

Meteorological Consulting Related to the Dendrite Generator Test Period in the Kitzsteinhorn Region, 2012

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Outline

- Introduction
- Verification Results
- Simulated Time Series
- Estimation of “Snow Making Potential“ for the Kitzsteinhorn Area
- Summary

Example of Real-Time MetGIS Forecast

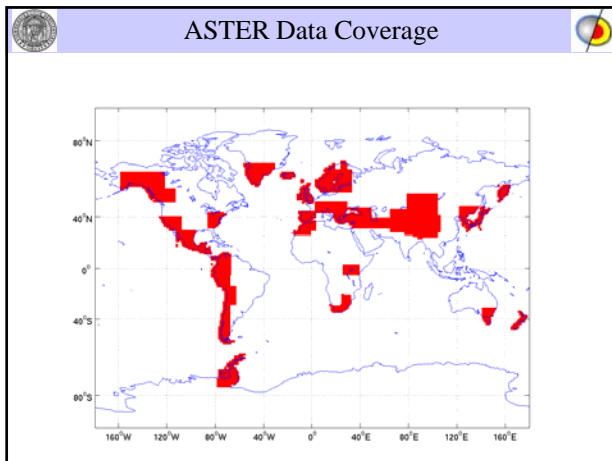
MetGIS Advances

Year	# of Fcst Regions	# of Fcst Param.	# of lang.	Java Source Code (Classes)	Major Technical Advances
2006	0	0	0	0.87 MB (52)	Preparation of Web-GUI and automated forecast construction
2007	7	5	2	1.04 MB (60)	NOMADS-GFS backup server Color Areas forecast mode
2008	23	5	3	1.11 MB (60)	NOMADS-HD- Server
2009	41	5	4	1.24 MB (60)	Raster data output, point forecast construction, forecast range incr. to 48 hours, digital globe forecasts
2010	48	7	4	1.34 MB (61)	LINUX-Server, ASTER-terrain data, PNG file output format, fcst values beside city names
2011	59	7	4	2.02 MB (77)	MetGIS-WRF forecast introduction, GUI tooltip texts, parallelized forecast calculation
2012	180	12	7	2.16 MB (84)	Language interface, weather forecasts for pass roads and ascent routes, website renewal

MetGIS Regional Forecast Areas

- World-wide 29 Forecast Zones, each including ~ 3-15 Fc. Areas
- Total: ~ 180 Forecast areas with several forecast updates a day

MetGIS Realtime-Forecasts: Seven Summits



Introduction to DG-related work

- High resolution forecasts produced by MetGIS were available for the DG test period.
- Two versions of MetGIS:
 - GFS (NCEP)
 - WRF (initialized from GFS data)
- Resolution:
 - GFS ~40km
 - WRF 6km
 - MetGIS ~50m

Reference Data

- SYNOP reports from stations Rudolfshütte, Schmittenhöhe and Zell am See throughout test period
- 25 year temperature time series of station Rudolfshütte

Verification Results

6h Precipitation totals at Rudolfshütte (2310m)

GFS From 20120101 to 20120403:

Forecast range	00-06h	24-30h	48-54h	72-78h	96-102h	120-126h
checked Forecasts:	111	109	106	103	101	99
Forecast OK(<0.1 mm and >=0.1 mm, y/n):	82.73	80.56	82.86	77.45	72	63.27

WRF From 20110101 to 20110403 and 20120101 to 20120403:

Forecast range	00-06h	24-30h	48-54h
checked Forecasts:	198	199	199
Forecast OK(<0.1 mm and >=0.1 mm, y/n):	76.14	72.73	74.75

Verification Results

Temperature at Rudolfshütte

GFS From 20120101 to 20120403:

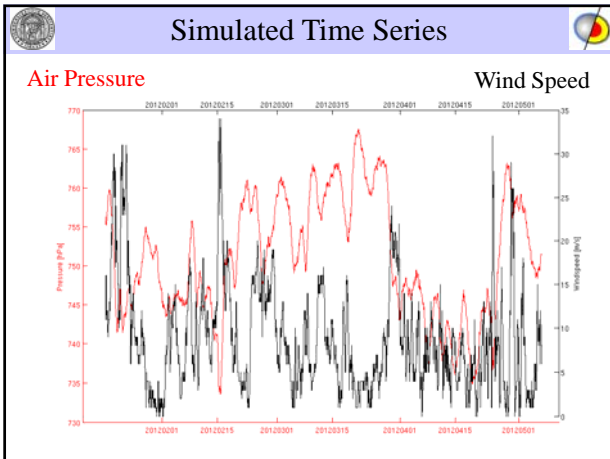
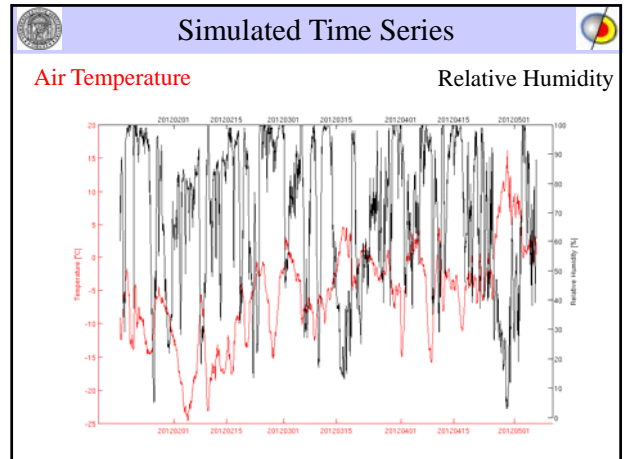
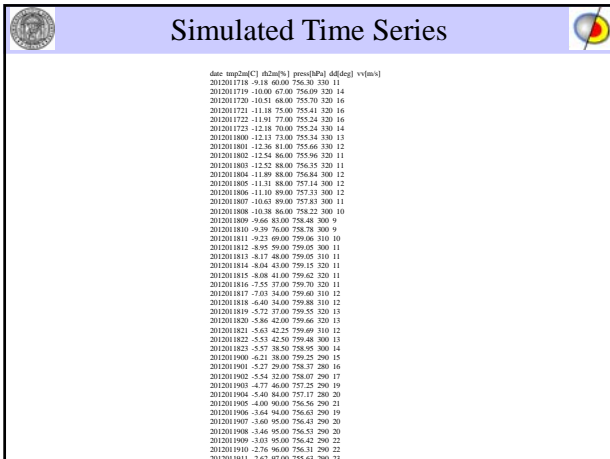
Forecast range [h]	24	48	72	96	120	144	168
checked forecasts	340	336	332	328	324	320	316
Forecast within 1:	51.1765	47.3214	39.1566	31.4024	28.7037	27.1875	21.519
Forecast within 2:	75	75.5952	68.3735	58.8415	52.1605	45.9375	35.1266
Forecast within 3:	89.7059	87.5	86.1446	75.9146	69.4444	61.25	50.9494
Bias:	-0.54103	-0.50568	-0.54346	-0.75369	-1.0082	-1.1589	-1.3059
Mean Absolute Error:	1.3349	1.445	1.6496	2.1047	2.5443	3.0007	3.7487
Correlation Coefficient:	0.97218	0.96564	0.95726	0.92584	0.8788	0.83251	0.74038

WRF From 20110101 to 20110403 and 20120101 to 20120403:

Forecast range [h]	0	12	24	36	48	60	72
checked forecasts	182	177	181	175	180	174	179
Forecast within 1:	51.6484	36.1582	38.674	32.5714	36.1111	27.5862	31.2849
Forecast within 2:	75.8242	61.5819	69.6133	54.8571	60.5556	51.7241	54.7486
Forecast within 3:	93.956	80.791	84.5304	74.2857	82.2222	70.1149	75.419
Bias:	-0.83286	-1.2308	-0.71105	-1.4497	-0.83422	-1.6932	-1.1303
Mean Absolute Error:	1.2418	1.8927	1.6866	2.0743	1.823	2.279	2.0785
Correlation Coefficient:	0.97604	0.93876	0.94426	0.93558	0.93888	0.92549	0.92526

Simulated Time Series

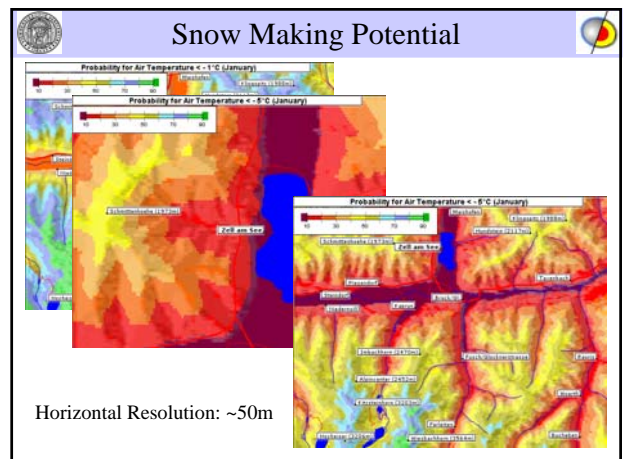
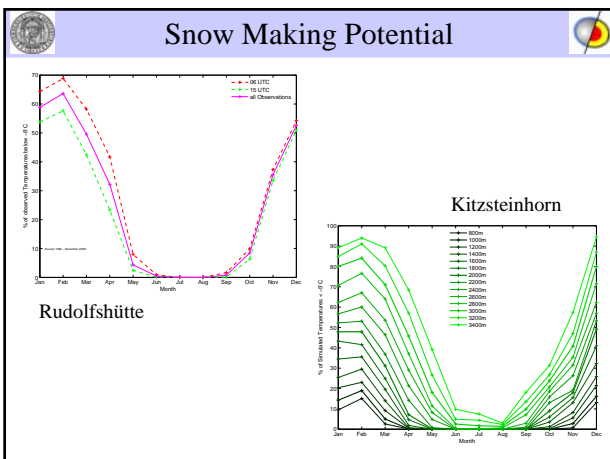
- Merged from hourly 3-30hour MetGIS-WRF forecasts
- Forecast hours 27-30 are blended with next days 3-6 hour forecast
- Downscaled to test site
- Temporal resolution: 1h
- Parameters: temperature, humidity, pressure, wind-speed and direction



Snow Making Potential

How high are the possibilities for temperatures below a threshold each month?

- ♥ Analysis of Rudolfshütte temperature time series (25y).
- ♥ Analysis of MetGIS temperature fields (5y).





Summary



- Verification of forecasts indicates that the absolute errors of the simulated temperatures are less than $\sim 2.5^{\circ}$ C in 75% of cases.
- MetGIS can be used to estimate a "Snow Making Potential", using a combination of
 - Meteorological observation Data
 - Gridpoint Data of Numerical Weather Prediction Models
 - High Resolution Terrain models
- This estimation can be done for the future, using the output of climate simulation models (technique available, computer time and data storage needed).
- Estimation could be done world-wide, due to international applicability of MetGIS forecasts.