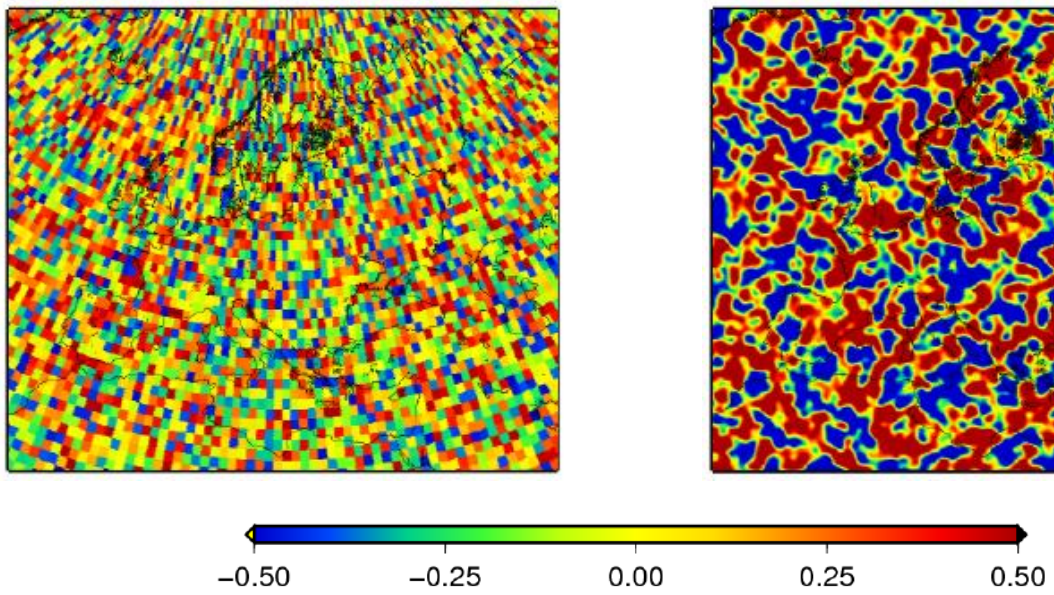
perturbation P' created with spectral pattern generator:

$$P'_j\left(e_j, t\right) = \left(1 + r_j(\lambda, \varphi, t)_{D,T}\right) P_j\left(e_j, t\right)$$

- surface temperature
- liquid soil water content
- frozen soil water content
- snow albedo
- snow reservoir water content
- snow density
- water intercepted by vegetation

old pattern generator

new pattern generator



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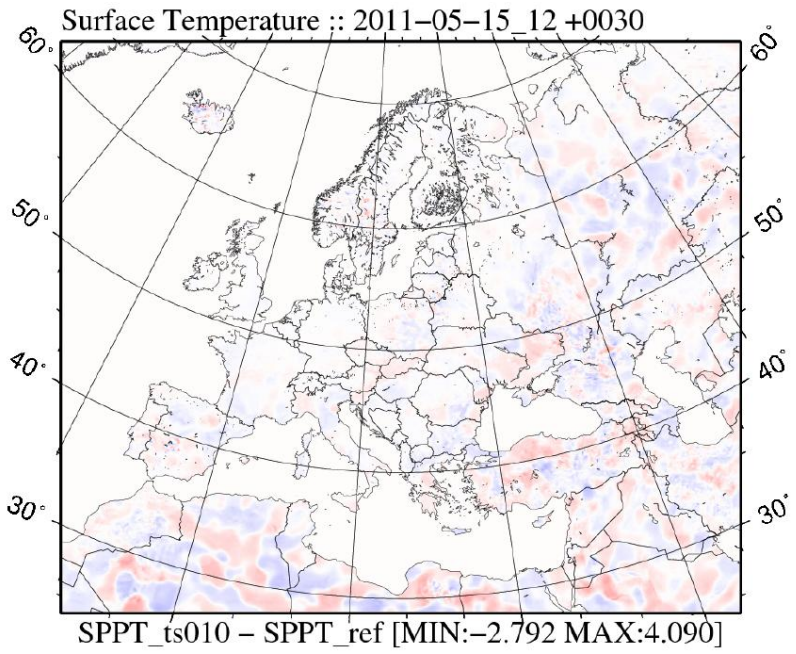
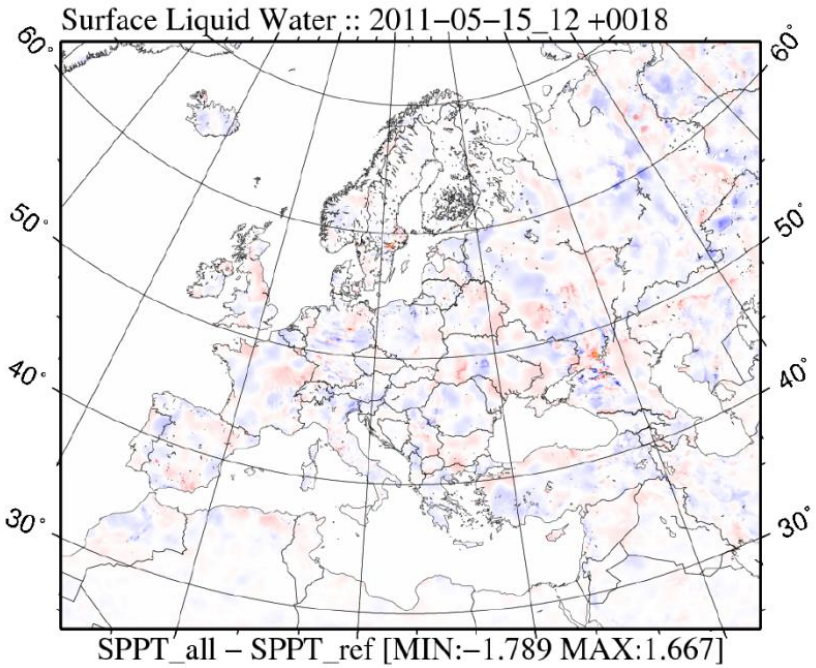
Stochastic physics – sensitivity studies II

significant effect on forecast (example: surface temperature and humidity)





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next steps / discussion

- agree on the shift of WP3 focus (towards the need of the project partners)
- agree on forecasts data sets and models which should drive the drought forecast system (suggestion: concentrate on medium range / long term range)
- finalize the data interface (model data -> netcdf)
- prepare forecast test data sets
- probabilistic / ensemble information for drought forecast system (2 possibilities: 1) use probabilities, 2) use more than 1 model run
- evaluation of forecast quality (temperature, precipitation, [global radiation]) once we agreed on forecast data set
- continue sensitivity studies (stochastic [surface] physics) and evaluate effect on relevant forecast parameters

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