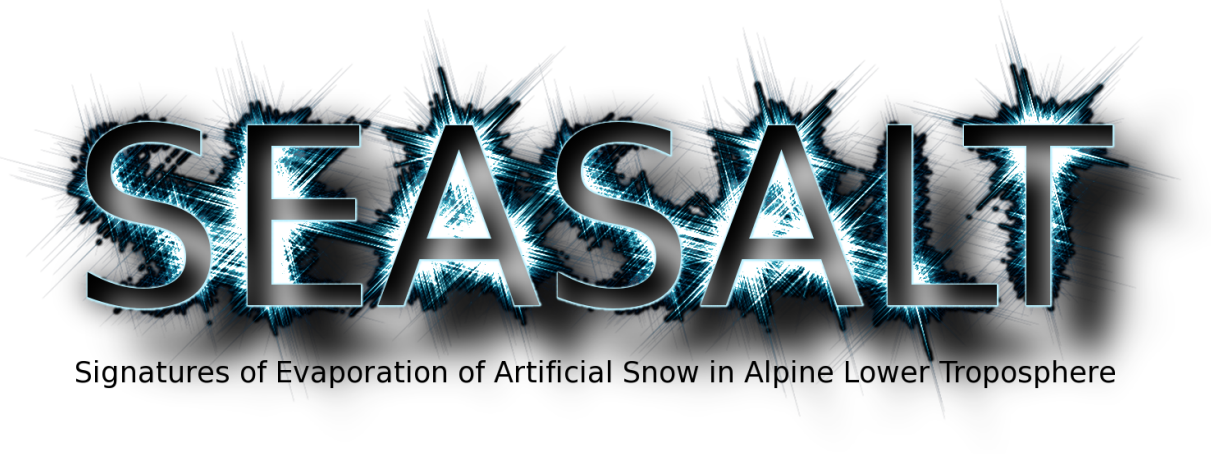

Campaign Diary

Sylwester Arabas*(editor, quick-looks), Lisa Haga†(meteo),
Wolfgang Junkermann‡(pilot's comments),
Bartosz Kulawik§(GIS, photos) and Pierre Paccard¶(quick-looks, tables)

March 29, 2008
(covers period: Feb. 23 – Mar. 8, 2008)

Abstract

The report is a set of notes taken during the SEASALT campaign summarizing activities carried out by the SEASALT team in Niederoeblarn, Austria. Document includes information on weather conditions, conducted flights, preliminary quick-look data as well as other information on team activities. Quick-look data covers airborne measurements made on board the ENDURO ultralight trike and four ground-based meteo stations located in Niederoeblarn, Groebming, Ramsau and Randstadt. The diary includes preliminary information and is intended to be a source of general information about the campaign for users of the SEASALT data-set.

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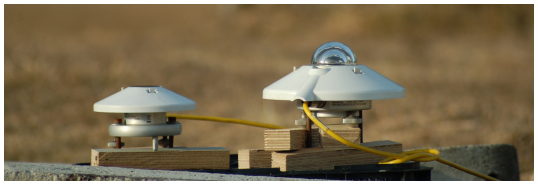

Figure 2: IGFUW radiometers deployed on the Niederoeblarn airport

1 2008-02-23

1.1 Diary entry

- morning: student team arrival in Vienna
- afternoon: transport to Niederoblarn
- evening: meeting with WJ

2 2008-02-24 / tf01

2.1 Diary entry

- morning: aircraft and ground-stations assembly (by 2pm) see figs 1, 2 and 3

Figure 3: IGFUW automatic meteo-station and EDYTEM temperature sensors deployed on the Niederoeblarn airport (both on the EDYTEM mast)

- afternoon: first test flight of the ENDURO (about 4pm)
- evening: WJ presented a talk on history and capabilities of ENDURO

2.2 Meteorological conditions

Perfect flying conditions in the valley, see figures 4 and 5.

2.3 Groud-based stations data

See figure 6.

2.4 Test-flight 01

Pilot's comments

- good visibility above 5000 ft
- flight east of the airport with one ascent and $\sim 20min$ constant level north of the airport waiting for the landing (radio problems)
- fairly calm conditions, no clouds

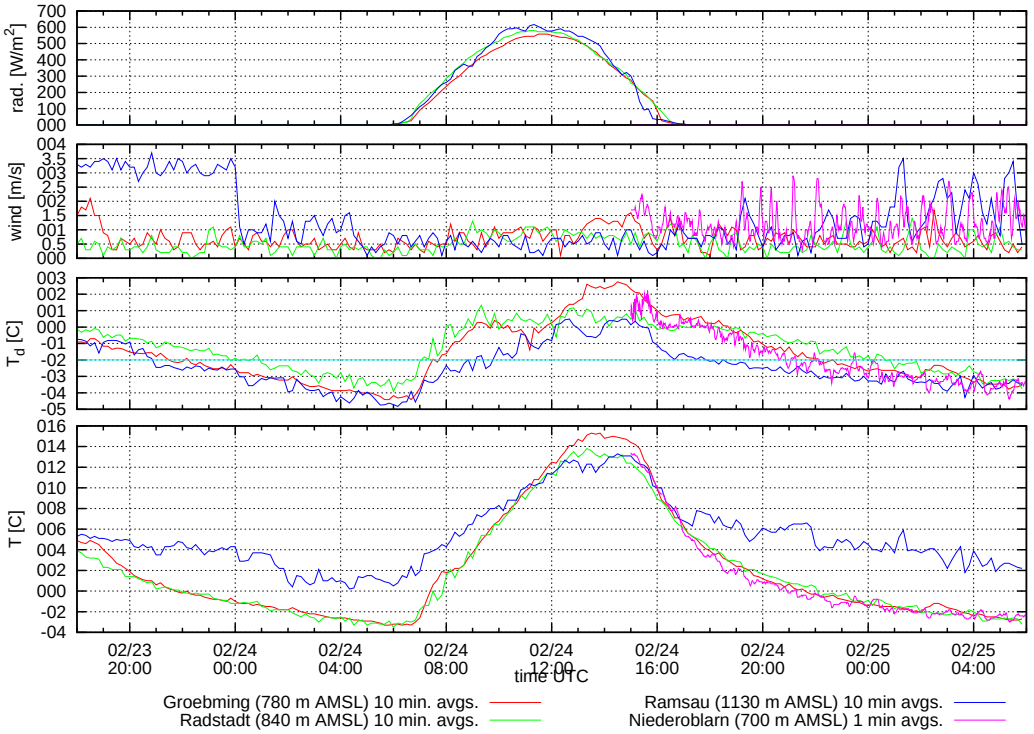

Figure 6: Ground-based data measured in three ZAMG stations and IGFUW station deployed in Niederoeblarn for Feb 24th

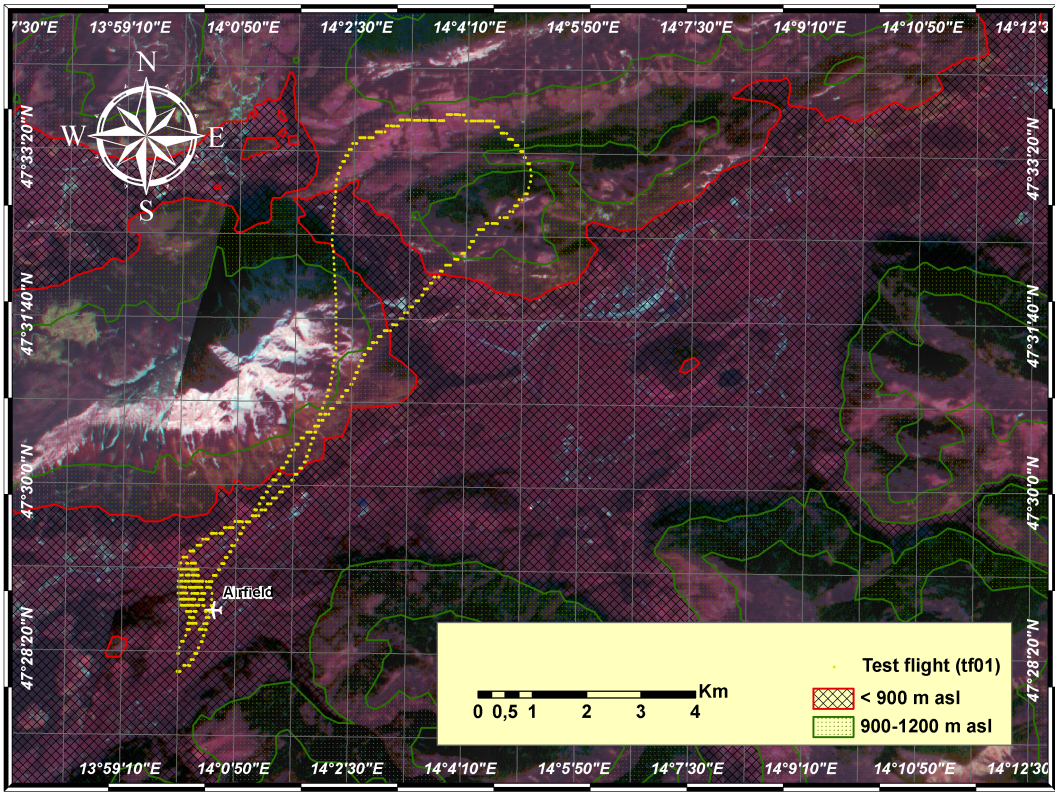

Figure 7: Test flight 01 trajectory projected on Aster mosaic images with DEM shading in background

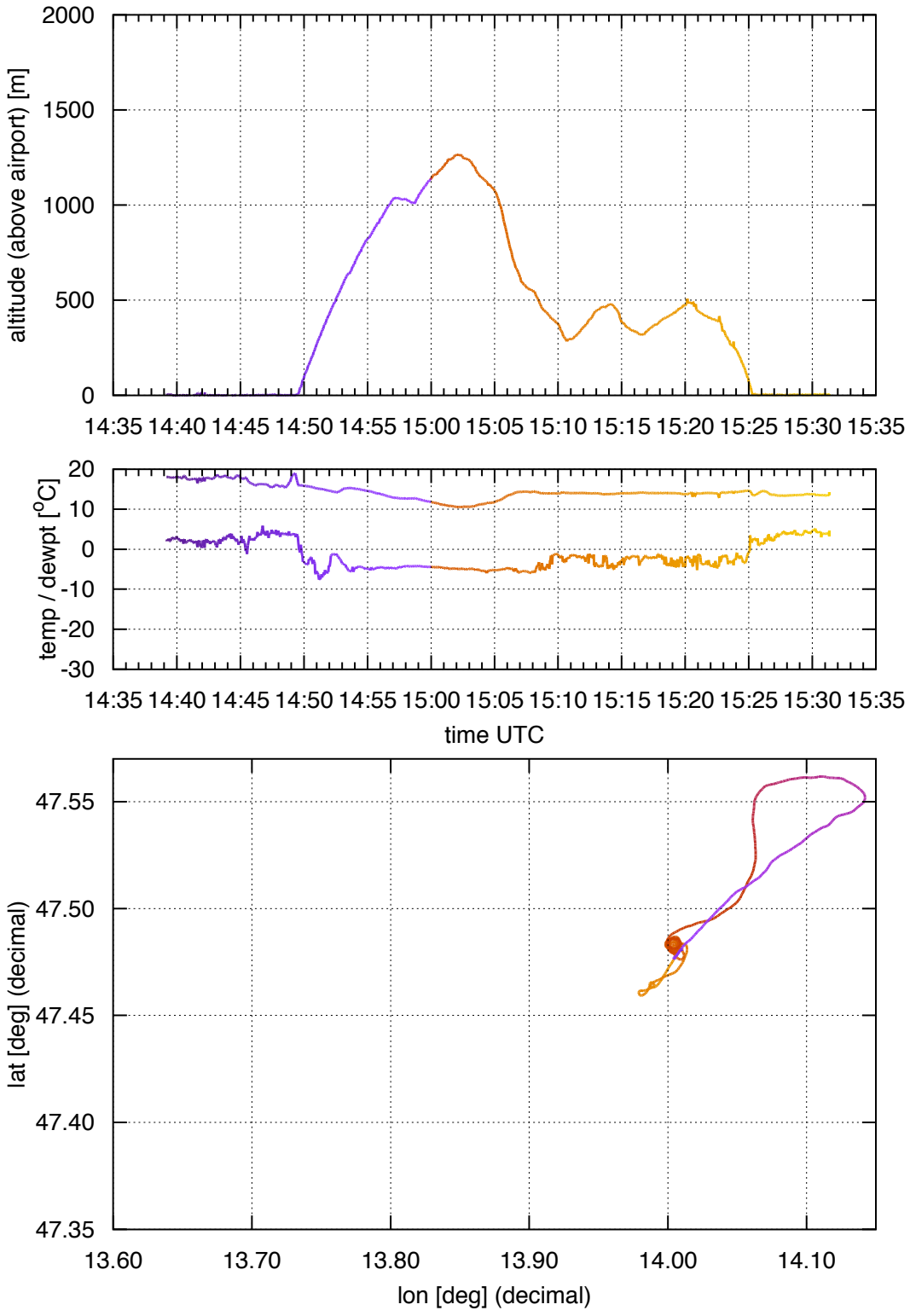

Figure 8: Test-flight 01 altitude, temperature and dewpoint profile together with trajectory plot (plot ranges common with similar plots for all other flights for comparison).

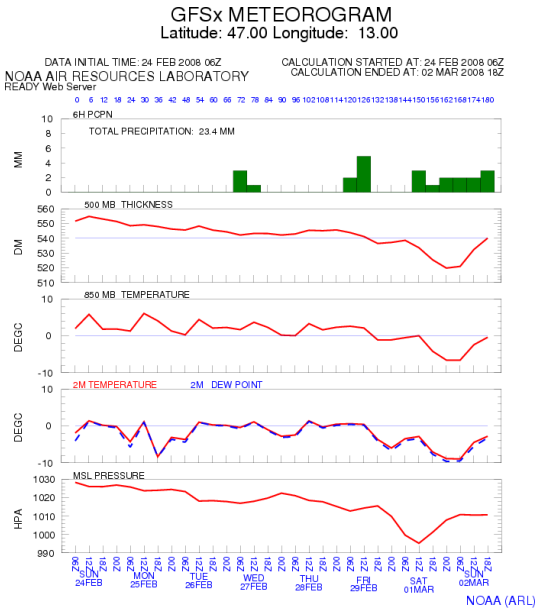

Figure 4: GFS model forecast meteogram for Feb 24th + one week

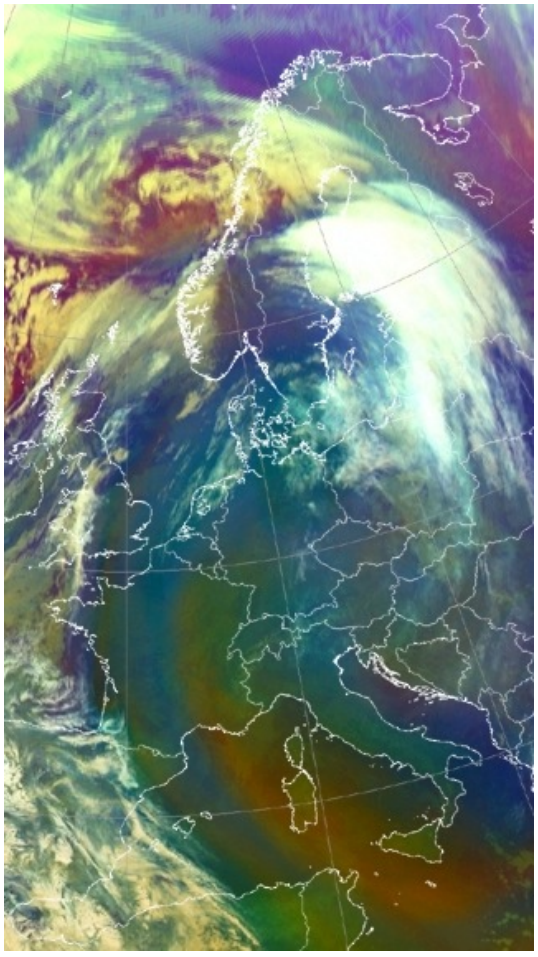

Figure 5: Meteosat 9 RGB composite taken at 06:00UTC Feb 24th 2008

3 2008-02-25 / rf01

3.1 Diary entry

- morning: groud-base sensors maintenance, visit to snow-production company in Haus
- afternoon: first research flight (about 2pm)
- evening: PP gives a talk on his background + some theory on snow production

3.2 Meteorological conditions

Clear and sunny weather (see figs 9, 10). The temperatures in the valley are too high for snow-making, in the night we had temperatures below 0 degrees, inversion. No rain expected until wed and temperatures over 10 deg. Fairly light winds shifting in direction, during the day also moderate wind and wind gusts expected.

3.3 Groud-based stations data

See figure 11.

3.4 Research-flight 01

Pilot's comments

- northerly flow causing turbulence in the valley (southerly slopes)
- a stratiform layer of high alt. cirrus clouds
- not very well defined PBL top (due to advection of a different air-mass)
- 3 legs @3000 ft, 1 leg @5000 ft, 2 soundings (Schl., Nied.) till @8000 ft
- difficulties to obtain a constant climb rate (updrafts and downdrafts in the valley)

3.5 Summary of discussion with snow-making people at Haus

- 110 snowguns (low pressure and high pressure)
- they start to produce sow with -2C (automatic system), but they can start with +1C

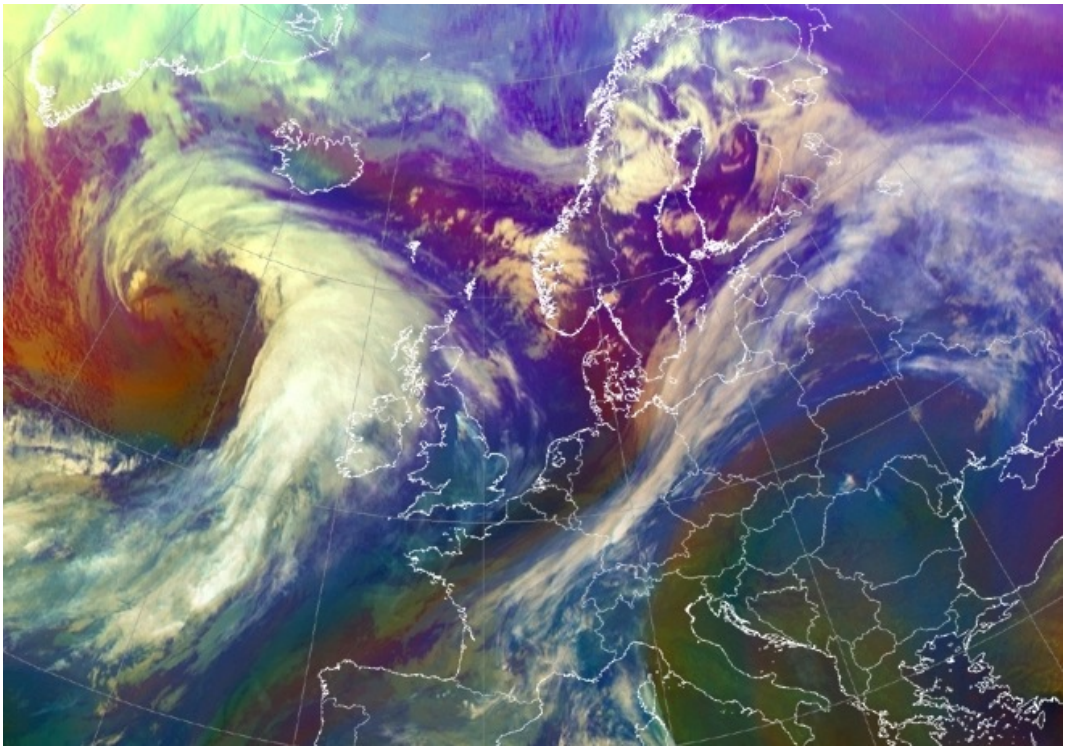

Figure 9: Meteosat 9 RGB composite taken at 06:00UTC Feb 25th 2008

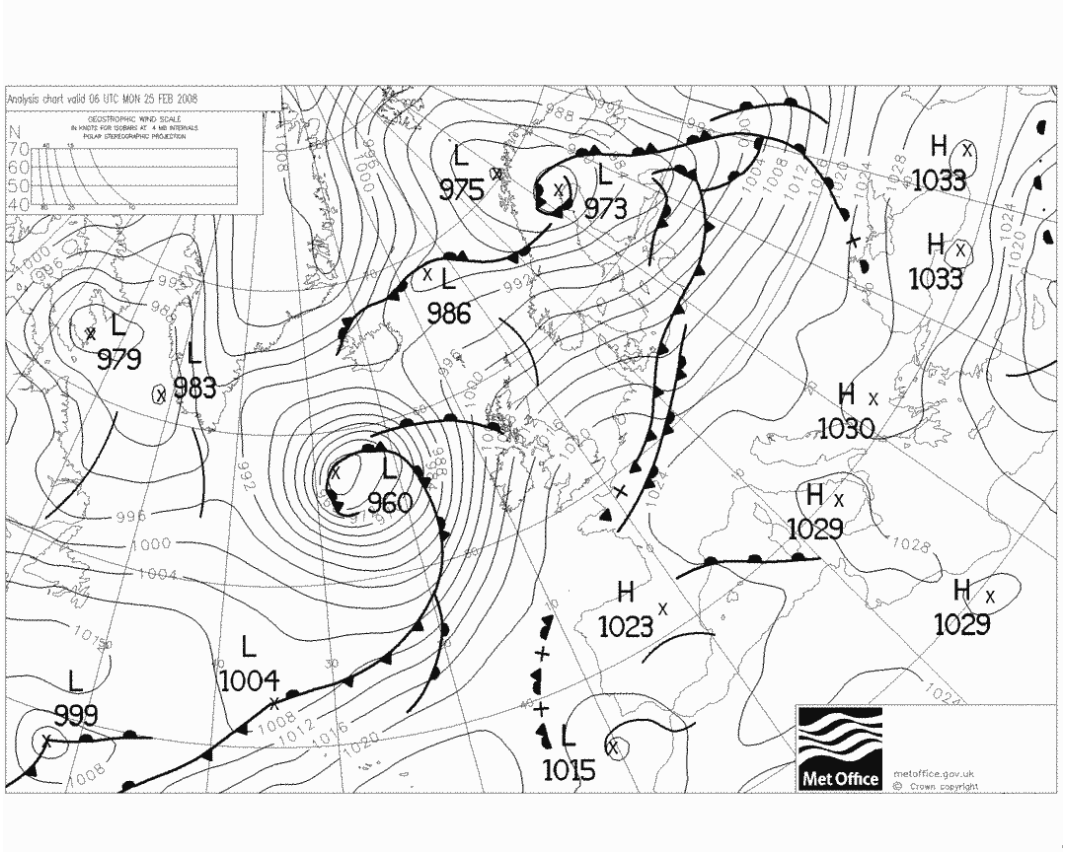

Figure 10: UK MetOffice Synoptic map (analysis) for 06UTC Feb 25th 2008

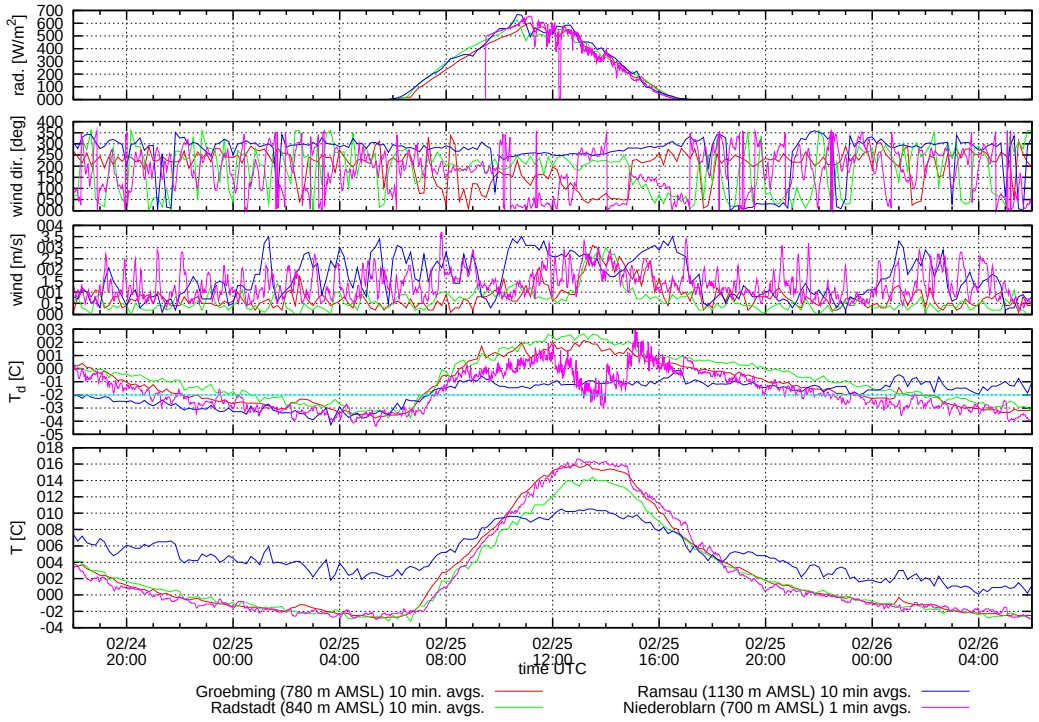

Figure 11: Ground-based data measured in three ZAMG stations and IGFUW station deployed in Niederoeblarn for Feb 25th

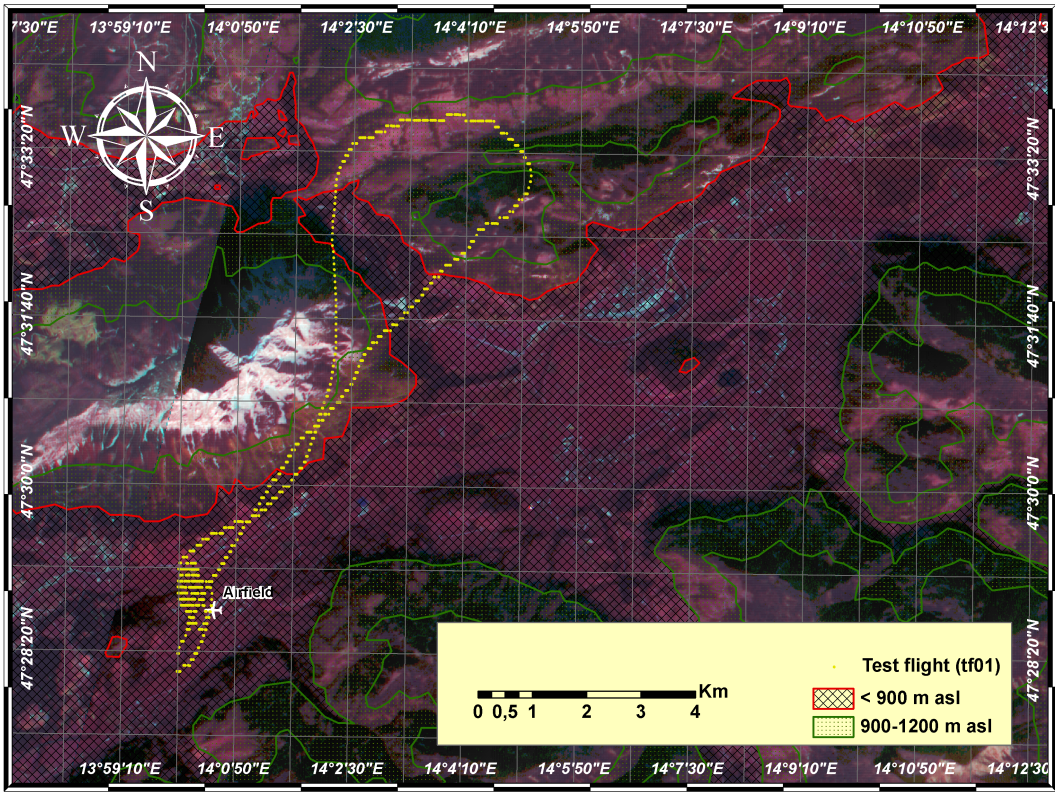

Figure 13: Research flight 01 trajectory projected on Aster mosaic images with DEM shading in background

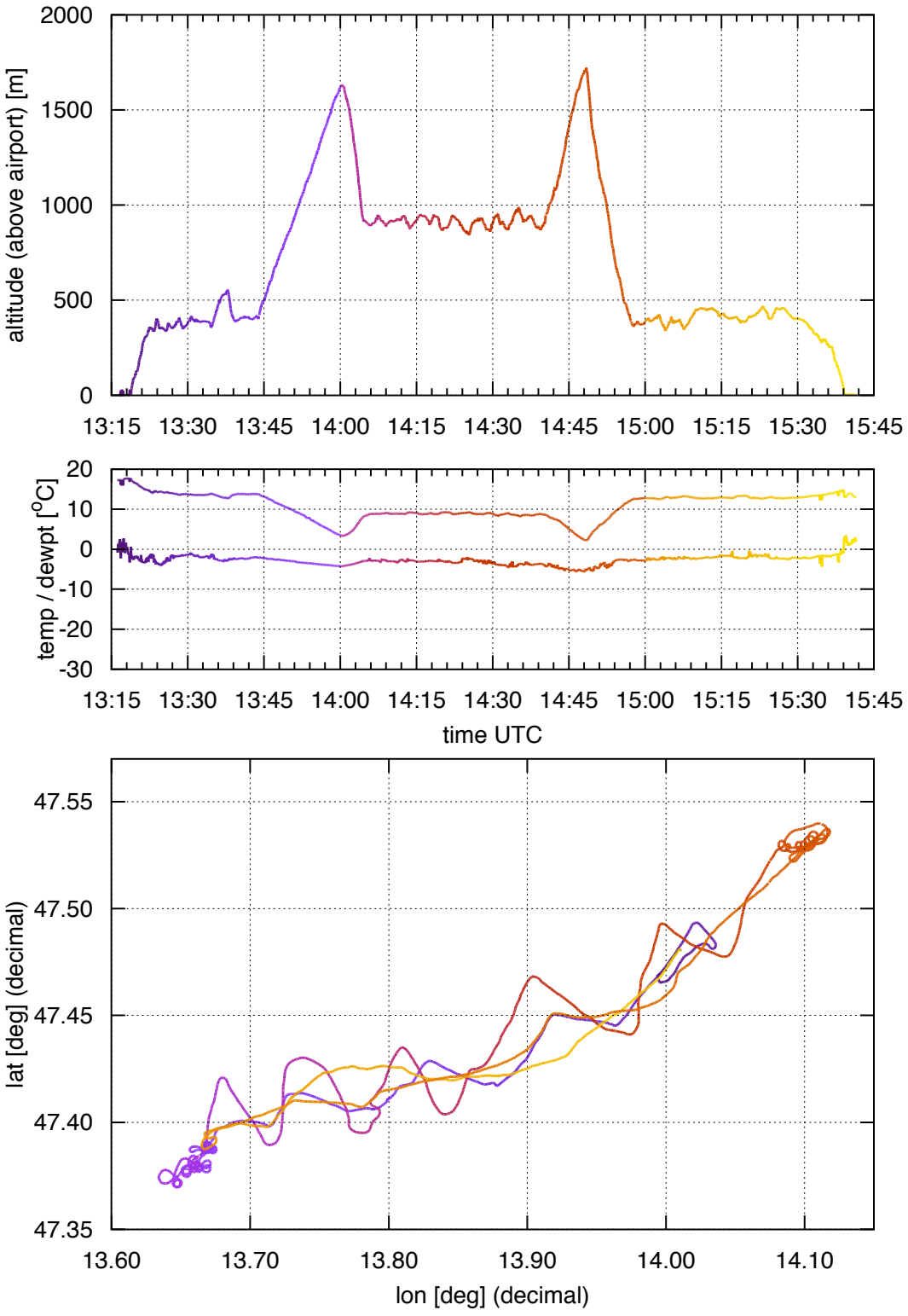

Figure 14: Research-flight 01 altitude, temperature and dewpoint profile together with trajectory plot (plot ranges common with similar plots for all other flights for comparison).

Figure 12: ENDURO overflying airport at the beginning of the rf01

- consumption : 20 liter per second and per snowgun (72 m3/h)
- 500000 m3 of water in 1 week = 1 million m3 of artificial snow
- (fog in the valley when they produce this snow)
- 80% of the production in October and November
- No additive in the water (but It may be that they use it, for a ski competition for example)
- Additives are not legal

4 2008-02-26 / rf02

4.1 Diary entry

- morning: second research flight (about 10 am)
- afternoon: aircraft maintenance (TSI repaired), phone call to snow making people in Planai/Schladming
- evening: LH and SA give talks on their background

4.2 Meteorological conditions

The temperature was a few degrees below zero point(inversion) at night and early morning. A ridge of high pressure keeps the weather sunny and clear during the morning and afternoon with good visibility and maximum temperature around +10-16 degrees. SW light winds during the day, increasing in the evening when a new cold front is approaching from the west making condition cloudy during the night and the next day. In this front we have light rain(1-3mm) falling on Tuesday night and Wednesday morning. No snowmaking.

4.3 Groud-based stations data

See figure 15.

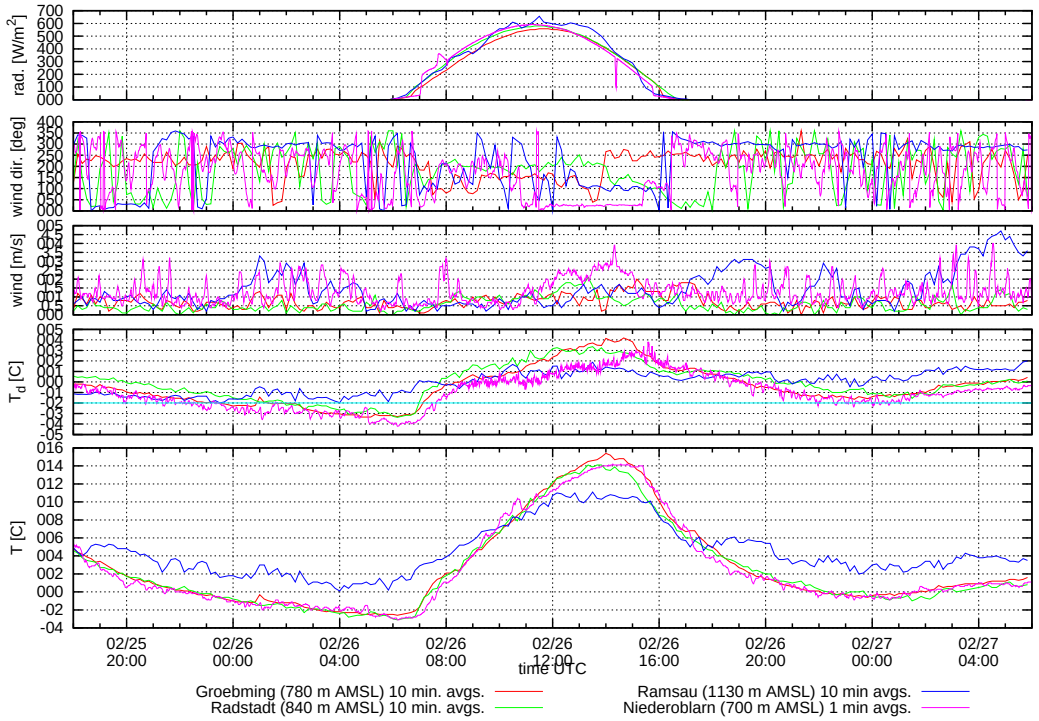

Figure 15: Ground-based data measured in three ZAMG stations and IGFUW station deployed in Niederoeblarn for Feb 26th

4.4 Research-flight 02

Pilot's comments

- 3 legs @3000 ft, 1 leg @5000 ft, 2 soundings (Schl., Nied.) till @8000 ft, 4 low level passes (misaproaches) over the airport @10 m
- very calm weather
- good visibility above 8000 ft
- some haze above the PBL top
- inversion at about 7000 ft
- easy obtainable continuous climb rate
- a wood-burning plume visible near the northern slope, far in the valley

4.5 Summary of phone-call to snow-making people at Planai

- they are currently not producing the snow (atm. conditions not met)
- they might produce snow in the nearest days (repair) if conditions are met
- they use the $T_d = -4°C$ threshold
- they have a reservoir-lake which is now 60%*empy*

4.6 rf02 data quick-looks

Soundings

See figs 18 and 19

Particle size spectrum

A short analysis was carried out comparing results of measurements with the SMPS spectrometer comparing values measured on the southern and northern slopes of the valley. The division of the valley was based on the Enns river location (see map on fig. 20). See figure 21 for results.

Water vapour distribution

See figs 22, 23, 24 and 25 for some quick-look analysis of water vapour distribution along the valley axis as well as it's vertical distribution. The set of plots compares actual mixing ratios with values

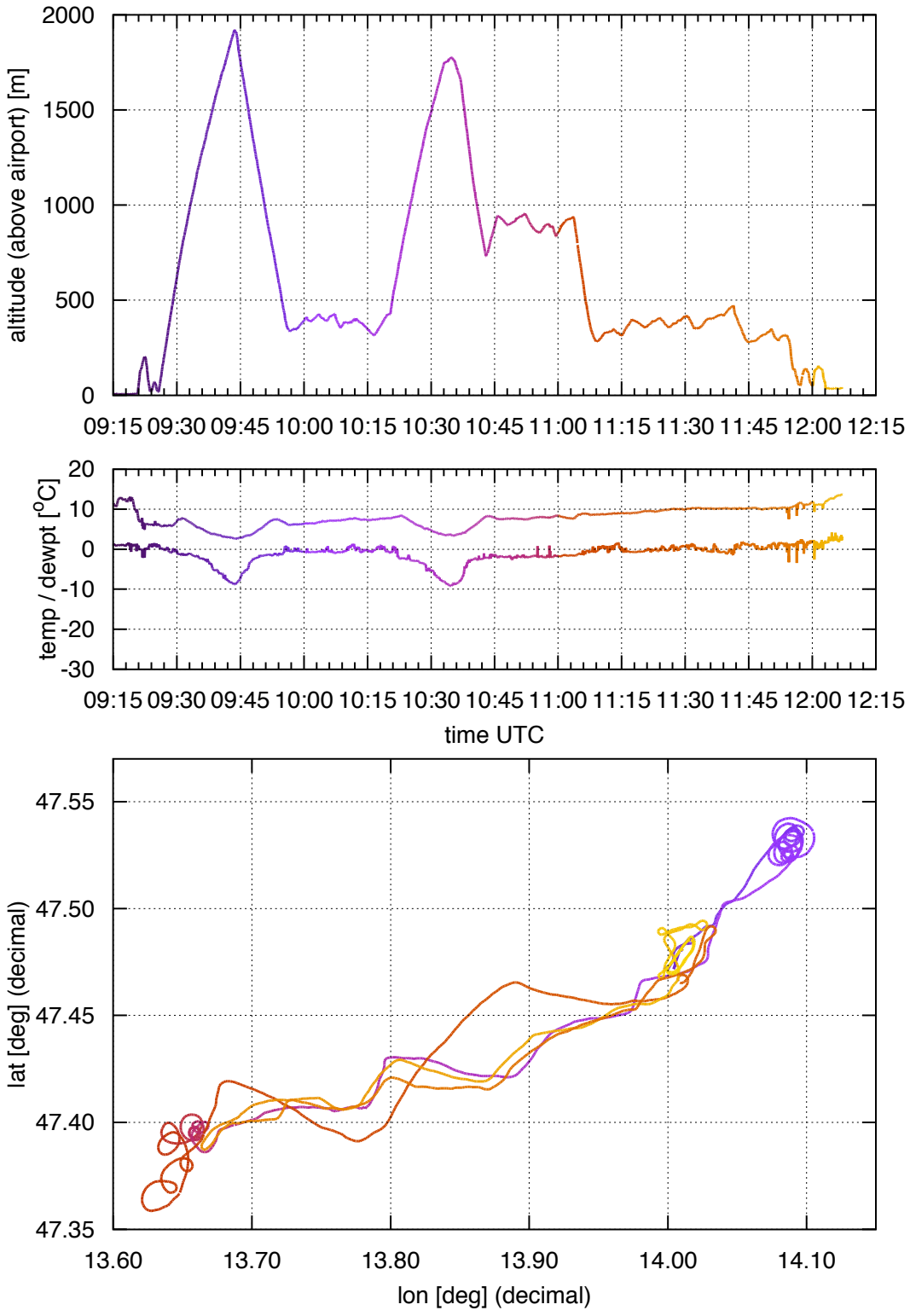

Figure 16: Research-flight 02 altitude, temperature and dewpoint profile together with trajectory plot (plot ranges common with similar plots for all other flights for comparison).

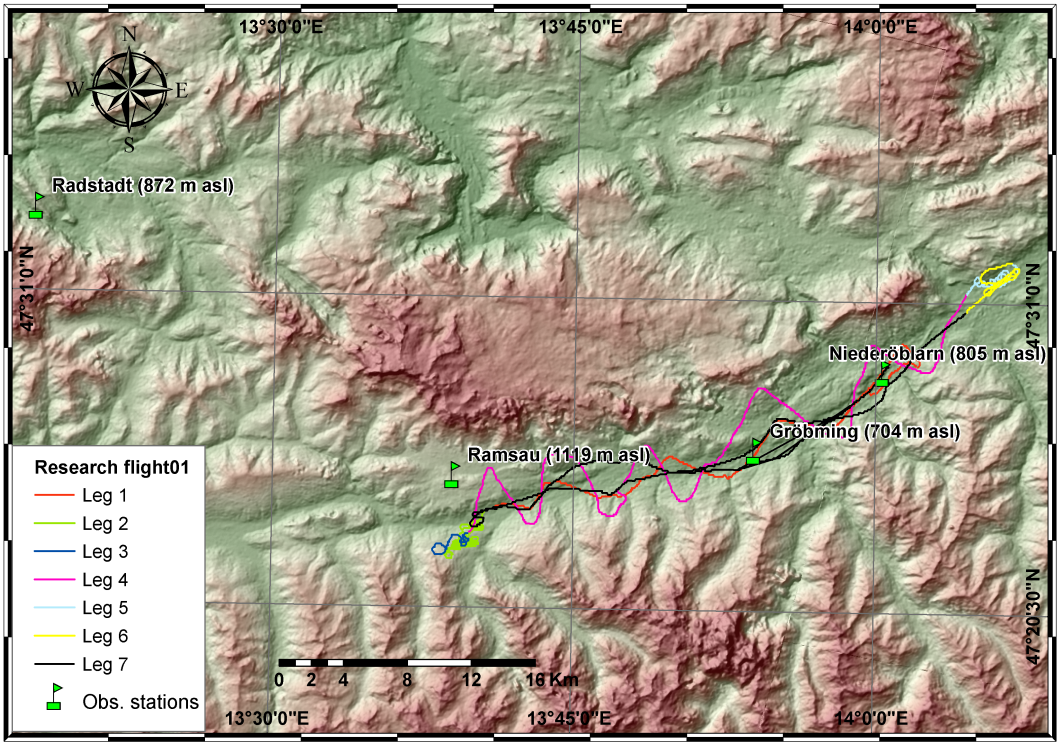

Figure 17: Research flight 02 trajectory projected on a rendered DEM with locations of the ground-based measurement stations highlighted

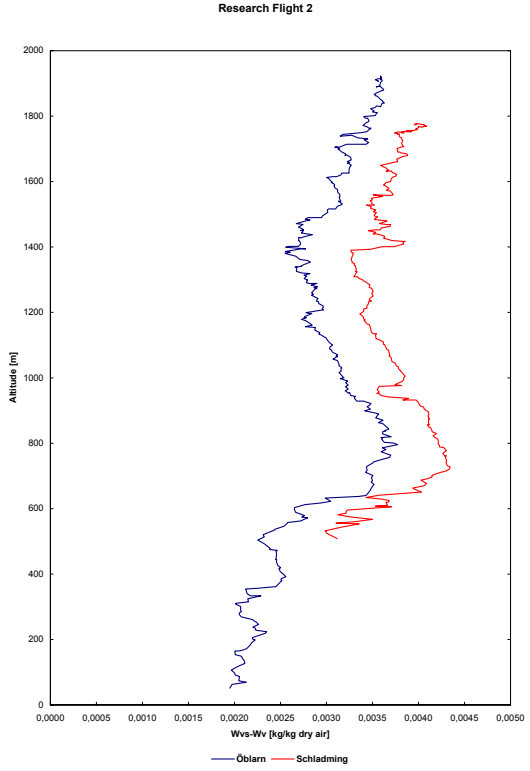

Figure 24: Vertical profiles of water vapour mixing ratio subtracted from its saturated value for the two soundings performed on rf02

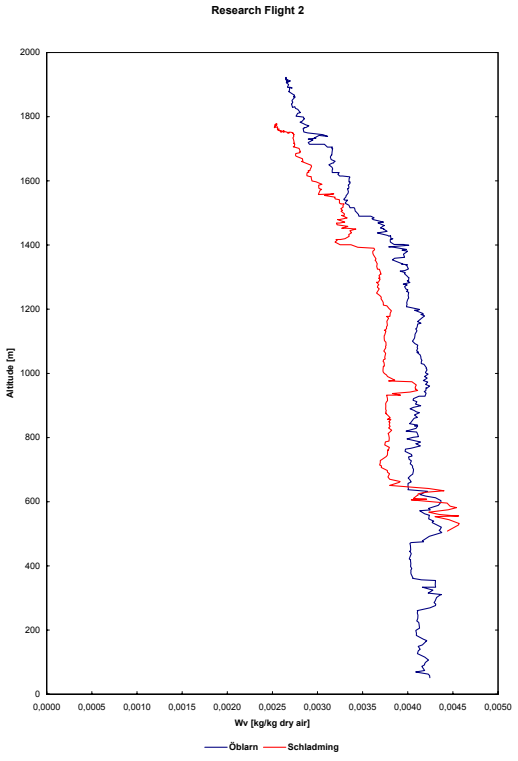

Figure 25: Vertical profiles of water vapour mixing ratio measured during two soundings performed on rf02: above Oblarn and Schladming

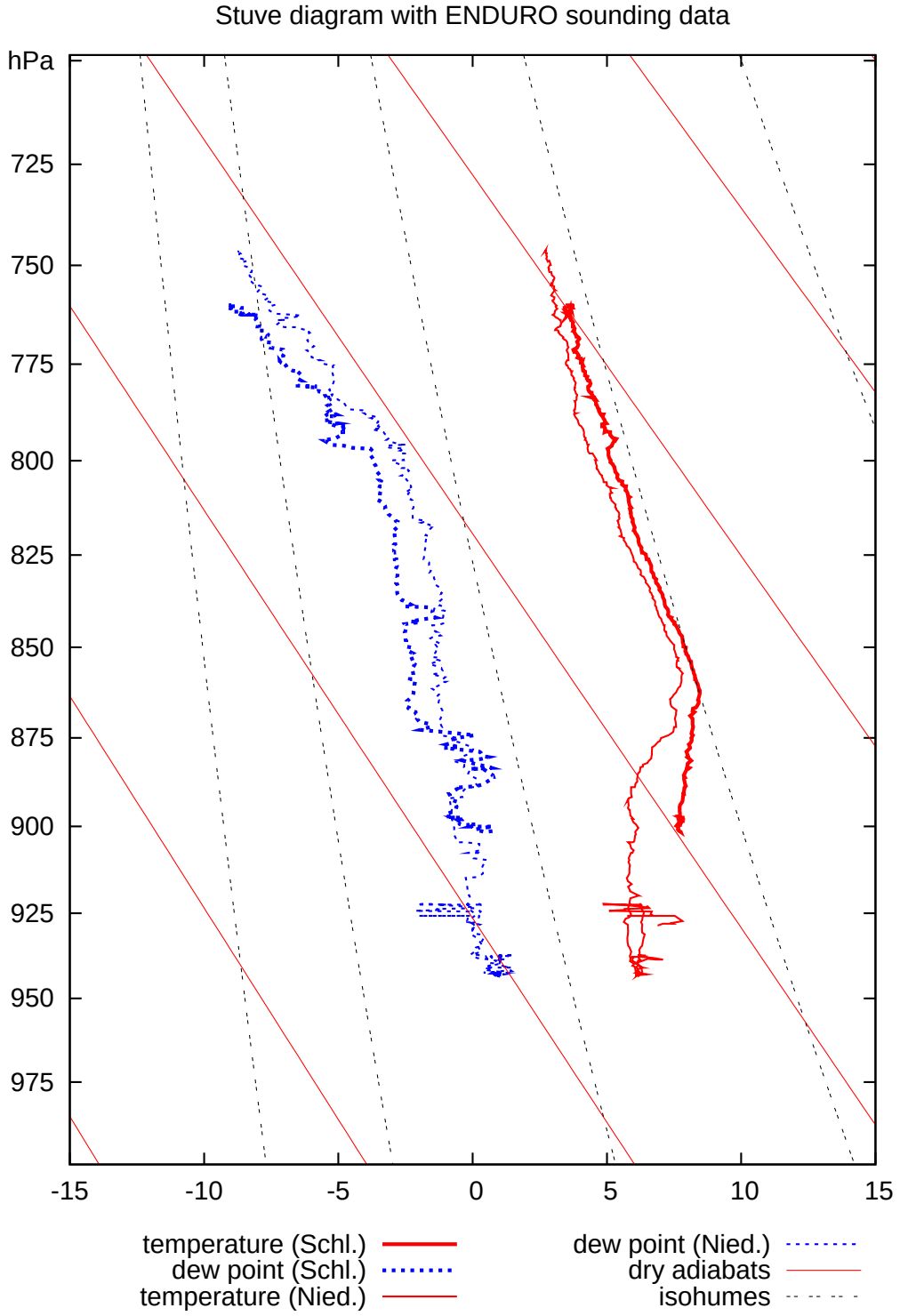

Figure 18: Stuve diagram based on data gathered during two sounding legs of SEASALT rf02

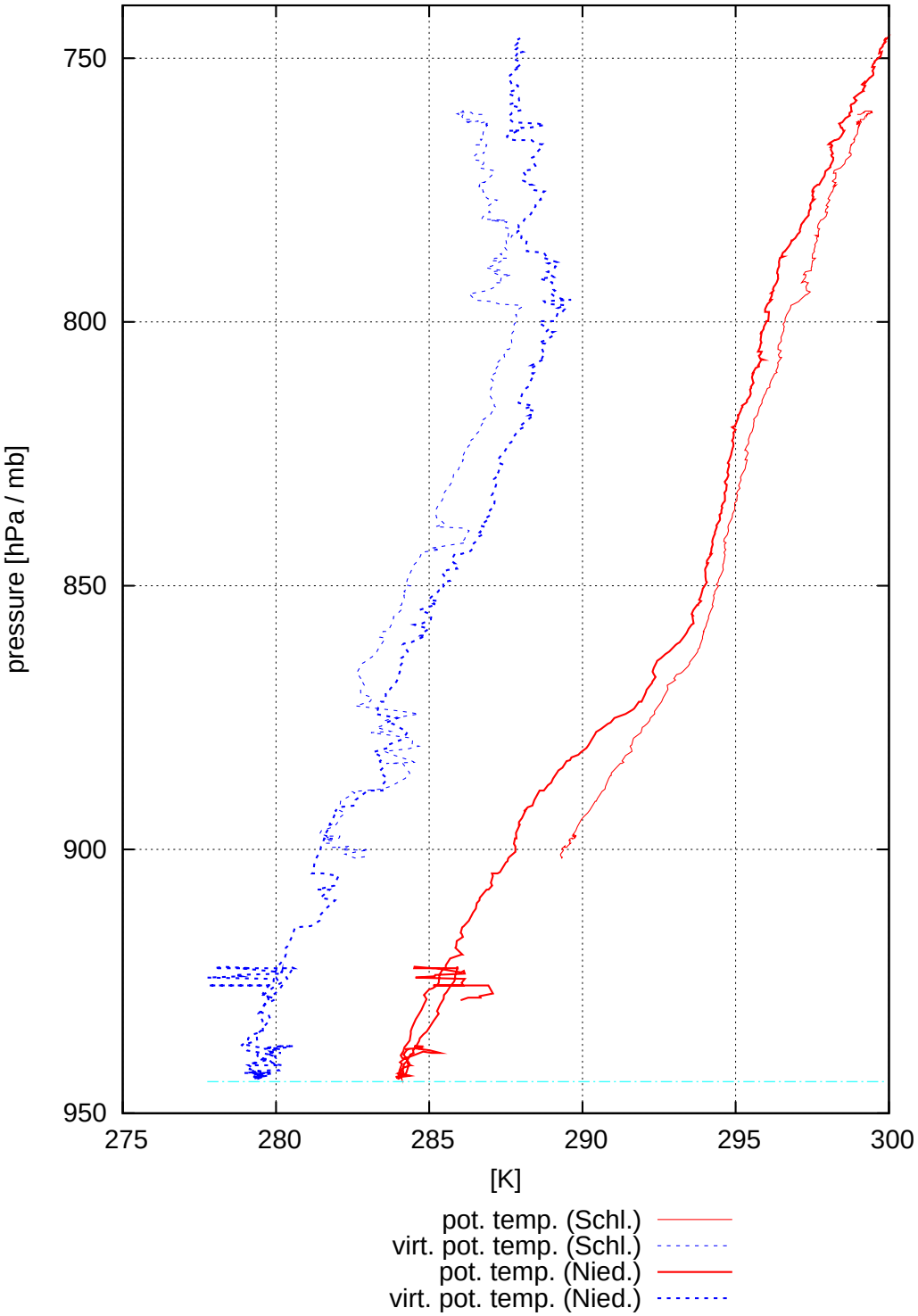

Figure 19: Profiles of virtual potential and potential temperatures based on data gathered during two sounding legs of SEASALT rf02

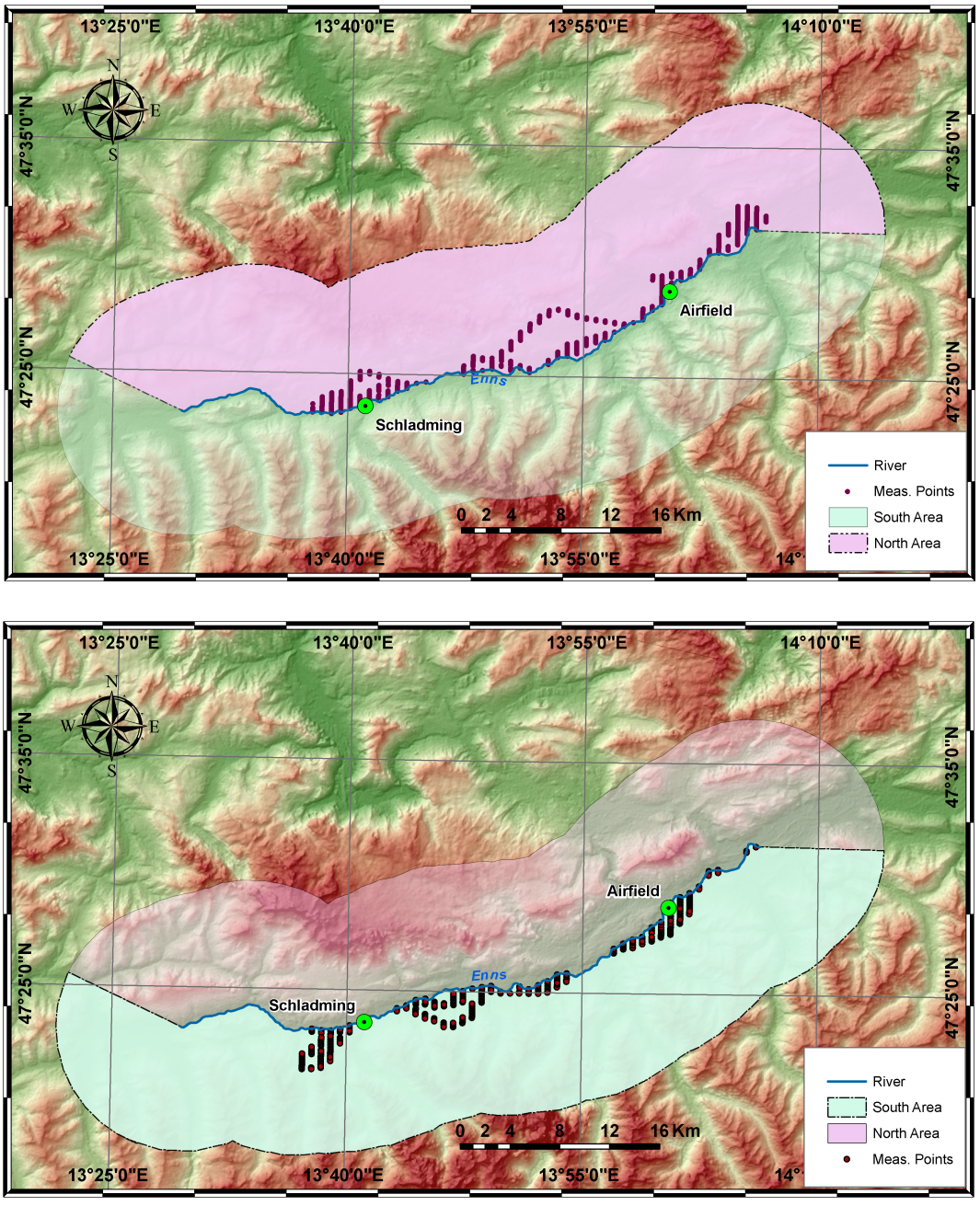

Figure 20: Division of the Enns river valley for the purpose of quick look analysis of the southern/northern slopes

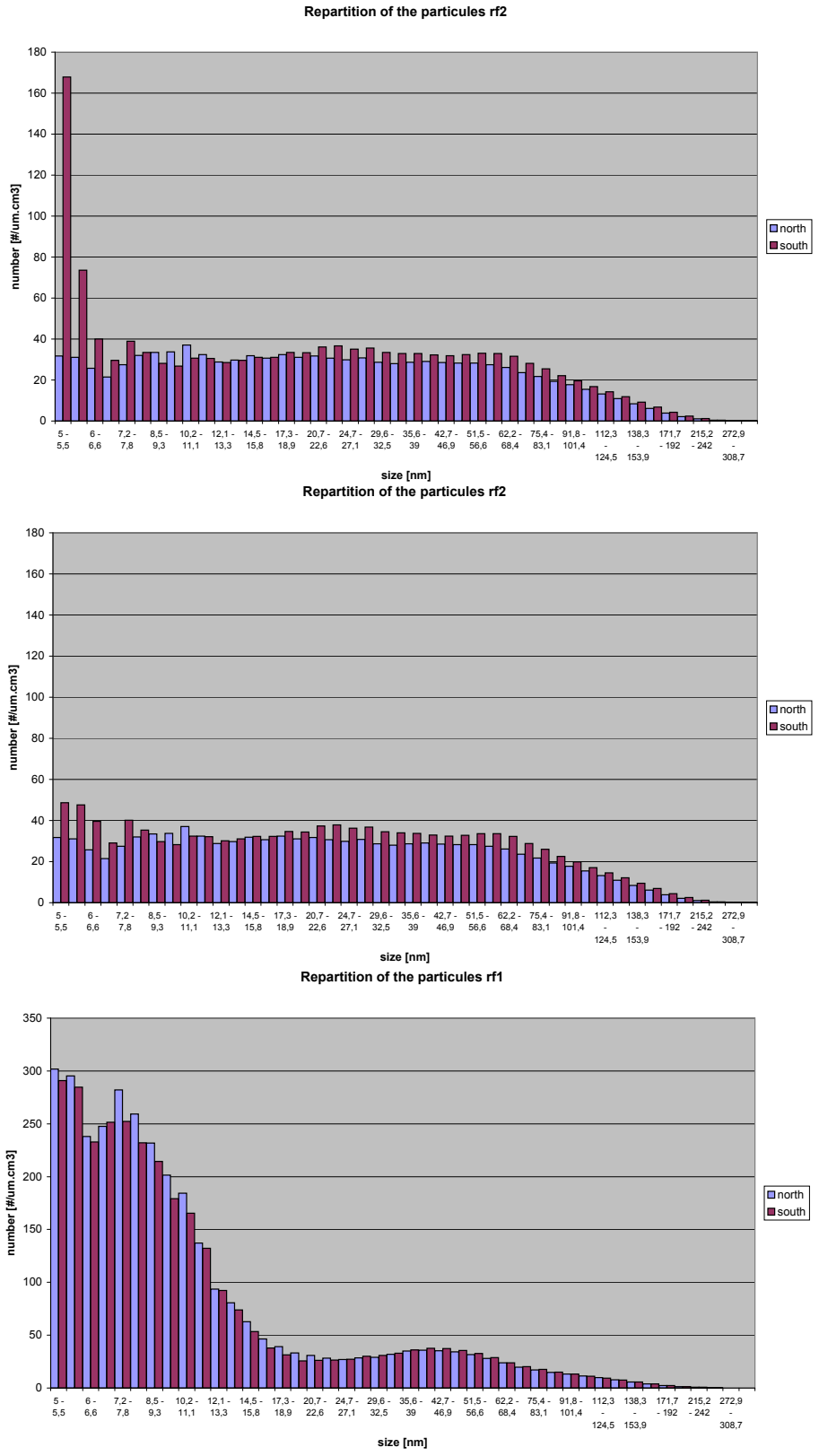

Figure 21: Average particle size spectrum for the south and north part of the Enns valley. Two upper plots represent data from the second research flight, the middle plot excludes two records with extreme values. The bottom plot, given for comparison, shows data from the first research flight.

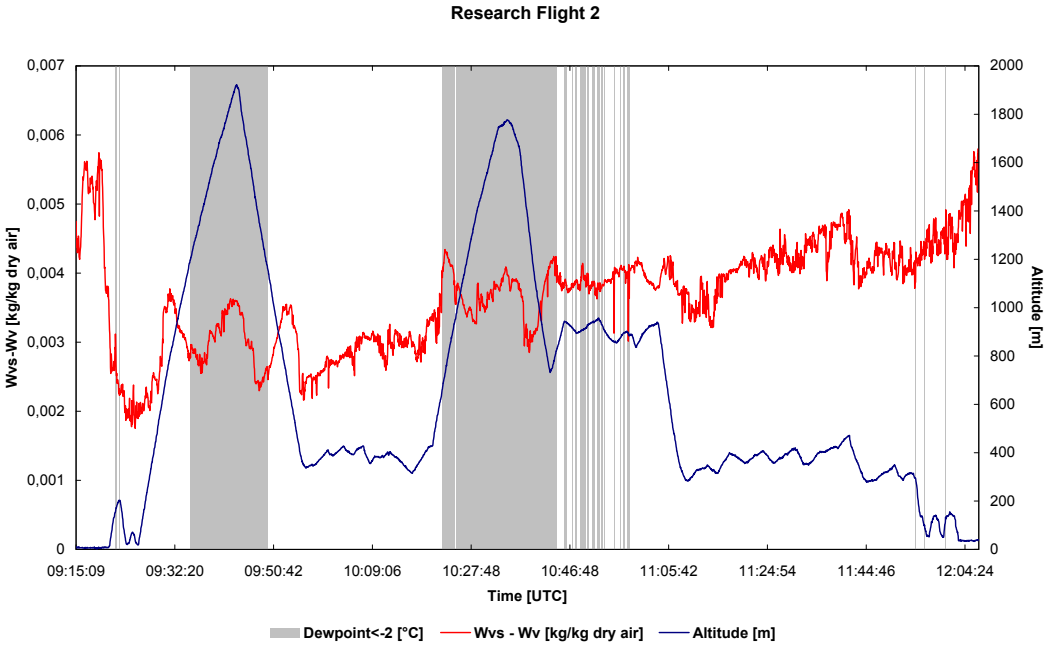

Figure 22: Water vapour mixing ratio subtracted from the saturated value vs. time of the rf02. Background-shading indicates snow-production conditions

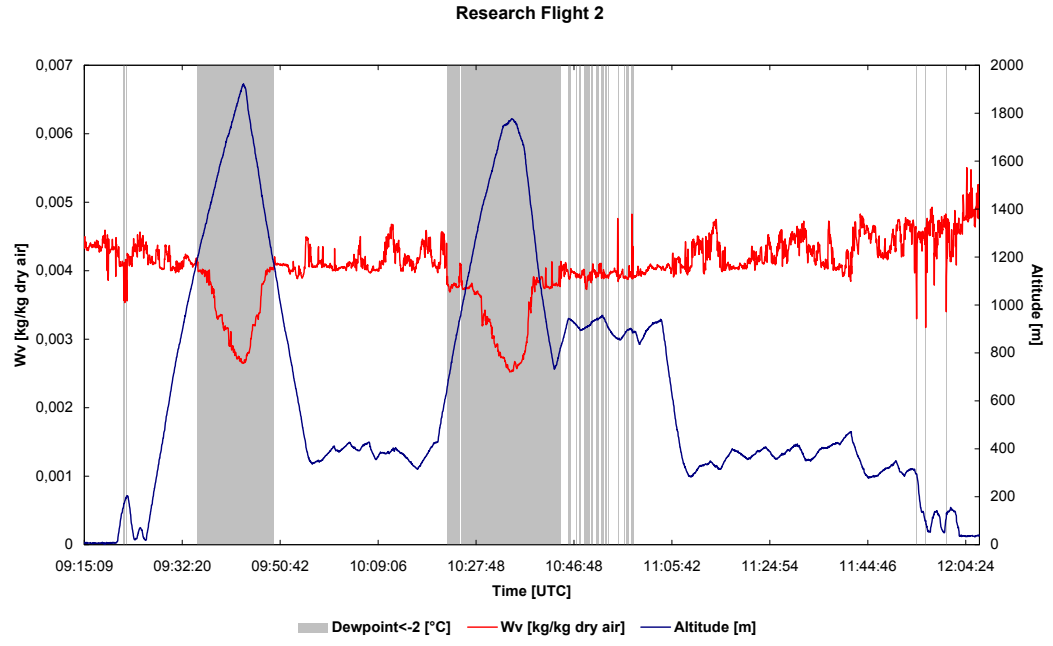

Figure 23: Water vapour mixing ratio vs. time of the rf02. Background-shading indicates snow-production conditions

subtracted from saturated values for current temperature/pressure conditions thus indicating an estimate of the amount of water vapour that can be injected into the air before saturation (water vapour saturation pressure with regard to water surface used – no water/ice distinction).

5 2008-02-27

5.1 Diary entry

- morning: ground sensors maintenance, work on data @ the airport
- afternoon: departure of Wolfgang
- evening: works on data @ home

5.2 Meteorological conditions

27.02.2008 (summary)

Meteoalarm alerts in Salzburg for snow/ice but no warnings in this area. In the morning and during the day we had some light rain because of the cold front passing. From the GFS forecast sounding you can see a cloud layer of sct/bkn stratocumulus and stratus clouds at 12UTC and also some sct/bkn cirrus clouds. Generally good visibility but locally under 8km because of haze and stratus clouds. The temperature is between +5-9C. Light NW winds between 3-9kt. During the night the sky will clear up. Too high temperatures in the valley for snowmaking.

28.02–01.03.2008 (3-d forecast)

On Thursday morning there will be good flying conditions with almost clear sky with light breeze. Some clouds in the afternoon but the weather changes on Friday when a new front is approaching. The weekend is cloudy and at times rainy. The total estimated precipitation is between 11-15 mm. Increasing E or SW moderate or fresh winds. Freezing in the cloud from fl060-fl130. Minimum temperatures in the area are between -1 and +3C and maximum temperatures from +7-14C.

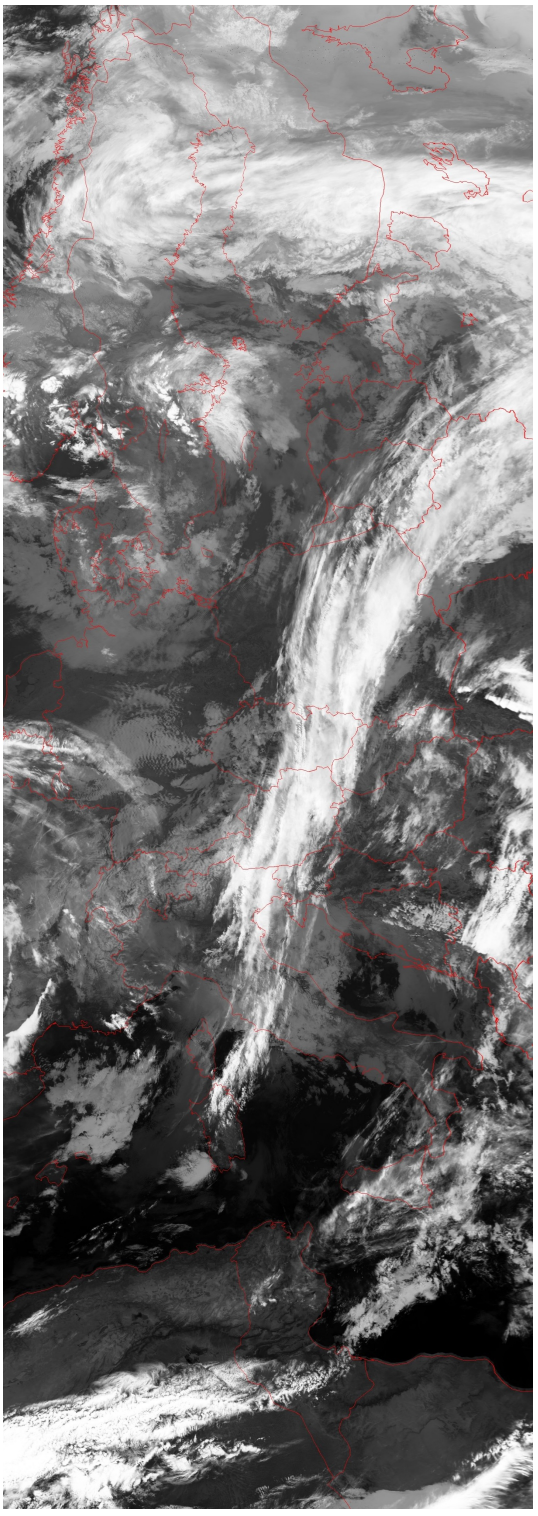

Figure 26: NOAA-15 satellite photo taken at 05:00UTC Feb 27th 2008

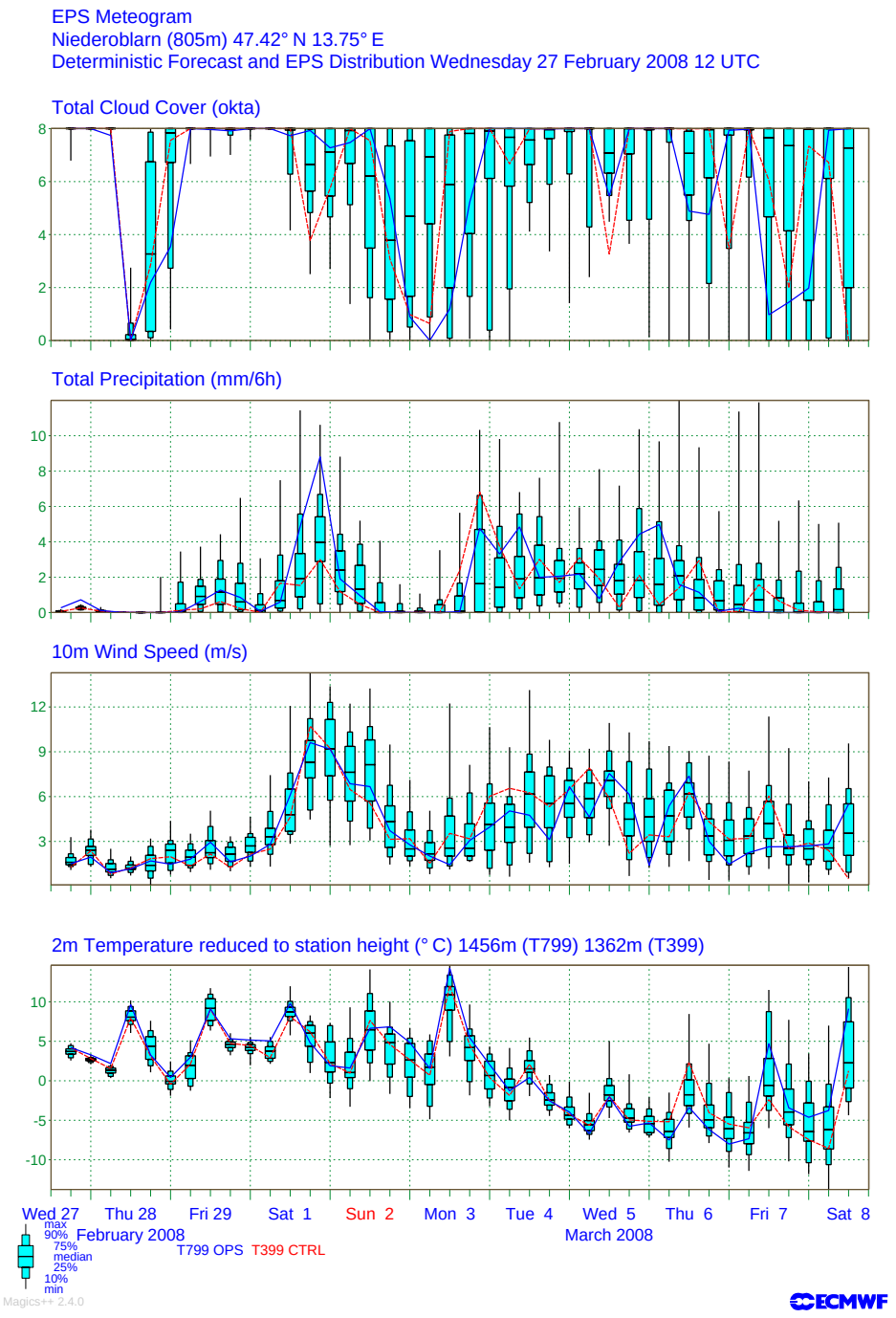

Figure 27: ECMWF long-term forecast meteogram for Niederoeblarn (Feb 27th – Mar 8th)

02.03.2008 – ... (long-term)

It is clearing up during Sunday afternoon and night. Monday morning there should no low clouds or rain but in the evening we have new system approaching. We can see a decrease in temperatures on Tue 4. and possibilities for snowmaking on Tuesday and Wednesday 5.3. From 4.3-6-7.3 there will be rain or snow, the precipitation sum varies every day from 5mm-10mm, but this forecast has lots of uncertainties.

5.3 Groud-based stations data

See figure 28.

6 2008-02-28

6.1 Diary entry

- morning: ground-based sensors maintenance
- afternoon: free time- skiing
- evening: short visit to the airport

6.2 Meteorological conditions

28.02.2008 (summary)

Another low-pressure system is moving through central Europe (Northern Austria.) Mainly cloudy (also low stratus and stratocumulus clouds) with light rain showers during the day. Maximum temperatures for Friday is between +9-12C and minimum temperatures from +4-6C. Wind is generally light but increasing during afternoon and evening. Temperatures are too high for snowmaking.

01–03.03.2008 (3-d forecast)

Saturday looks rainy and windy, we have turbulence from surface to fl150. The total estimated amount is 15-20mm during these days. The max. temp. are for Sat. and Sun. +9C and on Monday +12C. the min. temp. are between 0-3C. During Sat. and Sun. we have moderate to gale SW/W winds. Sunday is cloudy in the morning with rain showers but it is clearing up in the afternoon. Strong winds make it impossible to fly also on Sunday. On Monday the risk of rain is

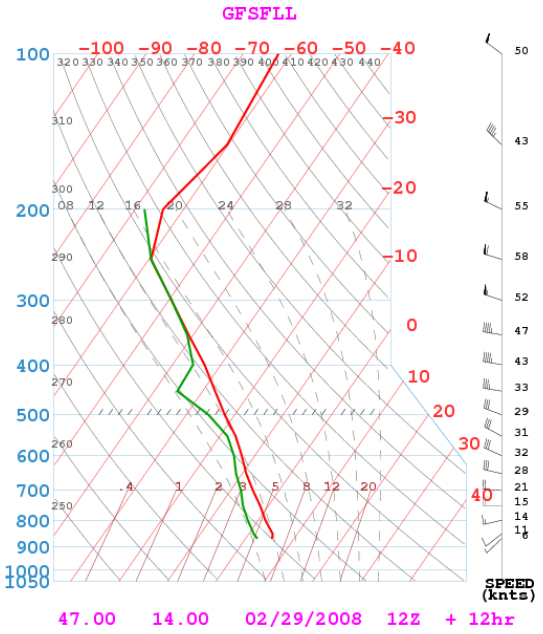

Figure 30: GFS model forecast sounding for Feb 29th

small during the day, in the night before Tuesday we have some light snow showers. If the wind becomes weaker during Monday one flight might be possible.

04.03.2008–... (long-term)

Generally light winds but risk of fresh winds during the Thu. and Wed. night. The temperature drops during Mon night. Maximum temperatures from 3-4C and min. temperatures from -4-7C. Mostly cloudy conditions with light snow or snow showers. It is difficult to forecast the cloud base; the forecast soundings suggest clouds above 850hpa. Temperatures below 0C so there is a good possibility that they will produce artificial snow. The concern is only if Wolfgang can fly because of bad weather conditions.

6.3 Groud-based stations data

See figure 31.

7 2008-03-01

7.1 Diary entry

- morning: ground-based sensors maintenance, met-briefing

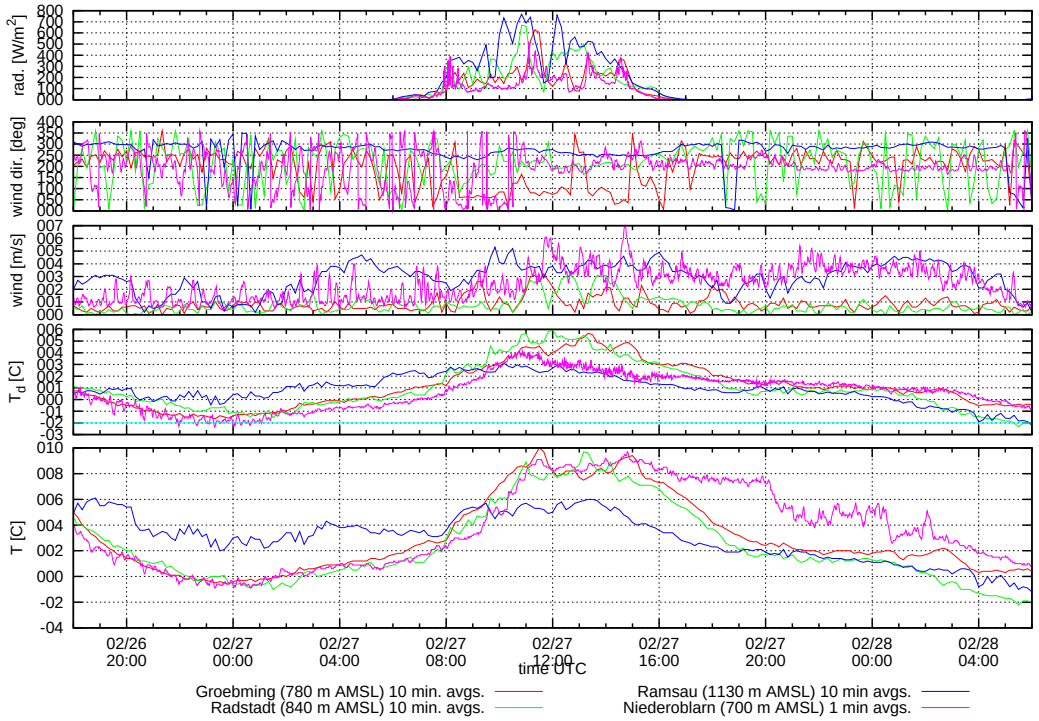

Figure 28: Ground-based data measured in three ZAMG stations and IGFUW station deployed in Niederoeblarn for Feb 27th

- afternoon: data analysis and observation of a Cb cloud from inside (hail, thunders, no power at the airport)
- evening: quick-looks preparation

7.2 Meteorological conditions

01.03.2008 (summary)

Today's weather is a cold front passing with embd CB-clouds and low cloud base during the whole day. Meteoalarm warnings for wind, rain and thunderstorm. No snowmaking expected today and impossible to fly because of low st-clouds, visibility between 1-8km and turbulence. Also freezing in the cloud. It is better to take a look at the weather for the next days? But take a look at the beautiful system in the IR-chart :) (fig. 32)

02.03–03.03.2008 (2-d forecats)

On Sunday it is still some light rain in the morning but clearing up in the afternoon.The wind/strong is fresh but weakening until Monday morning. On Monday morning we have some clouds and light wind, but this weather when it is possible to fly is short-lived. Monday max.temp are from +11 to +16C. and min. temp +4-7C Compared to last week we have more cyclonic activity in the area and a new front is approaching on Monday evening. Temperatures are going down all the time but more about that in the weather forecast for 4.3.

04.03–06.03.2008 (4-d forecast)

This forecast is both optimistic and pessimistic. First the bad news: Because of another low-pressure, we have light snow falling and it looks cloudy for the whole time period until Thursday evening. Most of the snow will fall on Wednesday and Thursday. The wind is generally increasing and turning from W to NW and it might be moderate or fresh on Wed and Thu. So we have to look at the forecast and see if we find a gap in the cloud to see if it is possible to fly.

From various model results it can be seen that the colder air reaching this area. For snowmaking this is a good thing. The maximum temperatures are on Thu. +3C and min temp. is between 1

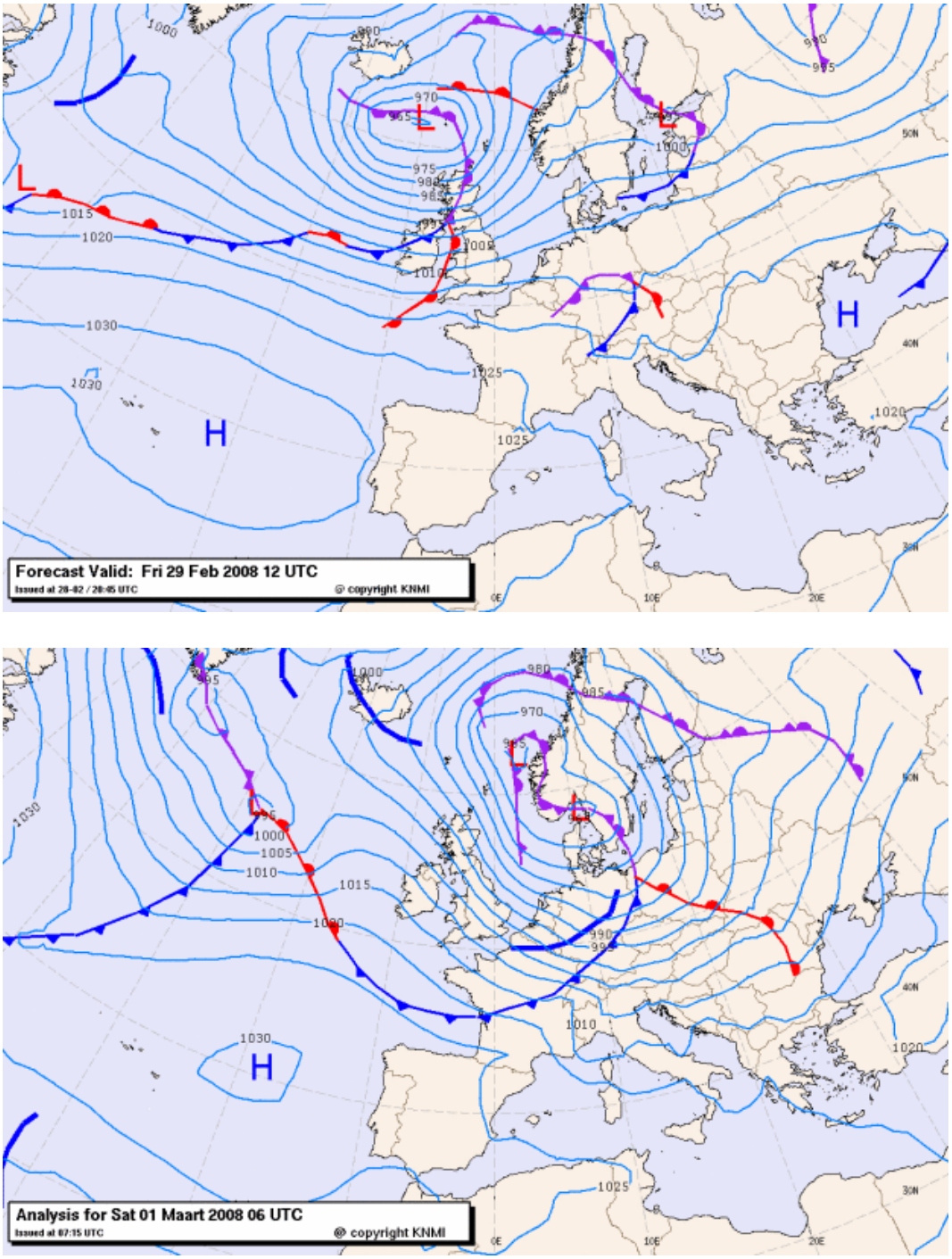

Figure 29: KNMI forecast maps for Feb 29 and Mar 01

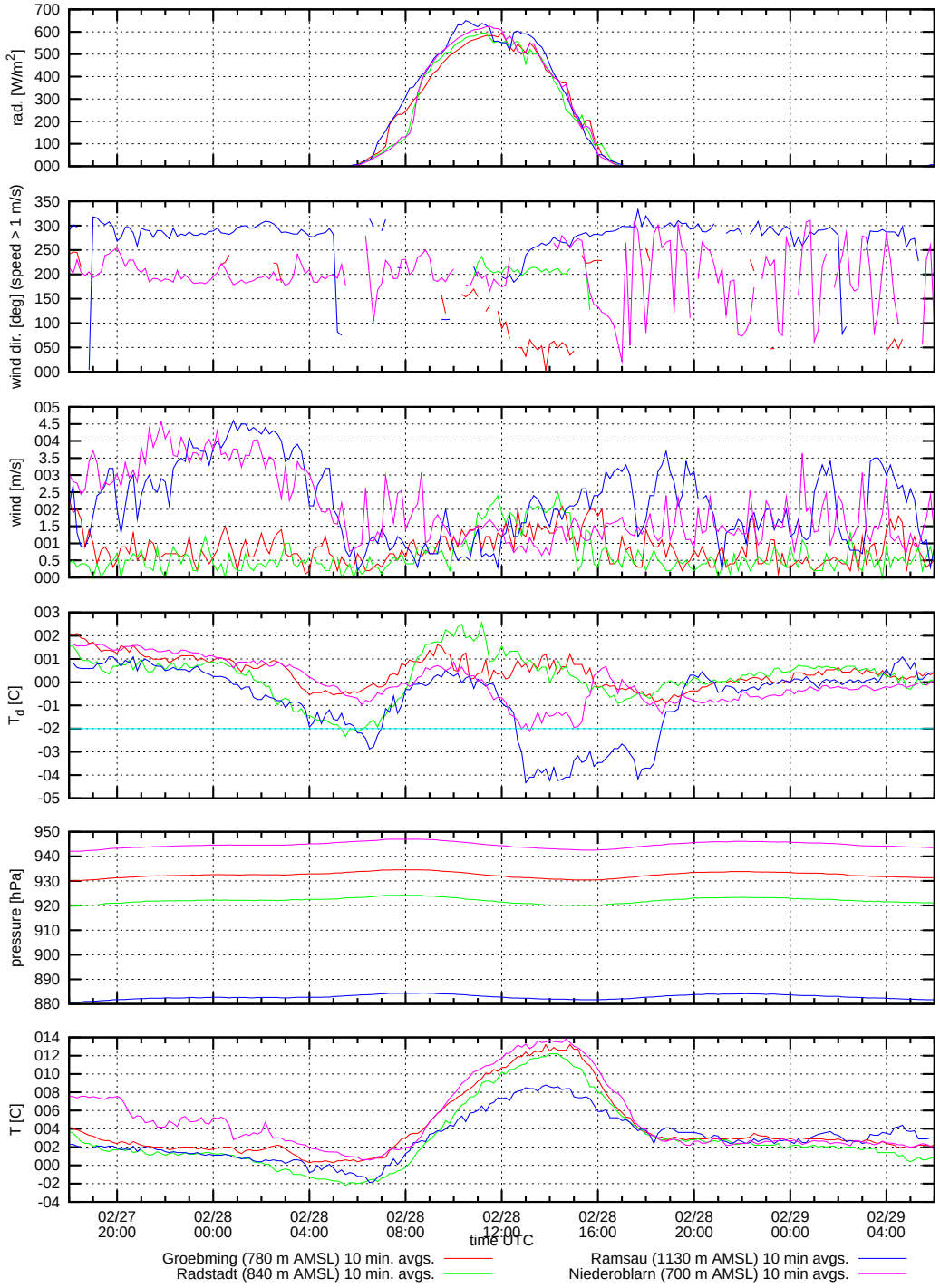

Figure 31: Ground-based data measured in three ZAMG stations and IGFUW station deployed in Niederoeblarn for Feb 28th

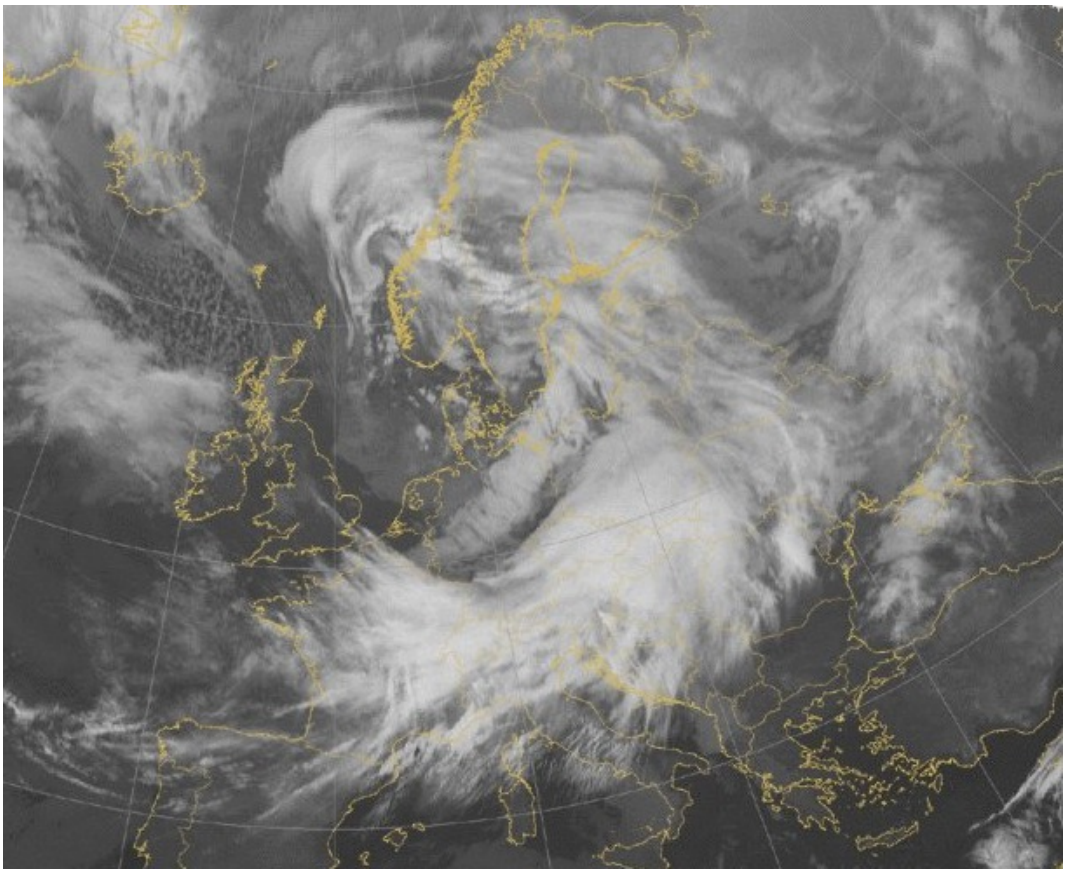

Figure 32: Meteosat 9 IR ($10.8\mu m$) image taken at 06:00UTC Mar 1st 2008

and -3C (with some uncertainties). Wednesday is a colder day than Tuesday. It looks like we have the lowest temperature on Thursday morning and after that the temperature is slowly increasing again.

7.3 Groud-based stations data

See figure 34.

8 2008-03-02

8.1 Diary entry

- morning: sensor maintenance at the airport
- afternoon: works on quick-look presentation at home
- evening: arrival of Wolfgang, presentations of quick-looks from rf02

8.2 Meteorological conditions

Let's not forget:
Yesterday's weather lasted about 2h with power failure at Niederblarn... Cold front. CB-cloud, Hail, lightning, High wind speeds, look at the values from our meteorological station (see fig. 34).

02.03.2008 (summary)

The weather continues on Sunday with high wind speeds (from meteoalarm wind gusts 70 to 110 kph) until the evening. Also the precipitation values can be high, from 20-50mm?. In the afternoon the cloud cover becomes thinner and then some light rain showers are still possible. The wind is weakening during the night.

03.03–04.03.2008 (2-d forecast)

Monday morning and day should be okay, although there is a new cold front approaching in the evening/night with some rain or snow. We have some scattered clouds during the day (GFS forecast sounding does not open but in a meteogram there should be a gap in the low cloud in the middle of the day).The wind is generally light after decreasing during Sunday night. Monday max. temp. is between +7-12C and min.temp. +1-6C. During the rest of the campaign Monday is the best day to fly.

Tuesday looks cloudy and we have some light snow showers during the whole day. The cloud base might be higher during the afternoon on Tuesday, but generally it should be quite cloudy. The wind is turning on Mon-Thu night from W to N so lot of cold air blowing in over the Alps. Min. temp. betw. (0-4C) and max temp.(+2C) so it should be possible to make snow during Tuesday.(maybe morning and also the temperatures can vary here and be lower.

05.03–07.03.2008 (5-d forecast)

Cloudy and light snow falling/snow showers. Winds increasing on Wed. morning and decreasing on Thu. night. Friday afternoon looks to have some scattered clouds but Wed and Thu should have a thick cloud layer. Temperatures are low and almost all the time below 0C. the lowest min. temp. -1C to -5C. And max. temp. +3-5C. At least the 850hpa gives temp values of -4 so we can expect that it is snowing and not raining. Wednesday might be another possibility in the morning for another flight. (Thursday have higher wind speeds).

8.3 Groud-based stations data

See figure 36.

9 2008-03-03

9.1 Diary entry

- morning: SMPS failure detection, delay of planned flight and final cancellation of rf03 due to turbulence and cross-winds at the airport
- afternoon: SMPS repair at the airport workshop with on-line contact with manufacturer (spare part obtained in electronics shop in Oblarn!)
- evening: birthday of Lisa :), BK gives talk on his background

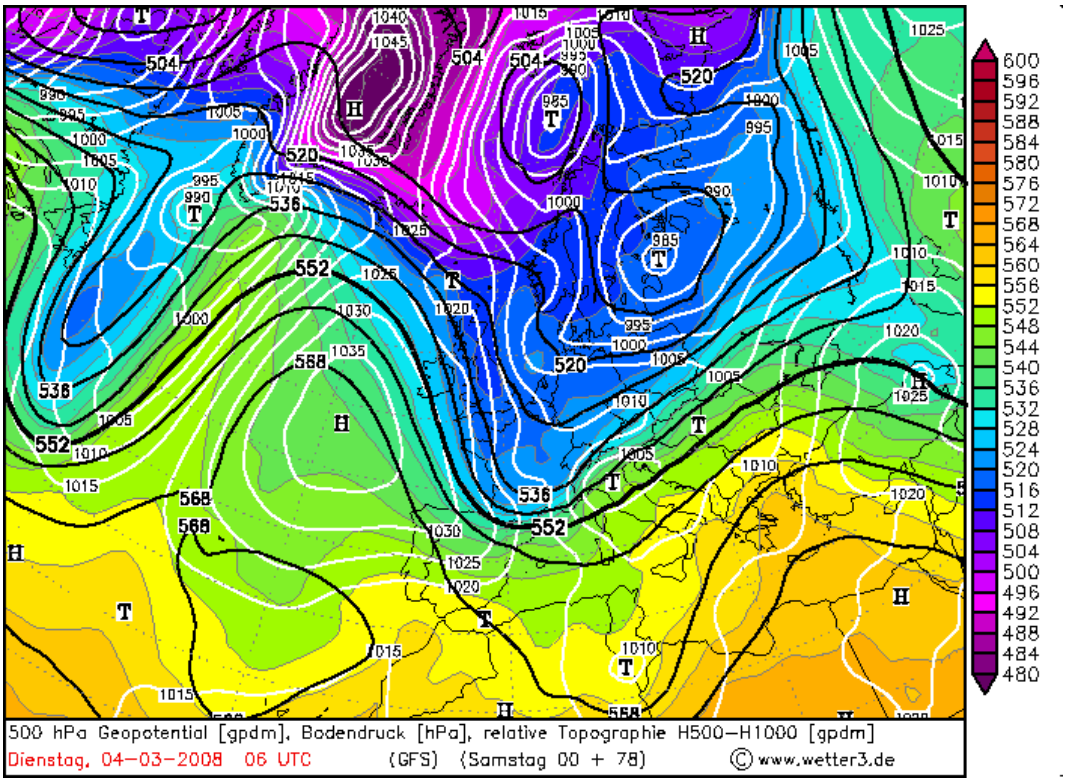

Figure 33: GFS forecats 500 hPa synoptic map for 06 UTC Mar 4th 2008

9.2 Meteorological conditions

03.03.2008 (summary)

During the day we have scattered clouds between 4500-8000ft?. The cloud cover is increasing and coming down a bit. In the afternoon/evening a cold front is approaching the Austrian Alps from NW and during the night we have light fall of rain/snow. The wind is generally light but during the day we have gusts (g25kt) and turbulence. Higher up we have a jet stream. Icing in the cloud above fl070. In the cold front also CB-clouds are possible.

04-05.03.2008 (2-d forecast)

The two next days look cloudy and we have some light snow falling and heaviest on Tue afternoon. Temperatures will drop and be near to snow-making temperatures. Winds will increase on Wednesday but generally they now look light or moderate. Max temperatures during these days are few degrees above zero. And minimum temperatures can go down to -5 to -7C. Meteoalarm warnings for 4.3 concern the snowfall.

06-07.03.2008 (4-d forecast)

The forecast has changed for these days. Thursday look clear with light northerly wind. We can go down to -10C (maybe not in this valley but this seems to be the coldest day during the campaign. So next flight is possible on Thursday. Also Friday have some scattered clouds during the day. Some models still predict low clouds on Thursday morning.

9.3 Groud-based stations data

See figure 38.

10 2008-03-04

10.1 Diary entry

- morning: ground-based sensors maintenance
- afternoon: all the team gathered in the hangar: WJ gives thorough presentation of all aircraft sensors including disassembly and description of working principles (see e.g. fig 39)

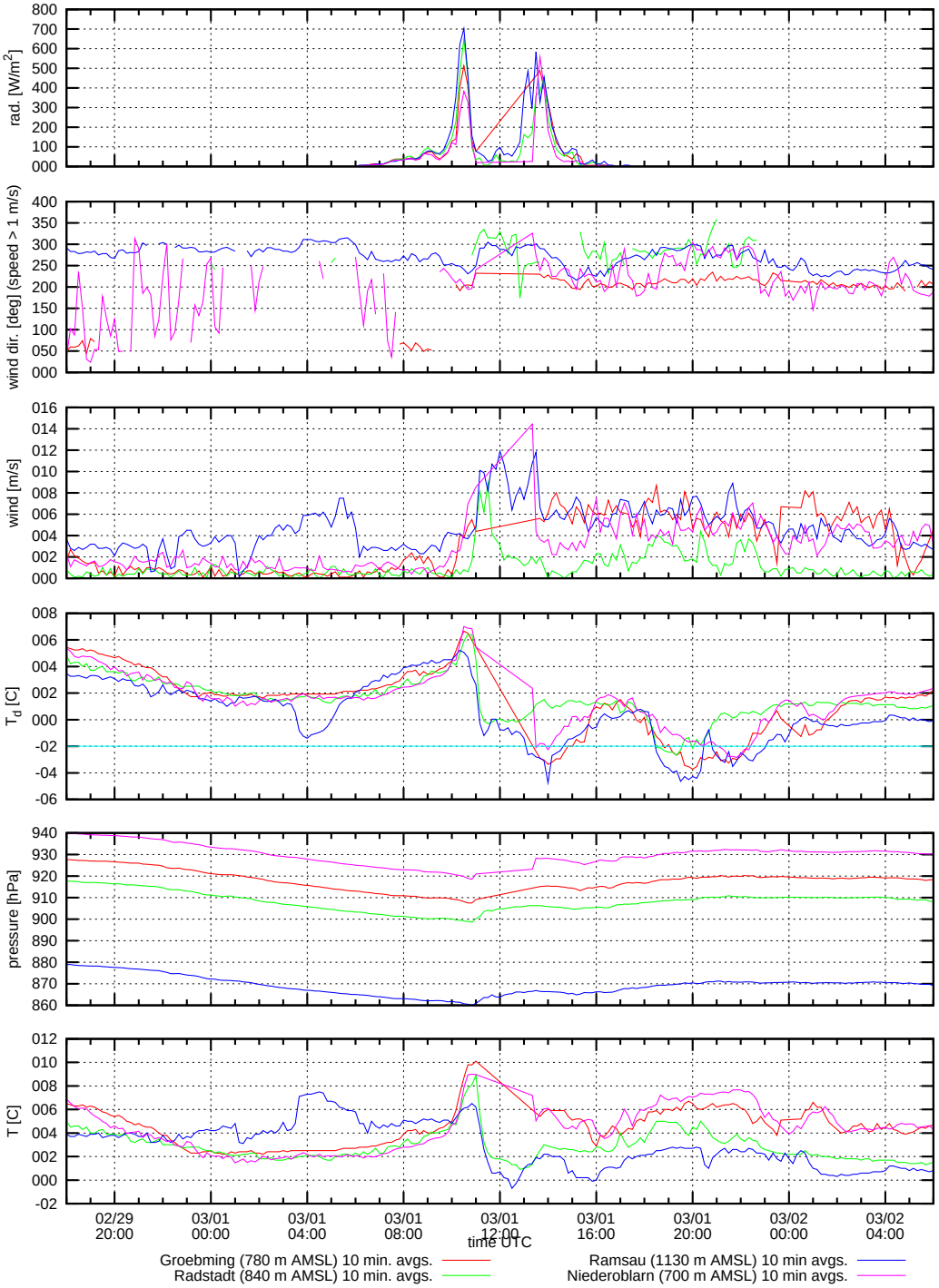

Figure 34: Ground-based data measured in three ZAMG stations and IGFUW station deployed in Niederoeblarn for Mar 1st

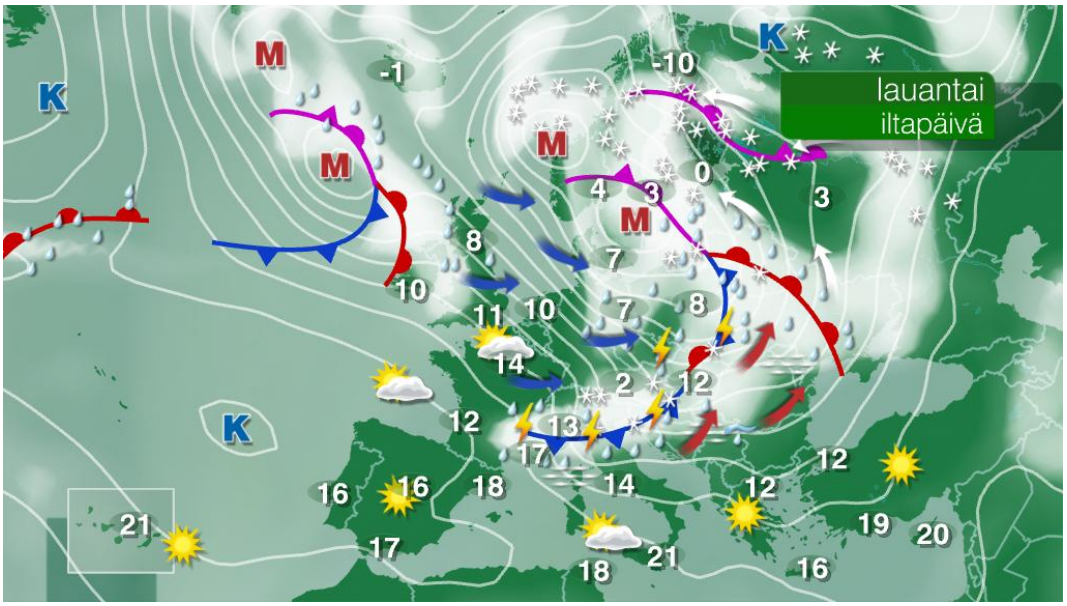

Figure 35: Finnish TV meteo-map showing thunderstorms in Alps on Mar 1st 2008

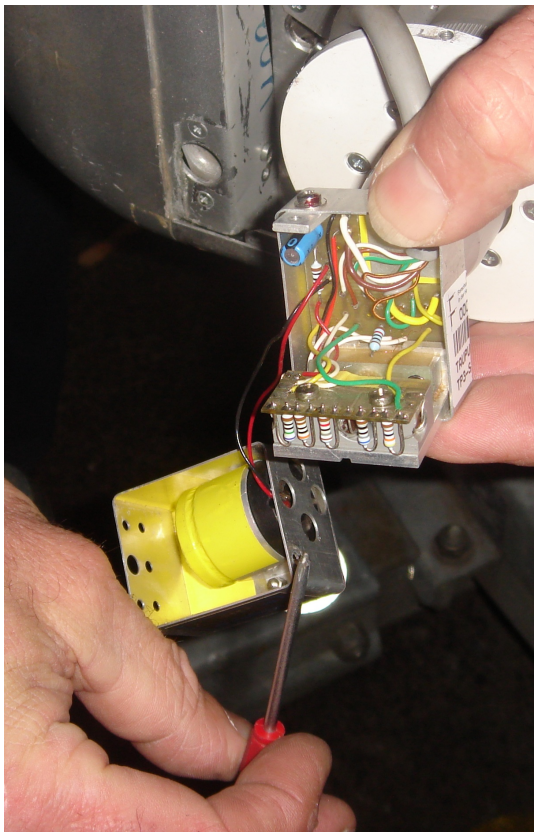

Figure 39: Chilled-mirror dewpoint sensor disassembled for presentation

10.2 Meteorological conditions

04.03.2008 (summary)

Cloudy conditions with snow or wet snow falling during the whole day. In the night we should have the heaviest snowfall. Max. Temperatures in the day is a few degrees above 0C and min. temperatures in the night -3-4C. No conditions for flying because of low visibility and snowfall. N/NW wind, which are generally light or moderate. The temperature is going down. Clouds: Low st, sc and ac+ci.. Icing in the cloud between sfc-fl150.

05.03.2008 (1-d forecast)

Light snow falling until the evening, cloudy conditions. Meteoalarm for the northerly strong wind for the day. Winds gusts from 20-32kt. During the night it is clearing up. Icing above 1000ft. Max temp. for whole Wed. 0-+1C.

06.03.2008 (2-d forecast)

Things that can cause problems for Thu. early morning flight: Wind gusts in southern part of Austria are still strong in the morning. This could also make it impossible for us to fly on Thu. Mornings, during the day gusts are in our area between 15 and 22kt-¿turbulence. The morning temperature can reach -10C. Some models pre-

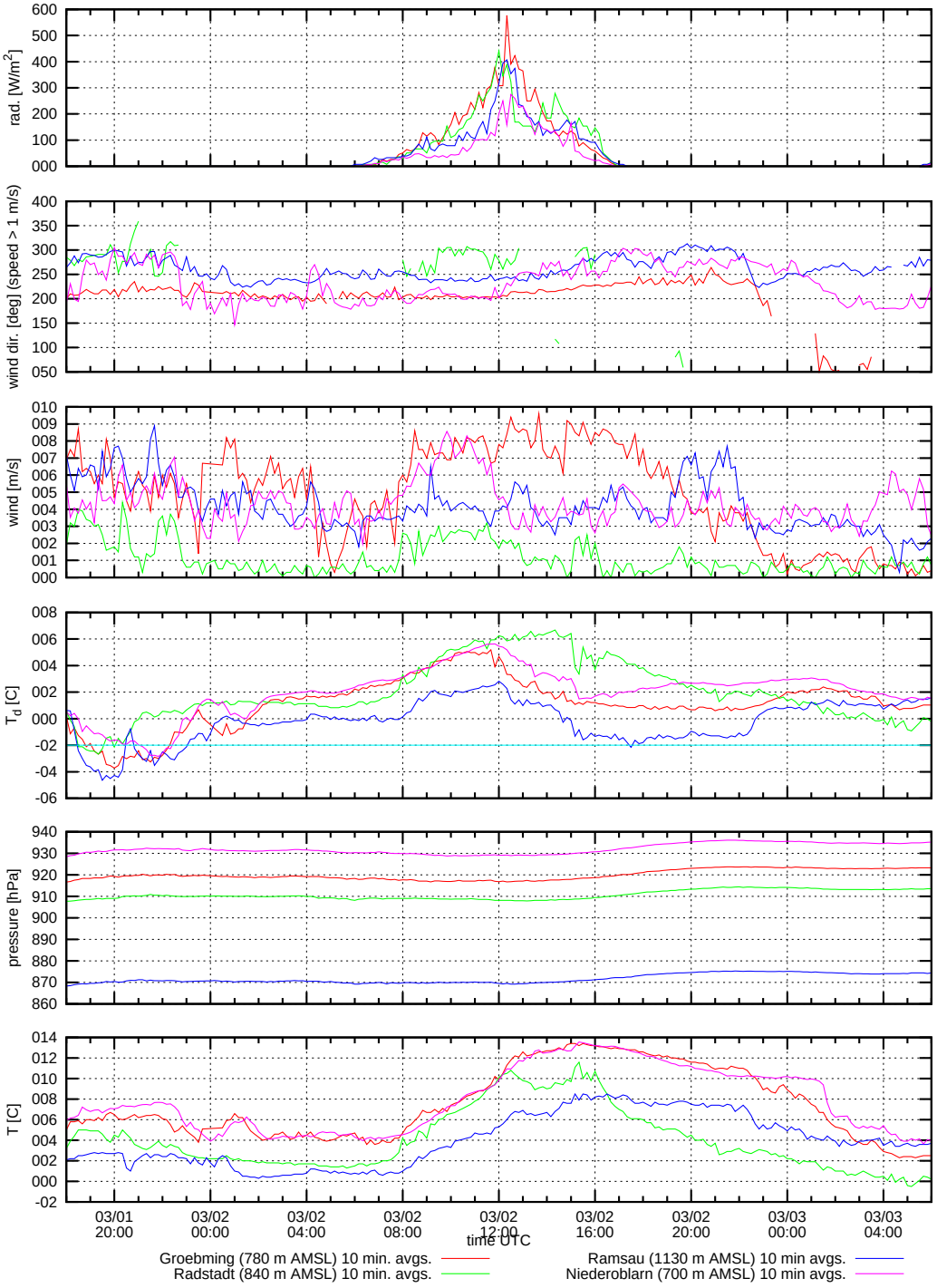

Figure 36: Ground-based data measured in three ZAMG stations and IGFUW station deployed in Niederoeblarn for Mar 2nd

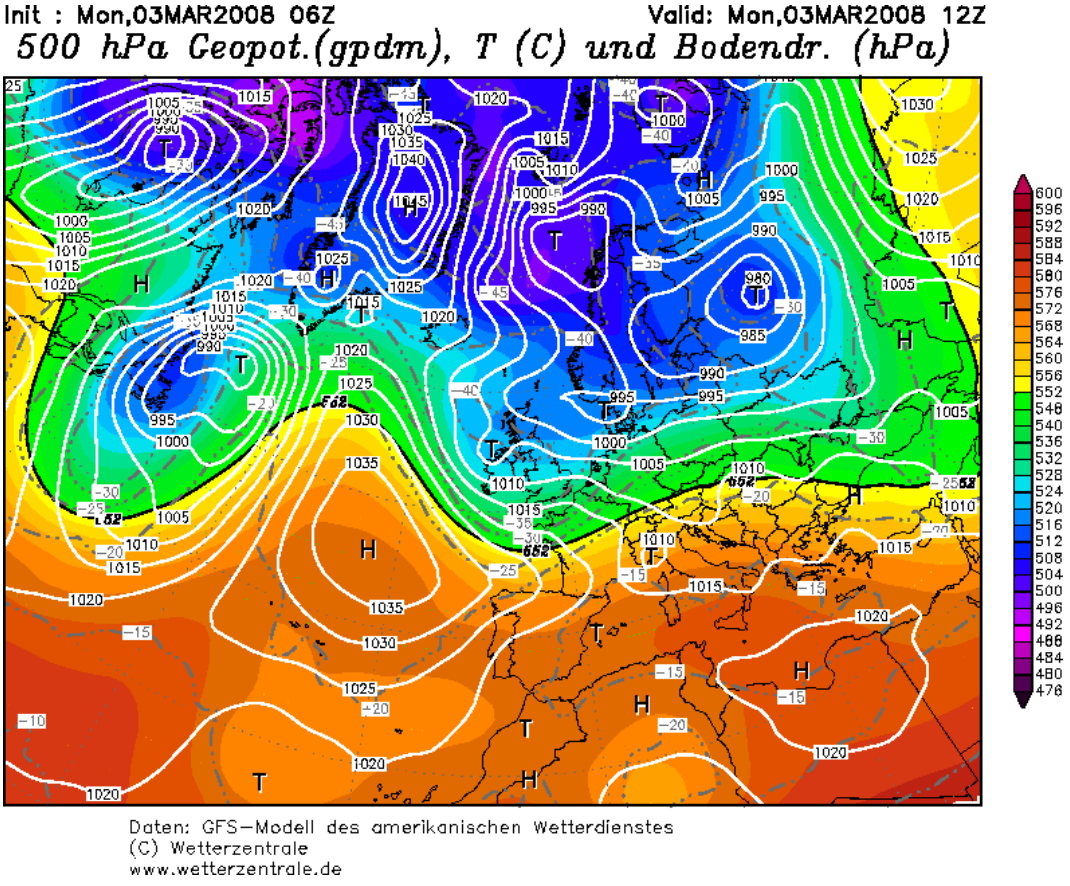

Figure 37: GFS model forecast synoptic map for Mar 3rd 12UTC

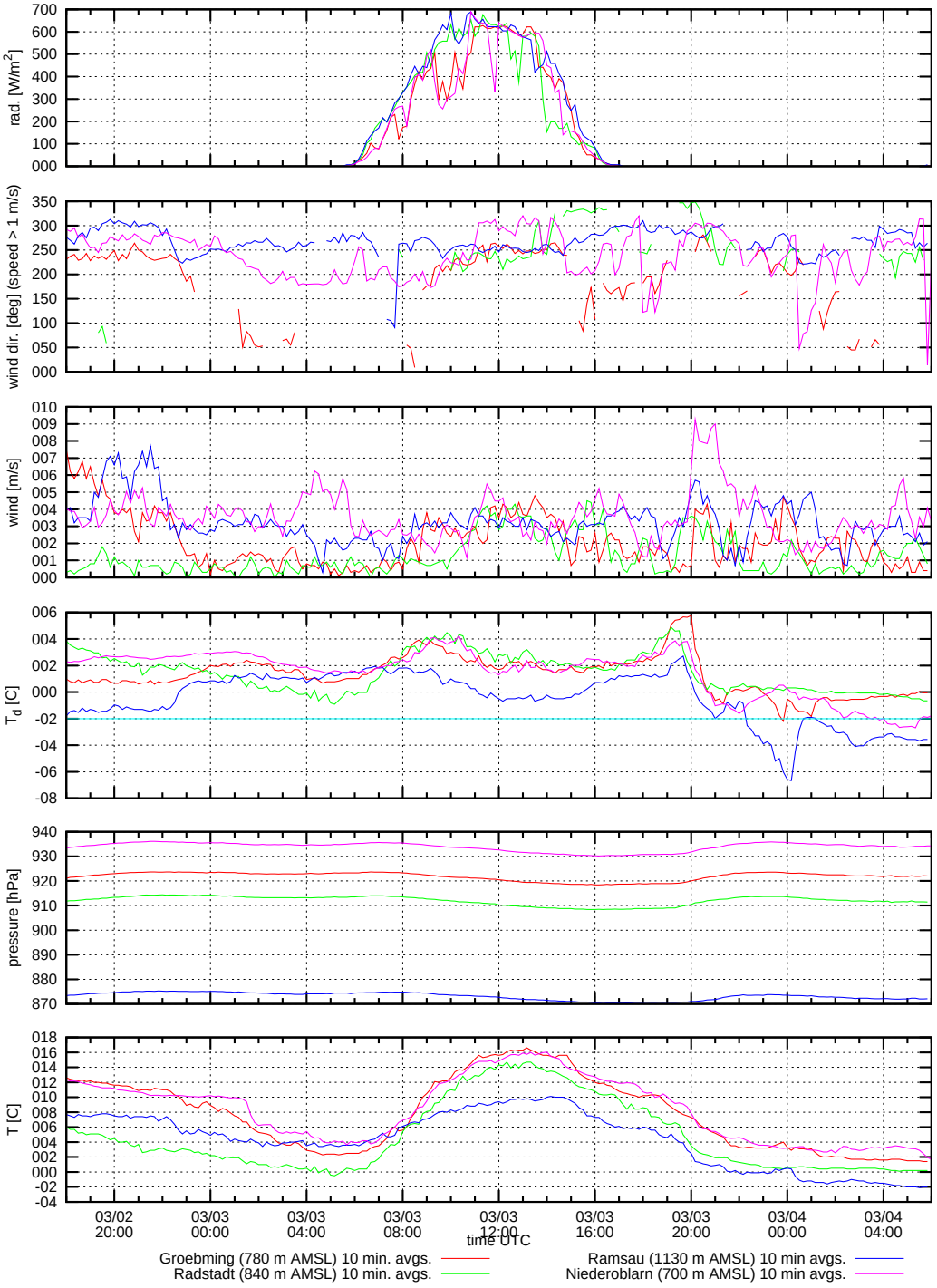

Figure 38: Ground-based data measured in three ZAMG stations and IGFUW station deployed in Niederoeblarn for Mar 3rd

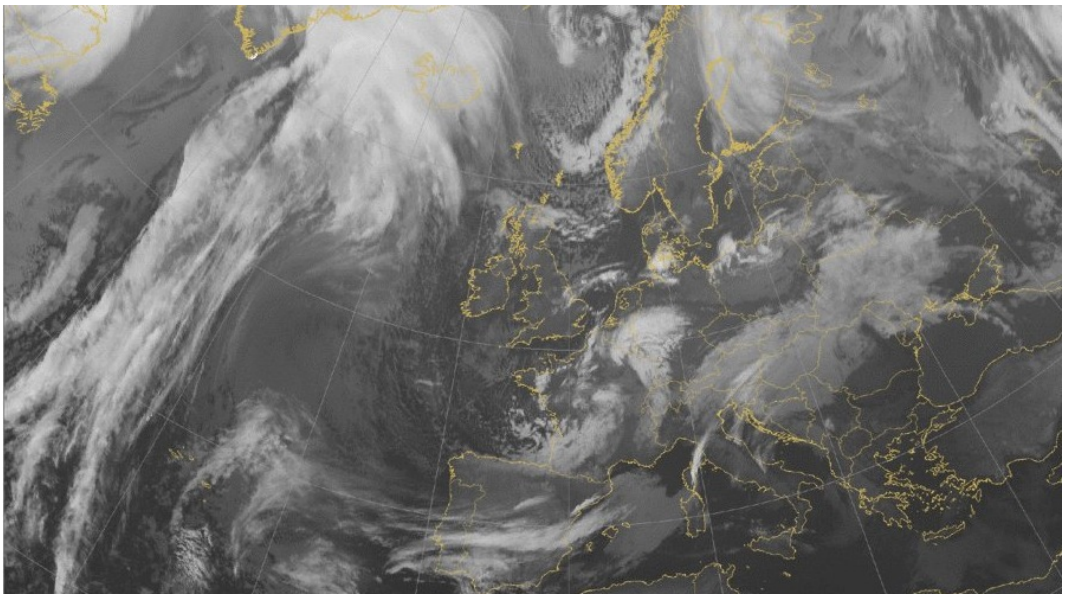

Figure 40: Meteosat 9 IR photo taken at 06:00UTC Mar 4th 2008

dict low clouds for Thu. Morning, which is really difficult to say now about the cloud base in the morning. Min. temp. is on thu. Afternoon has some scattered clouds but generally the wind speeds should decrease a bit. Max. temp on thu. is +1c and min. -8C.

07.03.2008 (3-d forecast)

Friday morning look okay, but in the afternoon we might have some rain showers. Max.temp on Friday is +7C. and min -3C. Light NW winds. Cold pool on Friday morning.

10.3 Groud-based stations data

See figure 41.

11 2008-03-05

11.1 Diary entry

- morning: phone call from Planai people-snow production expected, offer of lengthening the production period for the purposes of SEASALT measurements (from 8 till 10 am next day)
- afternoon: visit to Dahstein / aircraft preparation
- evening: early-morning flight preparations, met-briefing

11.2 Groud-based stations data

See figure 42.

11.3 Meteorological conditions

Heavy snowfall during most of the day, previous forecasts still valid: good flying and snow-production conditions expected for Mar 6th (see fig 43).

12 2008-03-06 / rf03, rf04

12.1 Diary entry

- early morning: instrument warm-up, met-briefing
- morning: rf03, car pursuit to Planai and photo session
- afternoon: rf04
- evening: aircraft disassembly
- late evening: farewell dinner

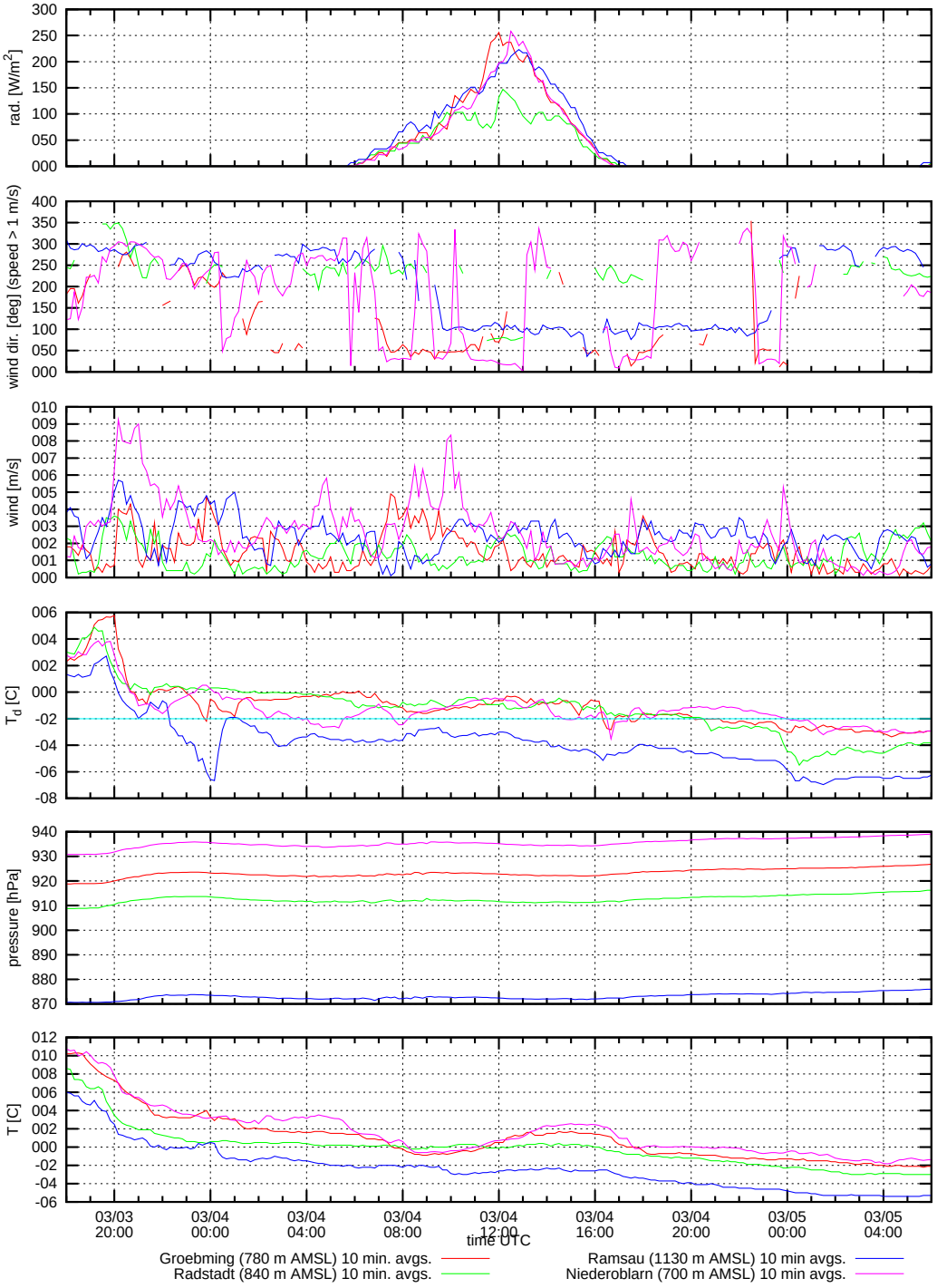

Figure 41: Ground-based data measured in three ZAMG stations and IGFUW station deployed in Niederoeblarn for Mar 4th

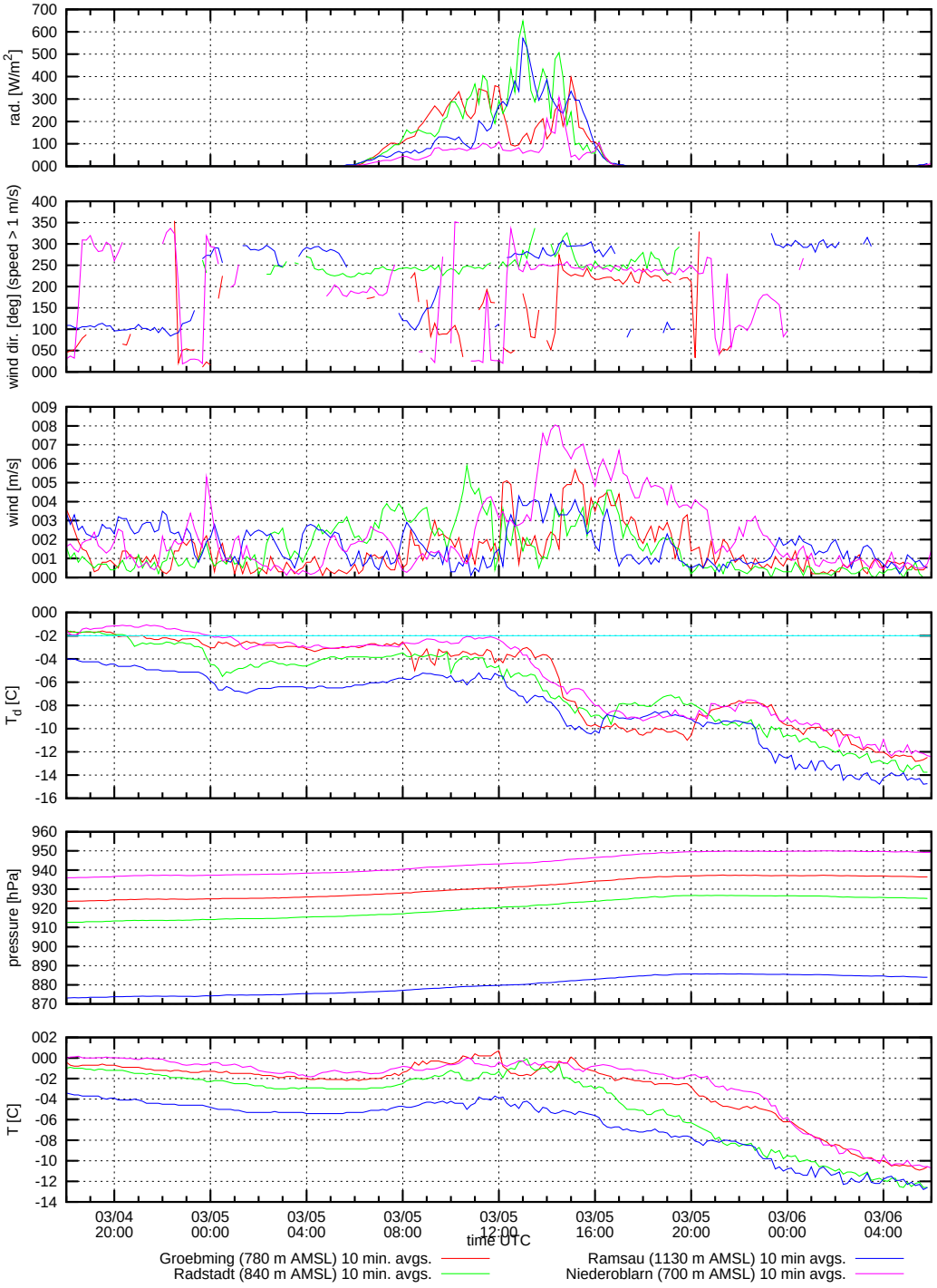

Figure 42: Ground-based data measured in three ZAMG stations and IGFUW station deployed in Niederoeblarn for Mar 5th

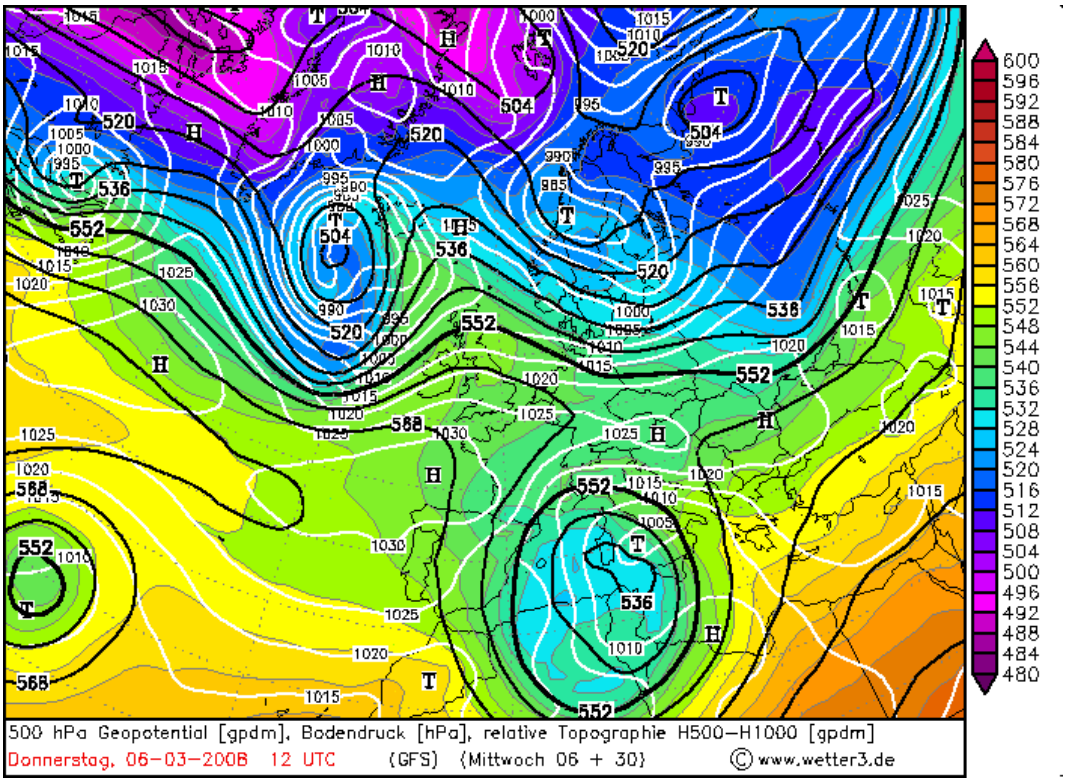

Figure 43: GFS model forecast map for Mar 6th 2008

12.2 Research-flight 03

Pilots comments (rf03)

- visibility excellent, very clean air
- no wind
- no clouds
- above Haus snowguns running, descent to $150m$ above ground with aerosol signature
- above Schladming snowguns running on FIS and west pistes, signatures in the particle conc. up to $8000cm^{-3}$
- return flight and above Schladming with particle conc. in range of 500 – $600cm^{-3}$
- two soundings: Schladming and Niederoeblarn with clear vertical structure

12.3 Research-flight 04

Pilots comments (rf04)

- visibility slightly reduced but still approximately $100km$
- throughout the valley particle numbers about $5000cm^{-3}$
- visit to Schladming and ascent to $7500ft$, significant advection from southerly directions
- lenticularis clouds in the south
- particle numbers above PBL up to $12000cm^{-3}$
- return and second profile above Niederoeblarn
- during the whole flight slight turbulence due to advection, wind speeds below $5m/s$

12.4 Groud-based stations data

See figure 49.

13 2008-03-07

13.1 Diary entry

- morning: last packing at home and at the airport (wing, flux station)

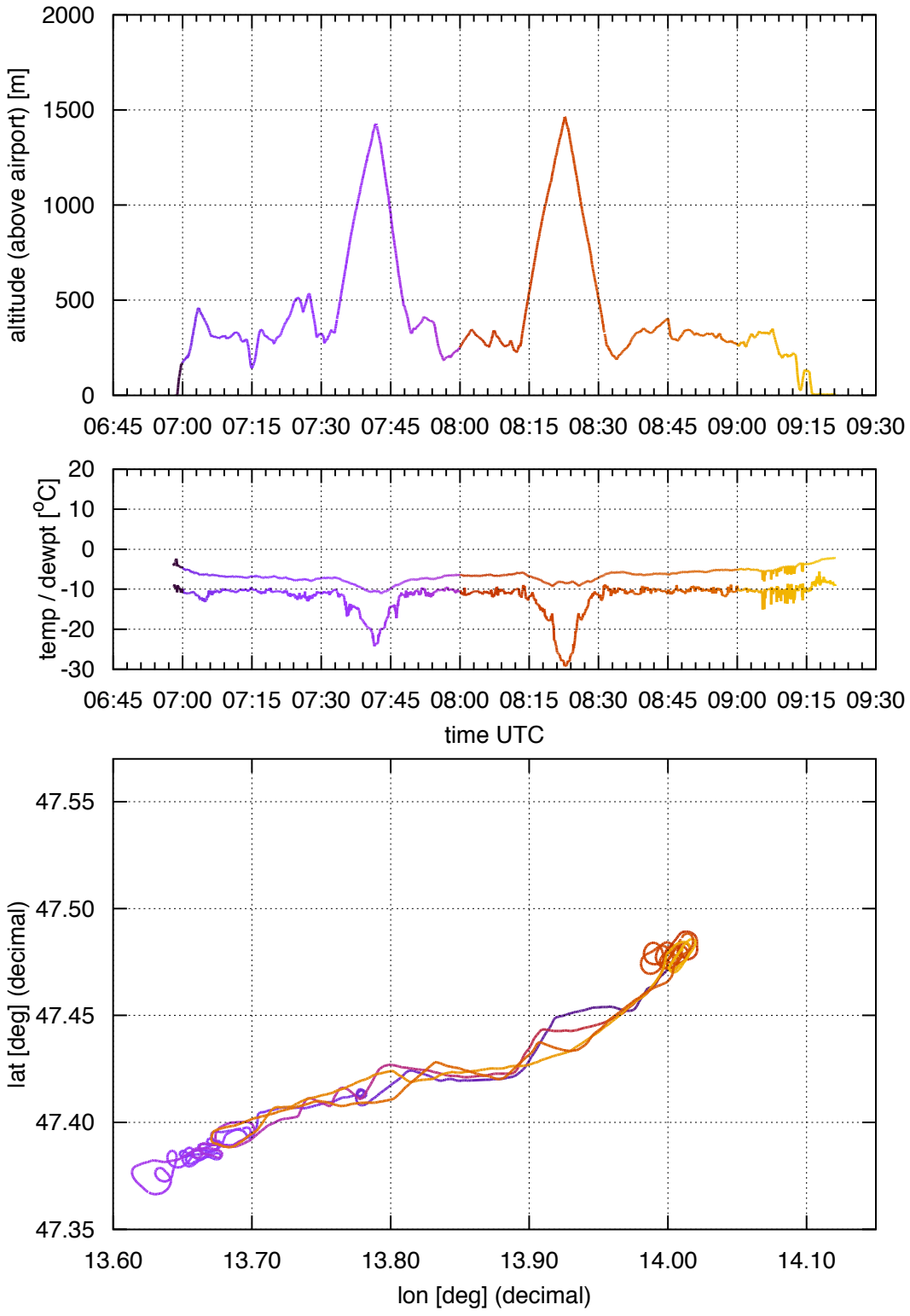

Figure 44: Research-flight 03 altitude, temperature and dewpoint profile together with trajectory plot (plot ranges common with similar plots for all other flights for comparison).

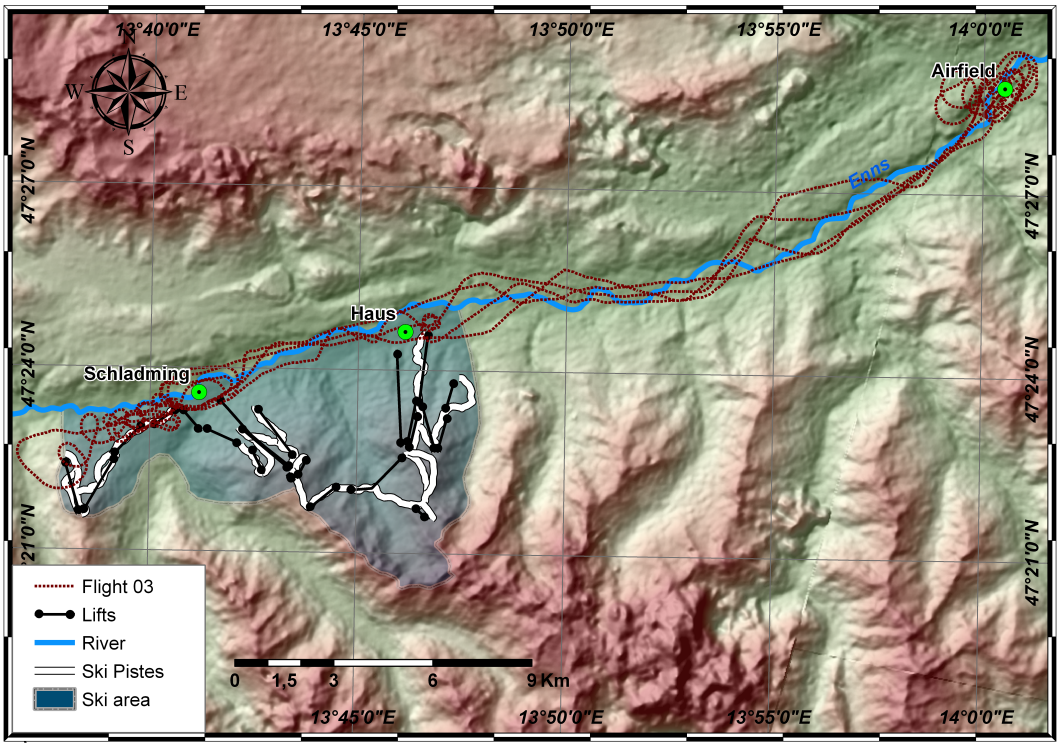

Figure 45: Research flight 03 trajectory projected on a rendered DEM with ski-infrastructure location

- afternoon: WJ leaves for Germany, ground-based sensors disassembly
- evening: packing

13.2 Groud-based stations data

See figure 50.

13.3 Meteorological conditions

Mediterranean air-mass observed during rf04 still present (see fig. 51).

14 2008-03-08

14.1 Diary entry

- morning: car transfer from Niederoeblarn to Vienna
- afternoon: farewell in Vienna
- evening: train / air transfers to home countries

A Summary of weather conditions

See fig 52.

B Airborne instrument status

See table 1.

C Ground-based instrument status

See table 2.

D Flight characteristics summary table

See table 3.

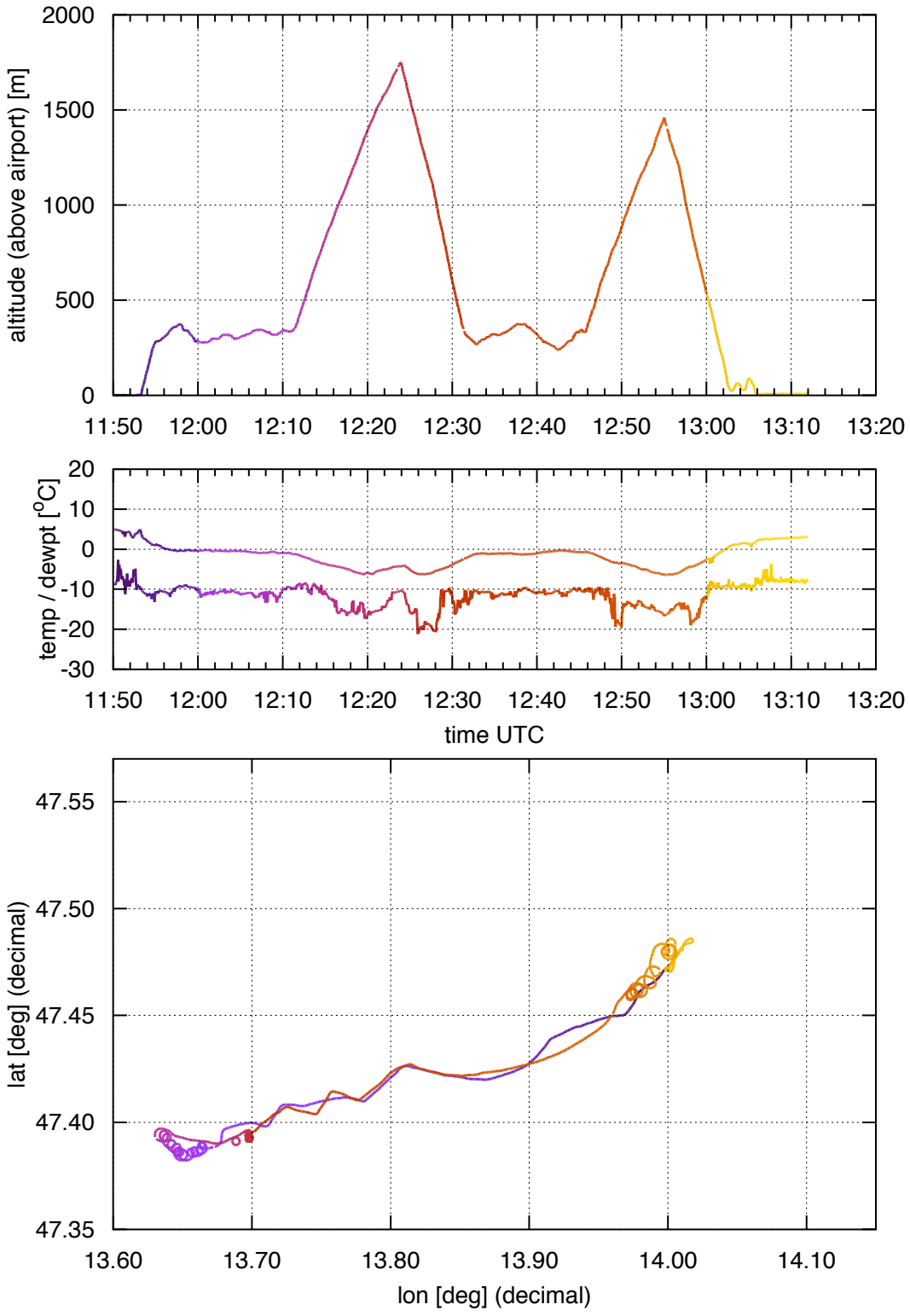

Figure 47: Research-flight 04 altitude, temperature and dewpoint profile together with trajectory plot (plot ranges common with similar plots for all other flights for comparison).

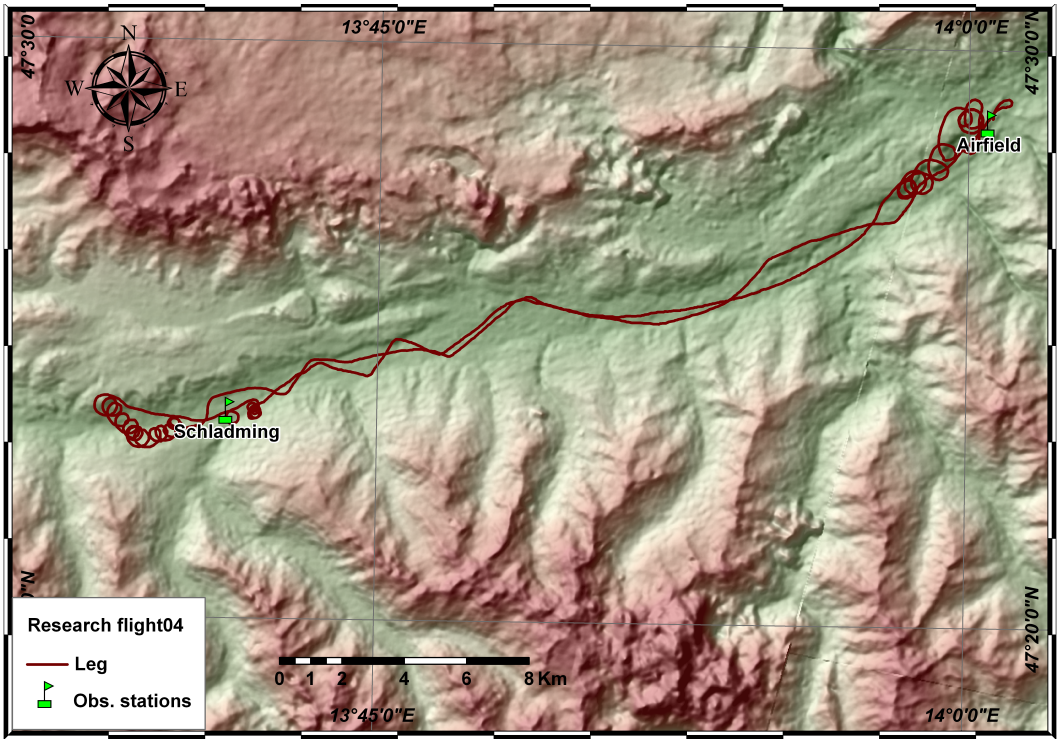

Figure 48: Research flight 04 trajectory projected on a rendered DEM

Airborne Instruments Status																		
flight reference	comment	SMPS Spectr.	GRIMM Spectr.	TSI-3010 Counter condensat. part.	Magee Aethalometer light absorption	chilled-mirror hygrometer	IR absorption sensor	2 radiometers VIS	actinic radiometers	5-hole probe	fast water vap.	fast temp. sensor	pressure sensor	GPS	inertial navigation system	video-camera	LASER altimeter	IR ground temp. CCD sensor	O3 sensor
tf01/0224		+/+	-/-	+/+	+/-	+/+	+/+	+/+	+/+	+/-	+/-	+/-	+/+	+/+	+/-	-/-	+/-	+/+	+/+
rf01/0225		+/+	+/+	-/-	+/-	+/+	+/+	+/+	+/-	+/-	+/-	+/-	+/-	+/+	+/-	-/-	+/-	+/-	+/+
rf02/0226		+/+	+/+	-/-	+/-	+/+	+/+	+/+	+/+	+/-	+/-	+/-	+/+	+/+	+/-	-/-	+/-	+/+	+/+
rf03/0306		+/+	+/+	+/+	+/-	+/+	+/+	+/+	+/+	+/-	+/-	+/-	+/+	+/+	+/-	+/-	+/-	+/-	+/+
rf04/0306		+/+	+/+	+/+	+/-	+/+	+/+	+/+	+/+	+/-	+/-	+/-	+/+	+/+	+/-	+/-	+/-	+/-	+/+

no measurement/no data	-/-
mesasurements/no data	+/-
mesasurements/data	+/+
gap	gap in data

Table 1: Airborne instrument status table

Ground-Based Instruments Status					
date	IGFUW/Niederoblarn	ZAMG/Grobming	ZAMG/Radstadt	ZAMG/Ramsau	FZK/Niederoblarn
2008-02-21	-	+	+	+	-
2008-02-22	-	+	+	+	-
2008-02-23	-	+	+	+	-
2008-02-24	+ (no rad. Vaisala from 13:00)	+	+	+	-
2008-02-25	+ (rad. from 16:00)	+	+	+	- (from 6pm)
2008-02-26	+	+	+	+	+
2008-02-27	+	+	+	+	+
2008-02-28	+	+	+	+	+
2008-02-29	+	+	+	+	+
2008-03-01	- (gap from 11:04 to 13:21)	- (gap from 11:00 to 13:40)	+	+	- (till 11:30)
2008-03-02	+	+	+	+	- (from 13:30)
2008-03-03	+	+	+	+	+
2008-03-04	+	+	+	+	+
2008-03-05	+	+	+	+	+
2008-03-06	+	+	+	+	+
2008-03-07	- (till 14:50)	+	+	+	- (till 10:00)
2008-03-08	-	+	+	+	-

no data	-
data	+

Table 2: Ground-based instrument status table

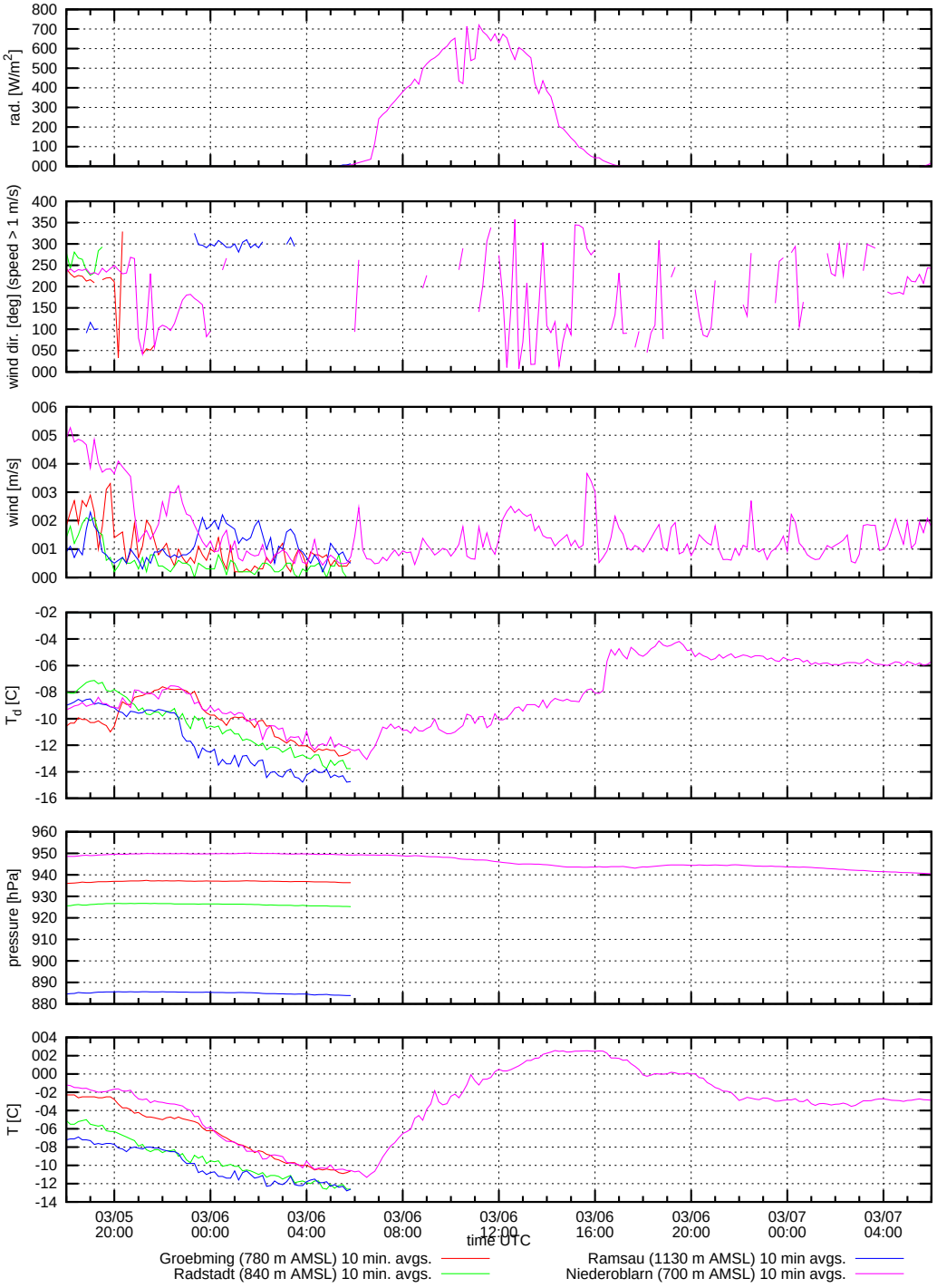

Figure 49: Ground-based data measured in three ZAMG stations and IGFUW station deployed in Niederoeblarn for Mar 6th

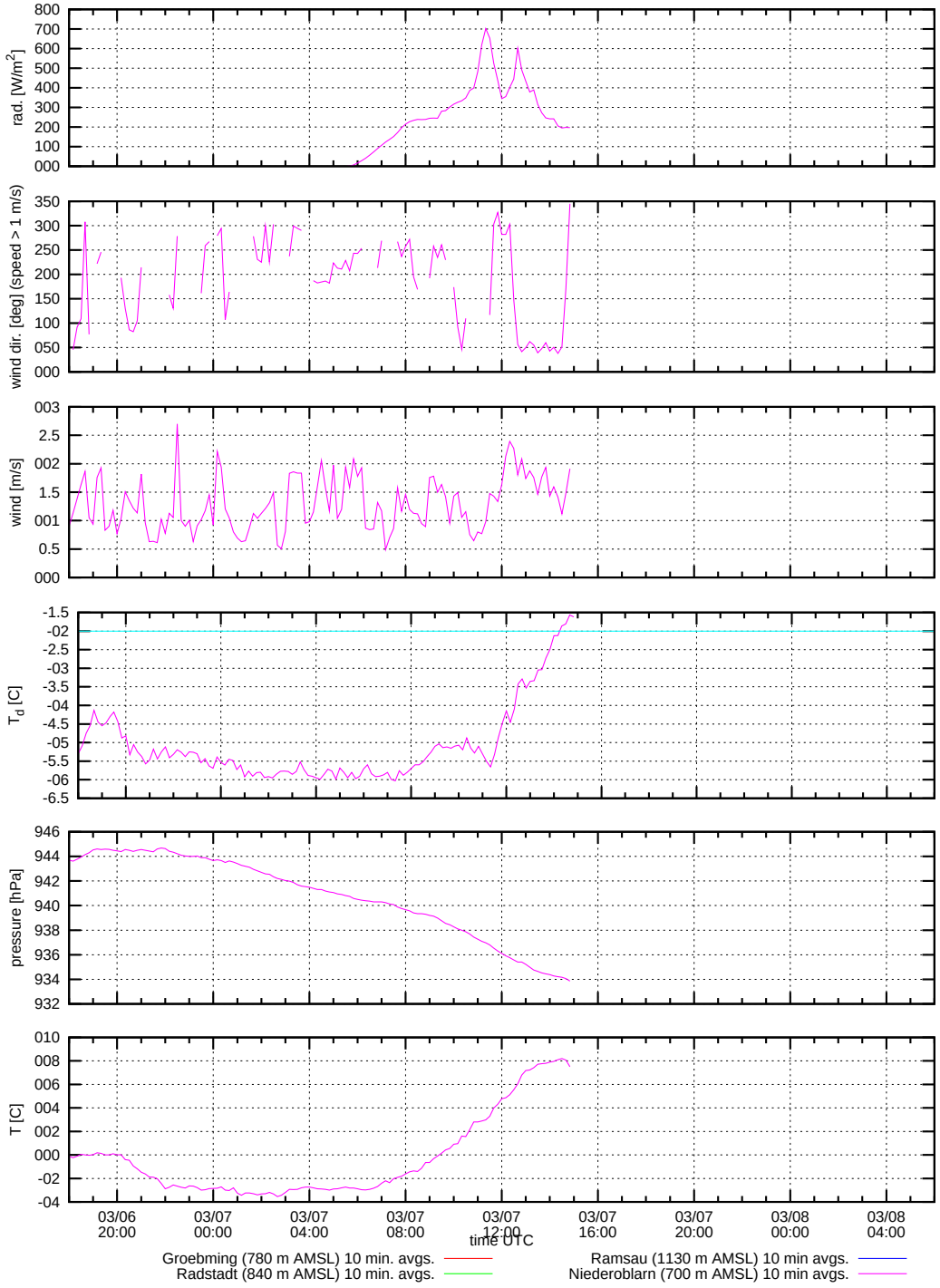

Figure 50: Ground-based data measured in three ZAMG stations and IGFUW station deployed in Niederoeblarn for Mar7th

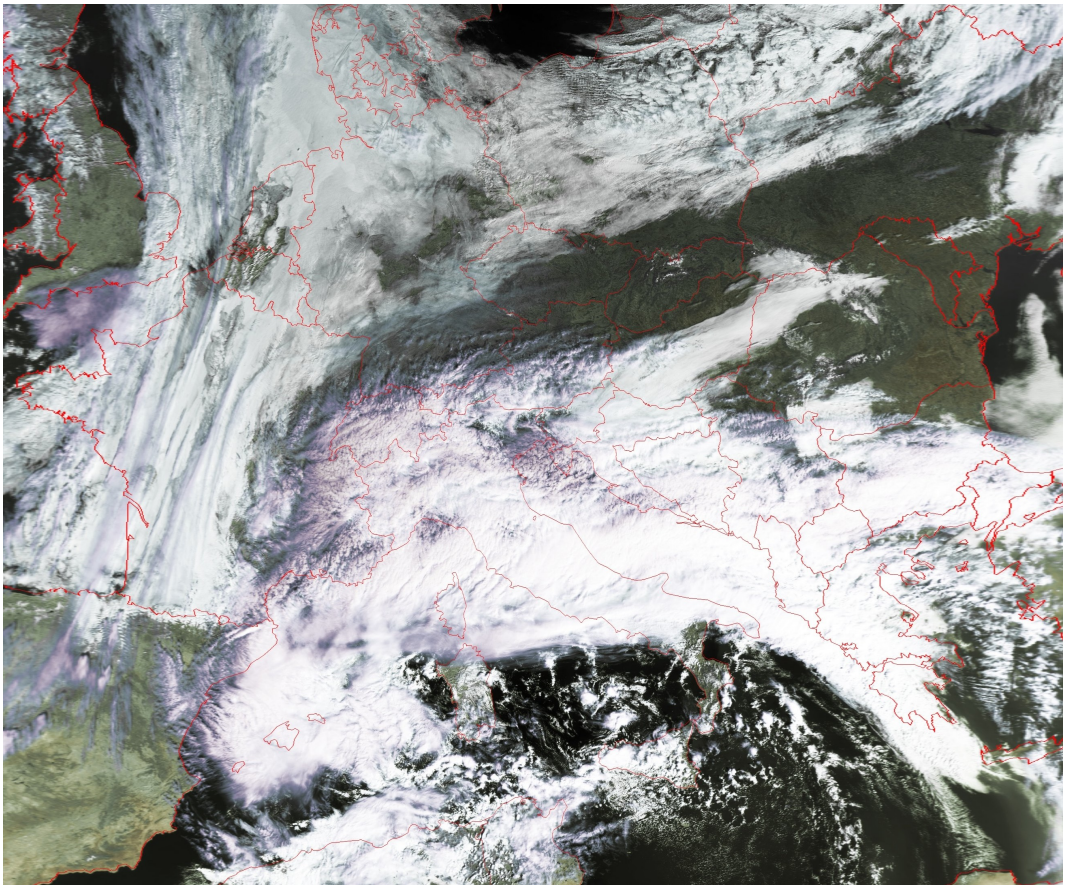

Figure 51: NOAA-17 satellite photo taken at Mar 7th 09:40UTC

Flight Characteristics						
flight reference	date	takeoff time [UTC]	lending time [UTC]	time	horizontal distance [m]	max. altitude [m]
tf01/0224	2008-02-24	14:39:12	15:31:20	00:52:08	39 654	1265,29
rf01/0225	2008-02-25	13:16:13	15:41:31	02:25:18	267 569	1721,70
rf02/0226	2008-02-25	09:15:09	12:07:04	02:51:55	230 601	1922,7
rf03/0306	2008-03-06	06:58:05	09:21:14	02:23:09	211 482	1465,07
rf04/0306	2008-03-06	11:50:10	13:11:58	01:21:48	116 906	1749,45
				9:54:18		

Table 3: Flight characteristics summary table

Figure 46: ENDURO overflying snow-production areas in Haus during rf03

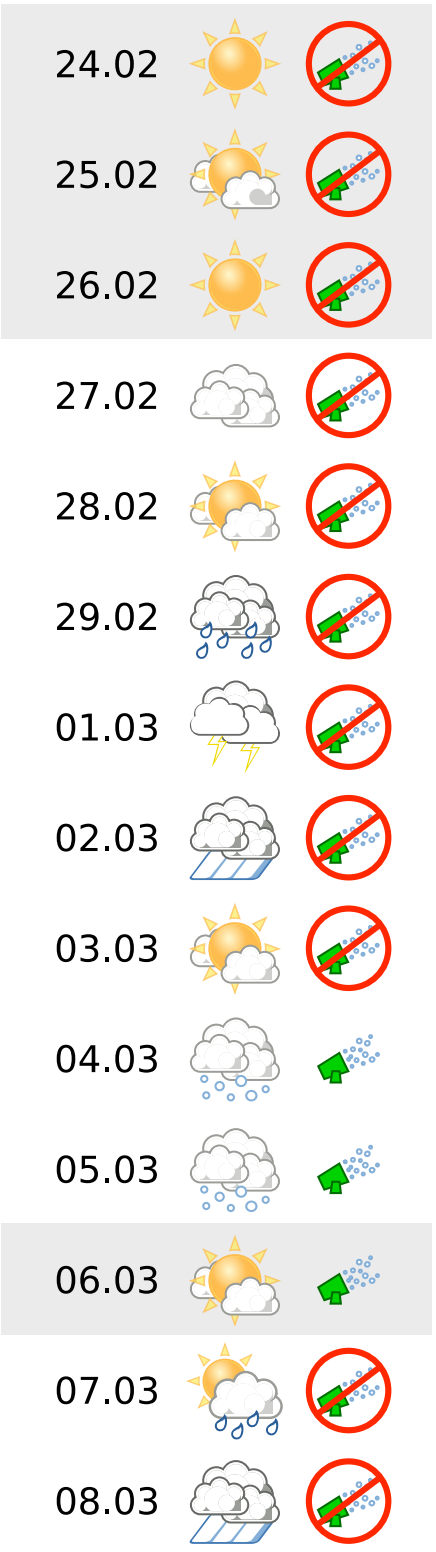

Figure 52: Graphical summary of weather conditions throughout the campaign with snow-production and flight days highlighted

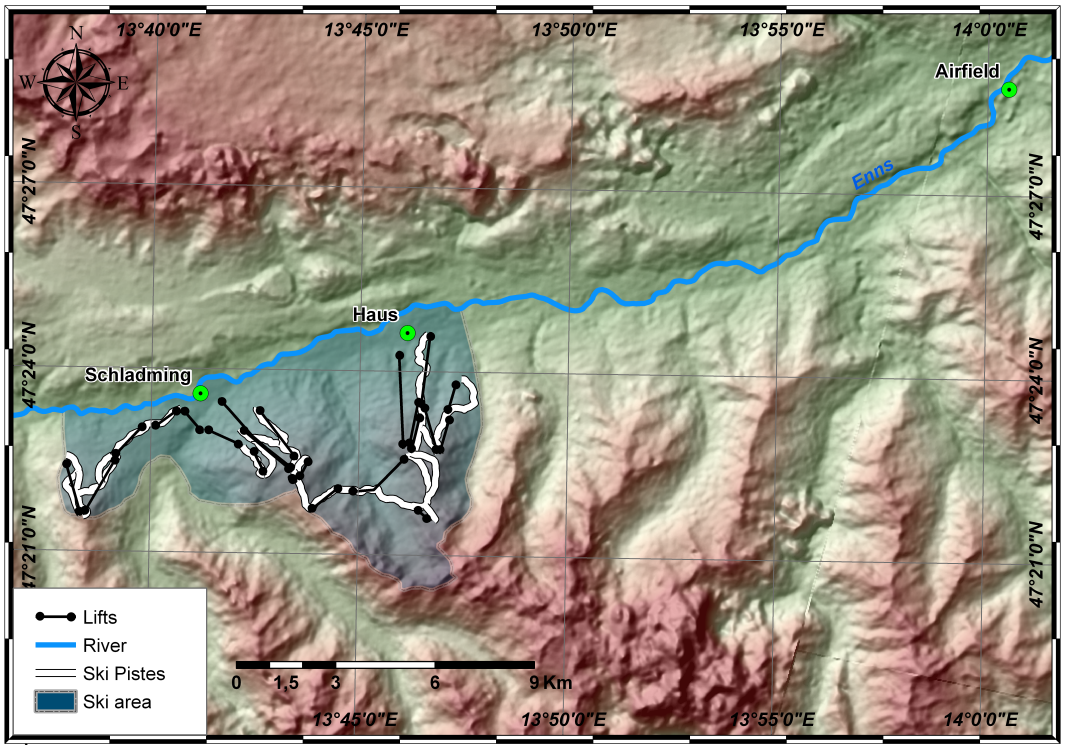

Figure 57: Major ski-infrastructure locations in the Enns River Valley (according to Dachstein-Tauren 1:50000 map)

E Valley shape

See figures 53, 54 and 55 for comparison of the Enns valley cross-sections at different locations along the valley.

F Valley volume estimation

In reference with the quick-look analysis an order-of magnitude estimation of the volume of PBL in the Enns river valley was carried out using the DEM of the valley- see figure 56 for visualisation and table 4 for the results of calculations.

G Ski-infrastructure locations

Consult figure 57 for the location of ski-infrastructure around the Schladming/Planai re-sort.

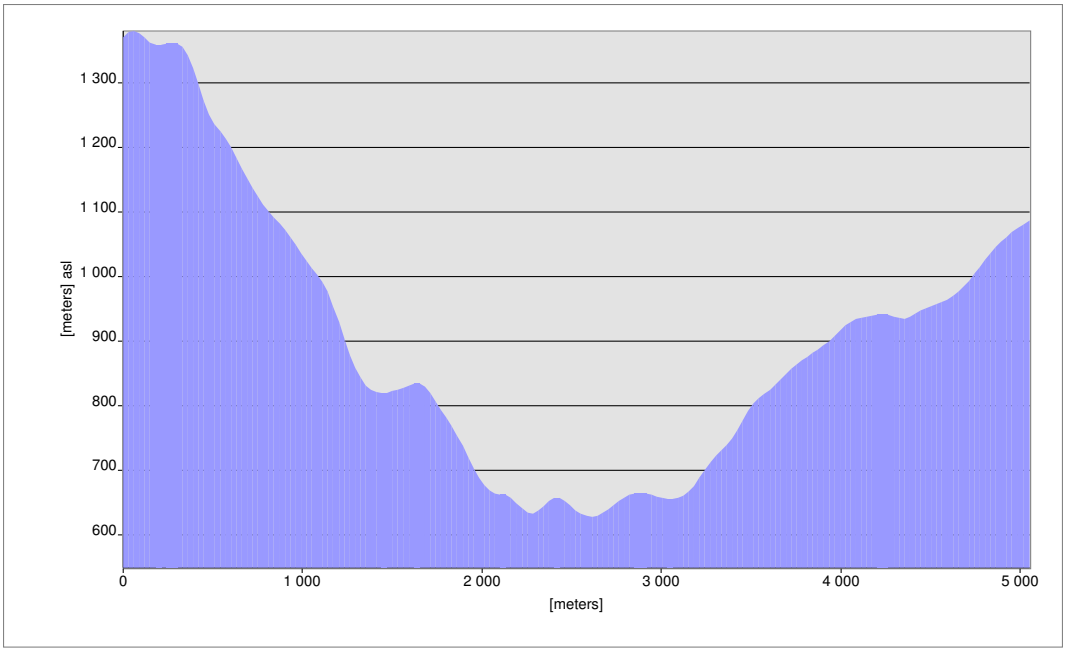

Figure 53: Profile of the Enns valley near Niederoblarn

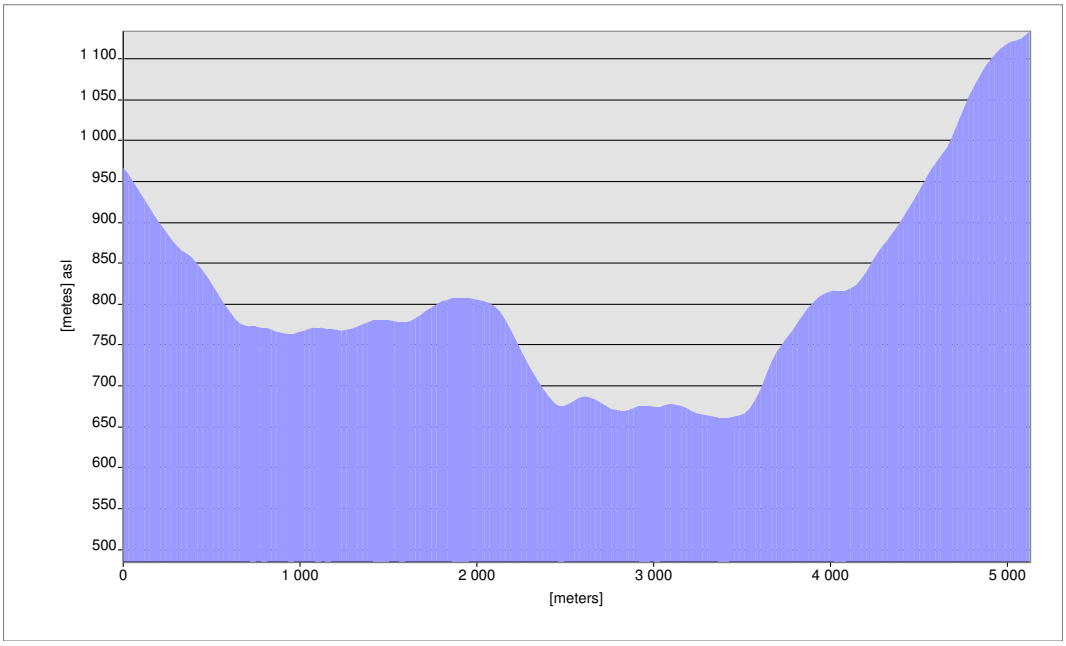

Figure 54: Profile of the Enns valley near Schladming

PBL [m] asl	400	450	500	550	600	650
Volume [m3]	6.47E+10	8.39E+10	1.06E+11	1.31E+11	1.60E+11	1.90E+11
Volume [km3]	64.7	83.9	106.1	131.5	160.0	190.2
Area [km2]	357.8	412.9	476.5	539.8	603.4	603.4

Table 4: PBL volume estimated value for different BL top altitudes

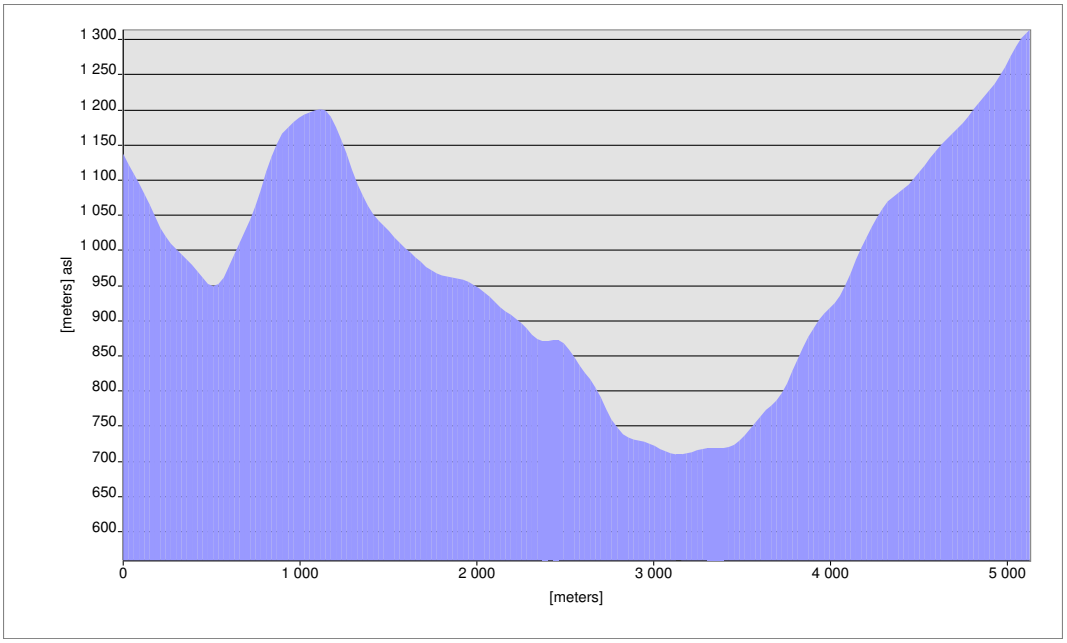

Figure 55: Profile of the Enns valley near Radstadt

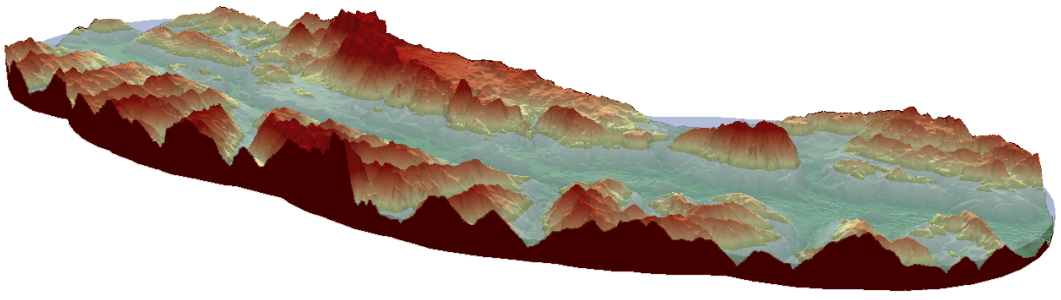

Figure 56: Rendered model of PBL volume in the Enns River Valley (600m above Niederoeblarn, 1200m above mean sea level)

H Web addresses catalogue

- Warnings
  - http://www.meteoalarm.eu/default.asp?lang=EN
- METAR and TAF
  - http://fi.allmetsat.com/metar-taf/itavalta-tsekki-slovenia.php?icao=LOWL
- GFS, weather parameters
  - http://www.westwind.ch/
  - http://www.wetterzentrale.de/
  - http://wetter3.de/animation.html
  - http://nomad5.ncep.noaa.gov/cgi-bin/pdisp_gfs.sh
  - http://profi.wetteronline.de/prec_frame.htm (ECMWF)
- Soundings
  - http://www.arl.noaa.gov/ready/cmet.html
  - http://weather.uwyo.edu/upperair/sounding.html
- Analysis
  - http://www.knmi.com/waarschuwingen_en_verwachtingen/weerkaarten.php
- Satellite pictures
  - http://saturn.unibe.ch/rsbern/noaa/dw/realtime/current/n1bcurr.jpg
  - http://www.satreponline.org/today.php
  - http://www.knmi.nl/satrep/
- Flight hazards
  - http://ows.public.sembach.af.mil/index.cfm?section=Hazards
- Snow forecast
  - http://www.snow-forecast.com/resorts/Schladming/6day/bot
- Meteogram
  - http://www.wetterzentrale.de/topkarten/fsavnmgeur.html

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