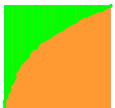


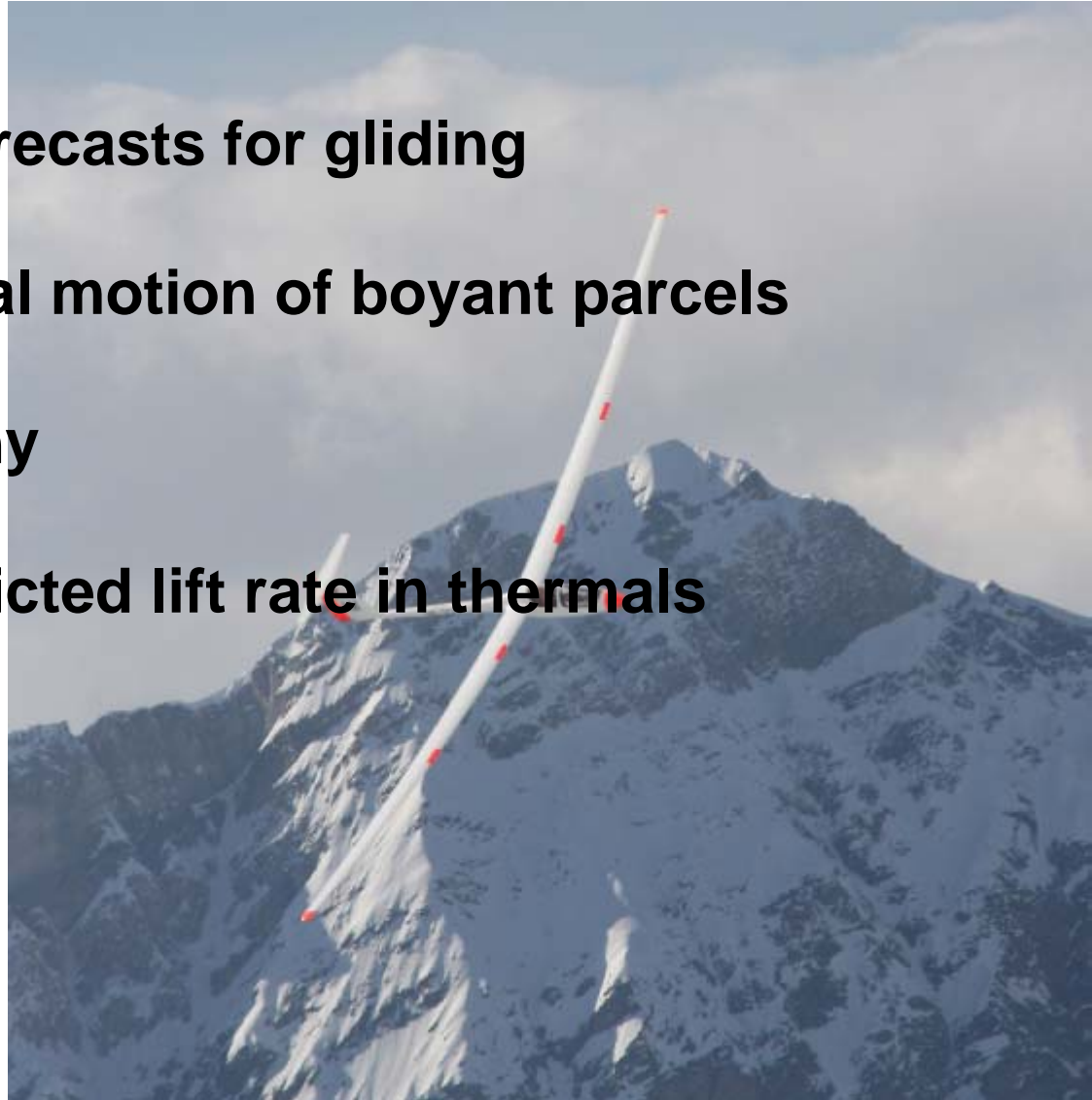
Parameterizations in 2d topographical boundary layer models

Olivier Liechti, Winterthur, Switzerland

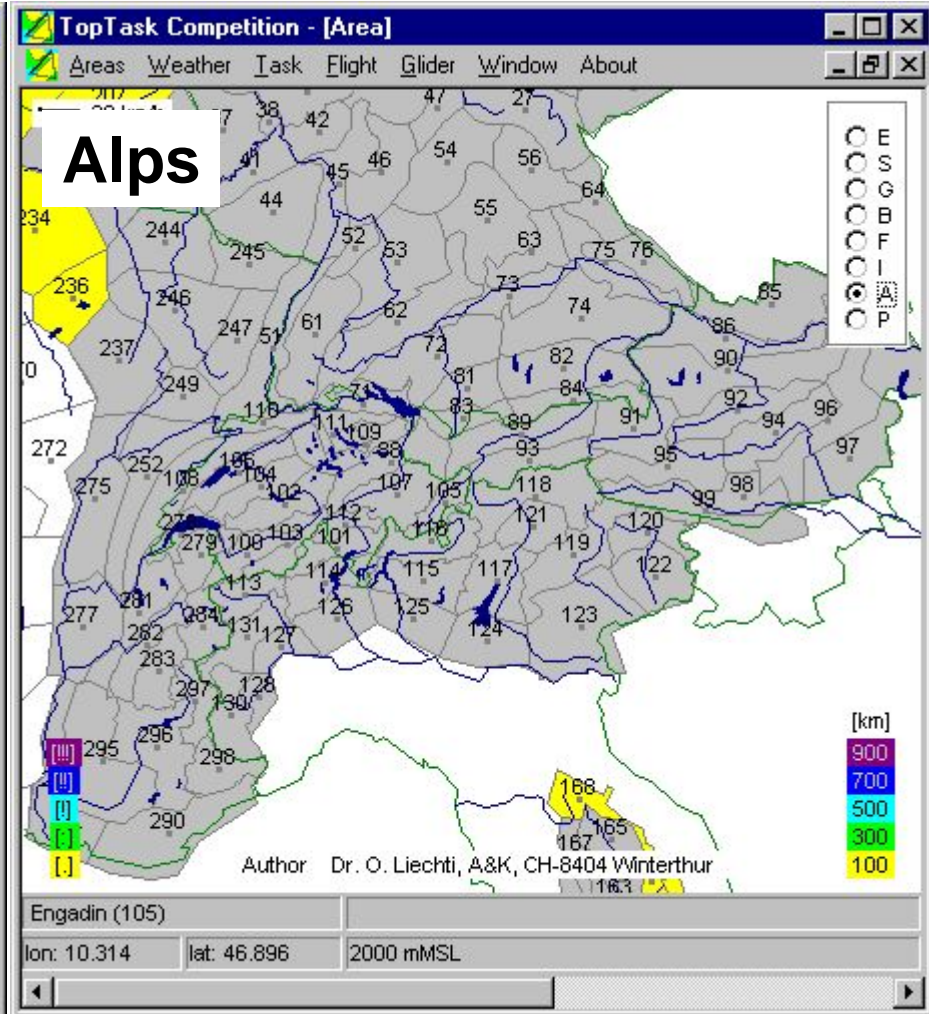
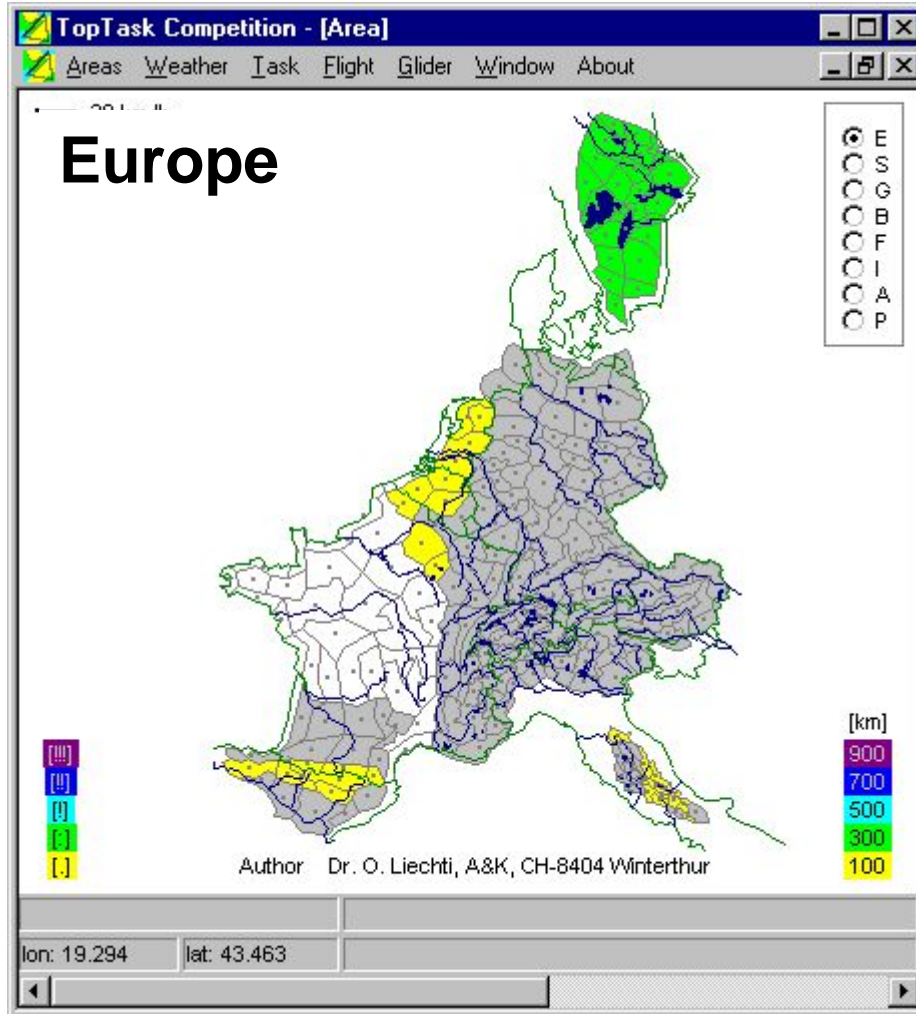


Outline

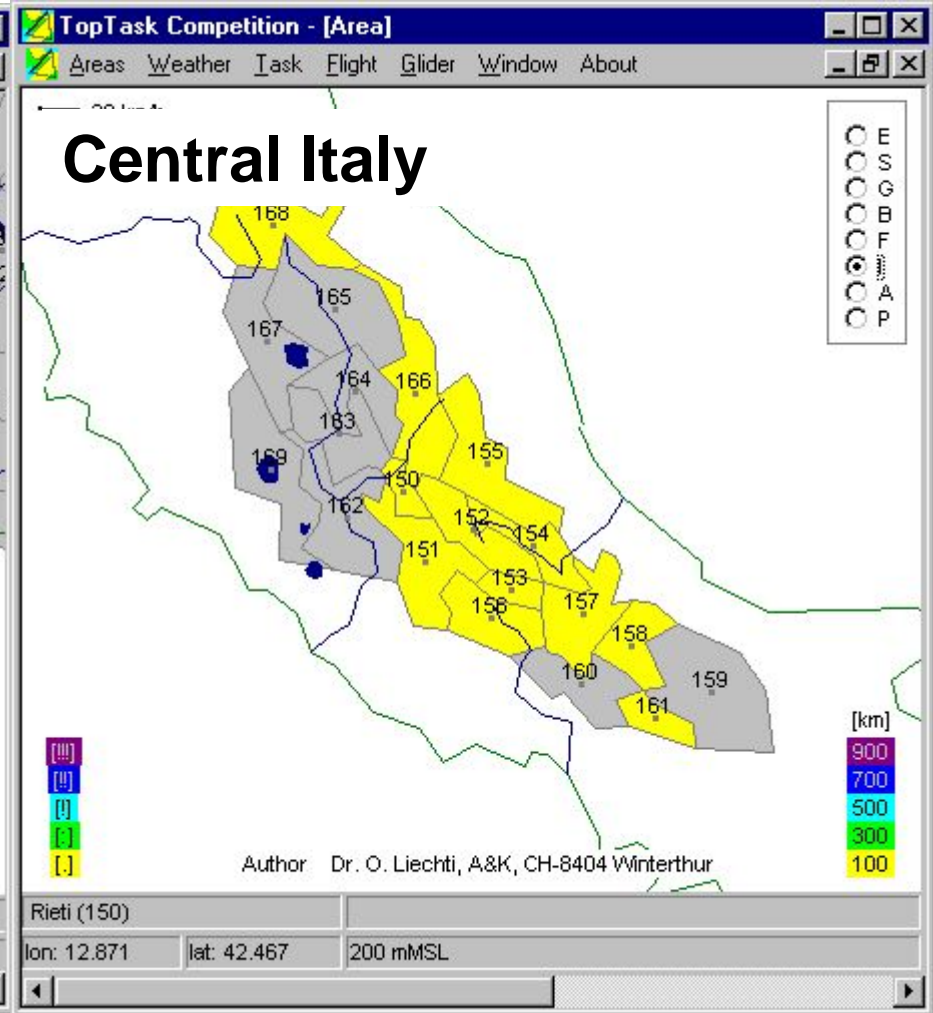
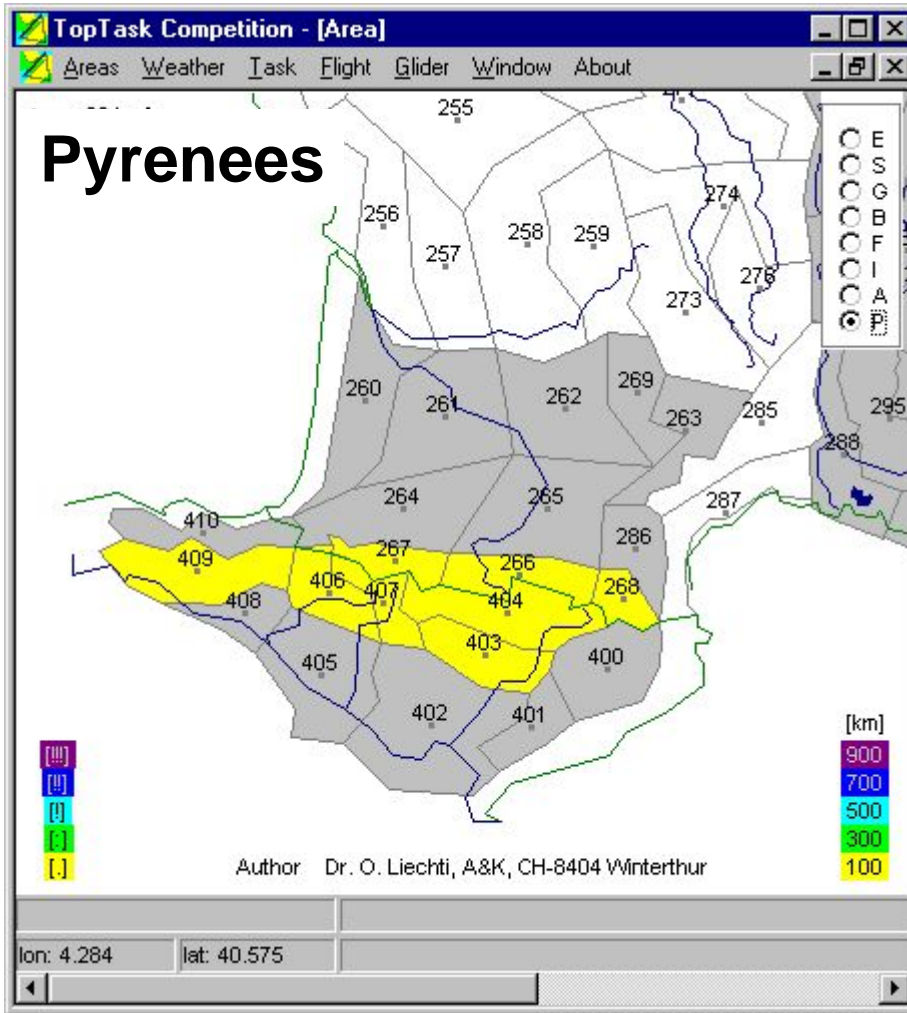
- regional thermal forecasts for gliding
- creation and vertical motion of boyant parcels
- complex topography
- verification of predicted lift rate in thermals
- nocturnal cooling



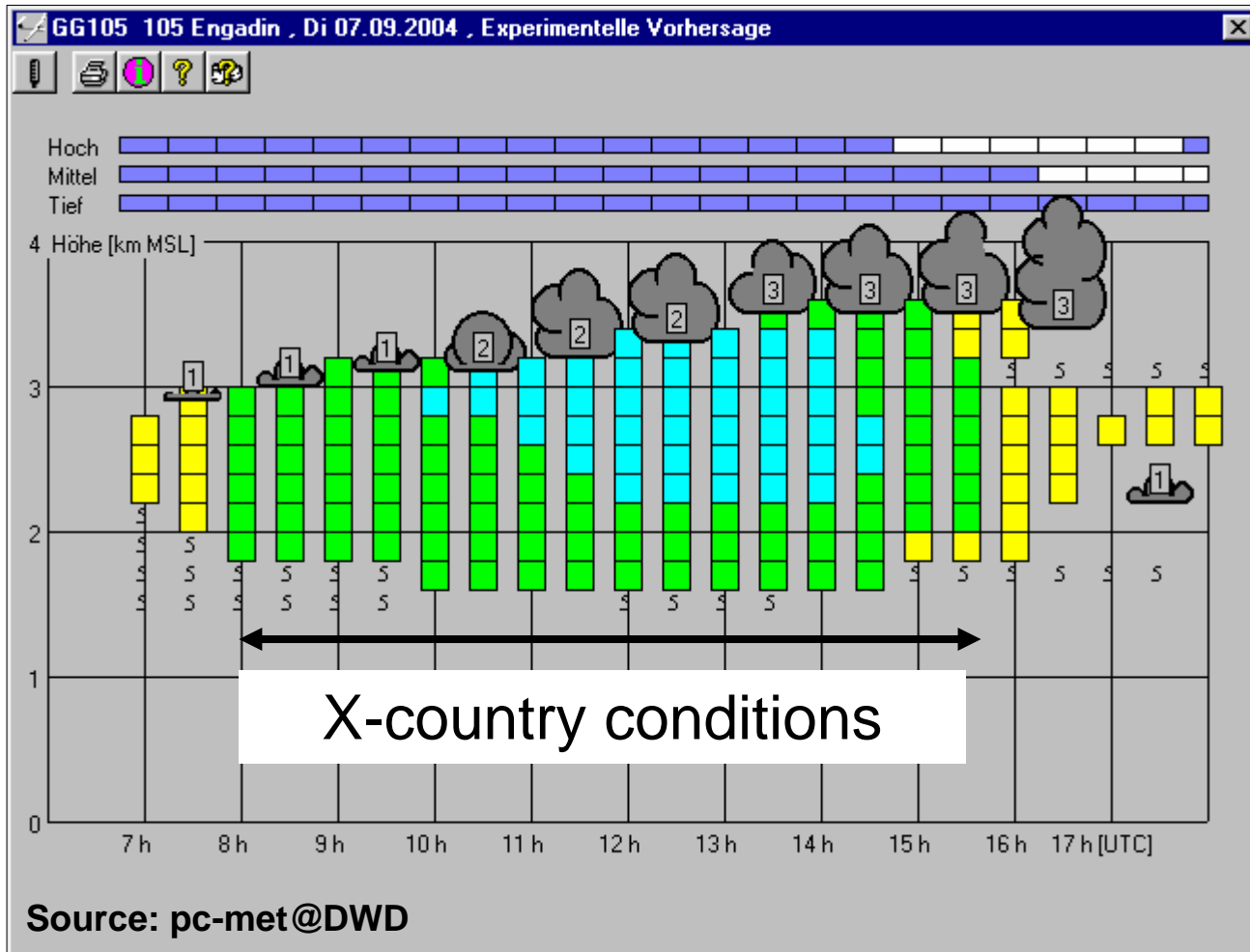
Forecast Regions



Forecast Regions



Regional Forecast



Stratiform Clouds

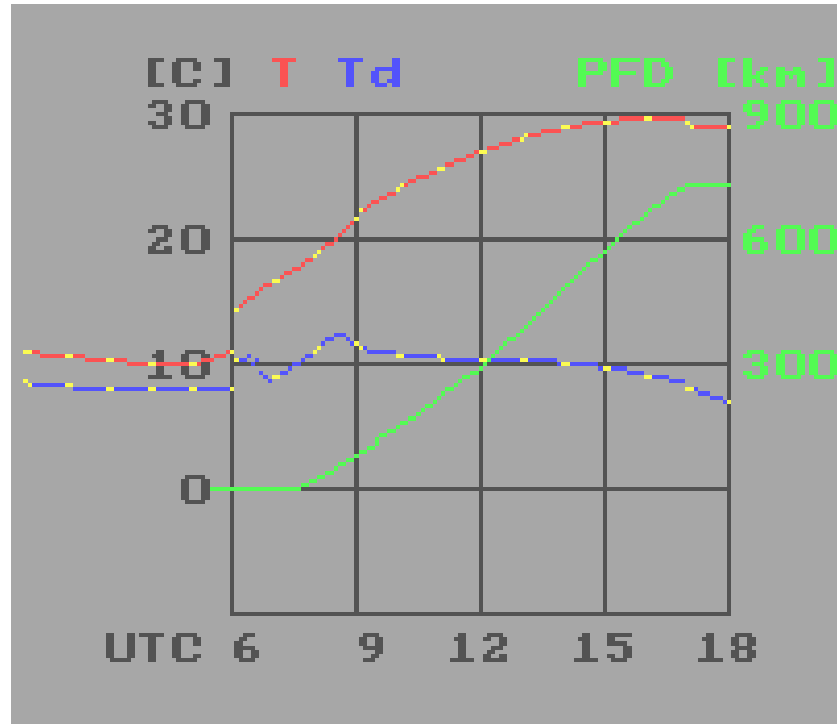
Cumulus Clouds

mittleres Steigen	Schichtwolken
< 0.1 m/s	0 Achtel
0.1 - 0.8 m/s	1-2 Achtel
0.9 - 2 m/s	3-4 Achtel
2.1 - 3 m/s	5-7 Achtel
> 3 m/s	8 Achtel

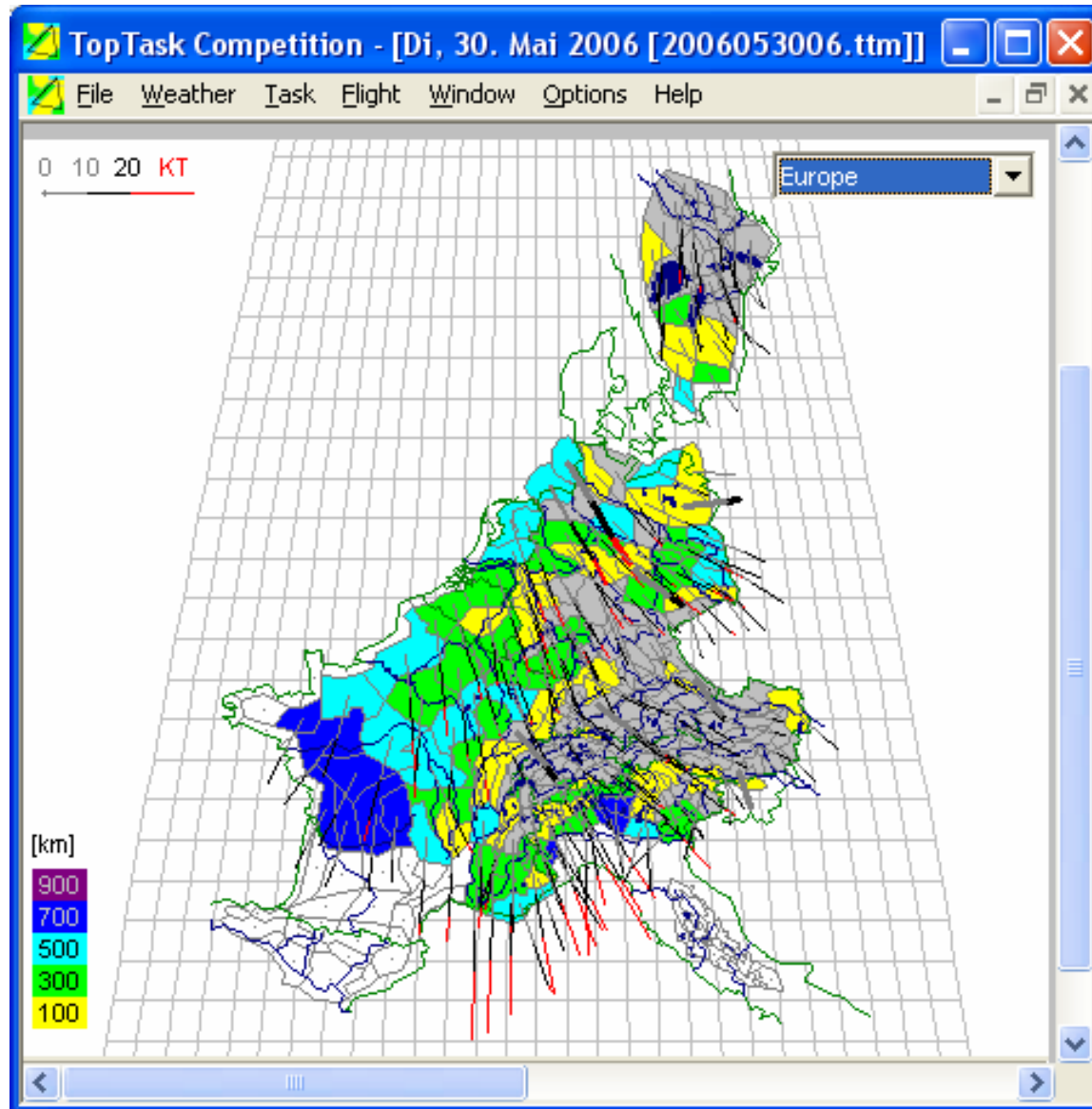
Avg. Lift

Clouds

Potential Flight Distance (PFD)



PFD Map



TopTask Competition - [Mi, 15. Jun 2005 [2005061506.TTM]]

File Weather Task Flight Specials Window Options Help

km hh:mm hh:mm km/h km

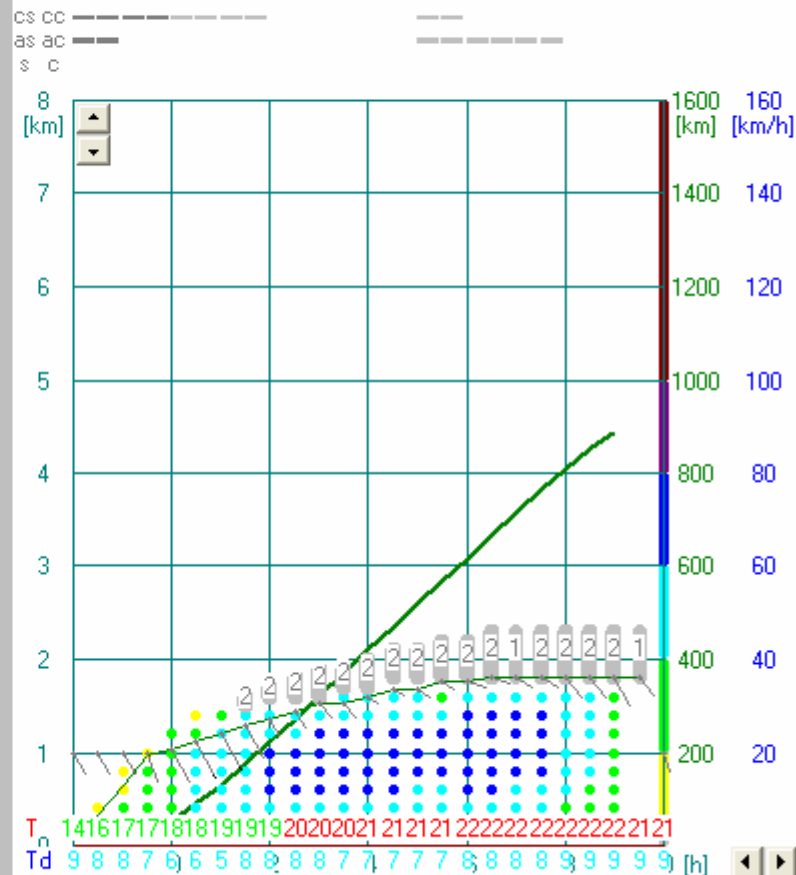
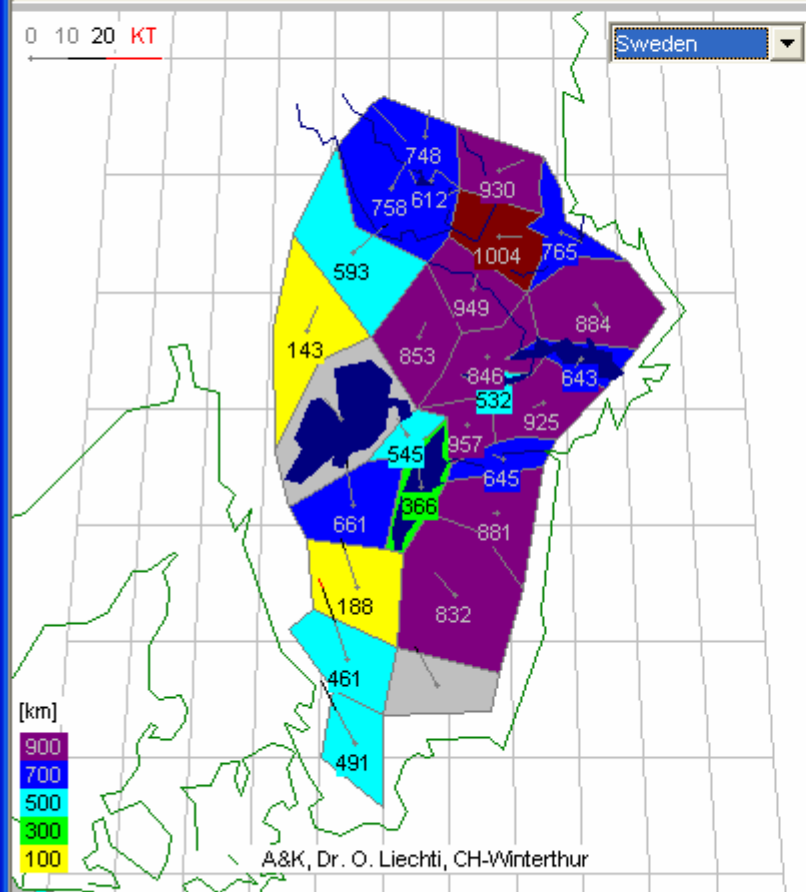
Glider class Handicap [kg/m²] L/D@km/h

Standard 108 40 45@101

wind aligned lift

0 10 20 KT

Sweden

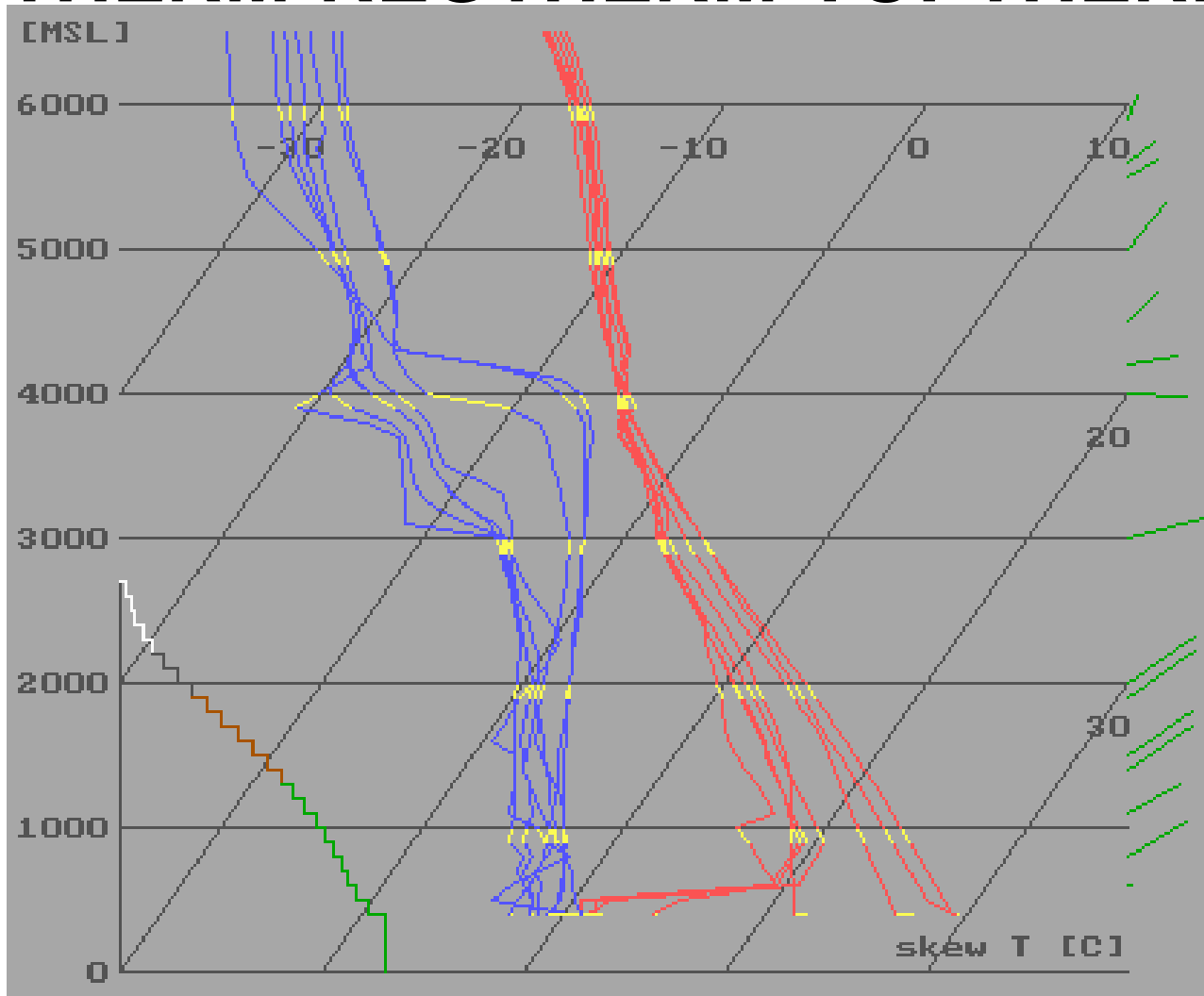


Norr Malaeren (307)

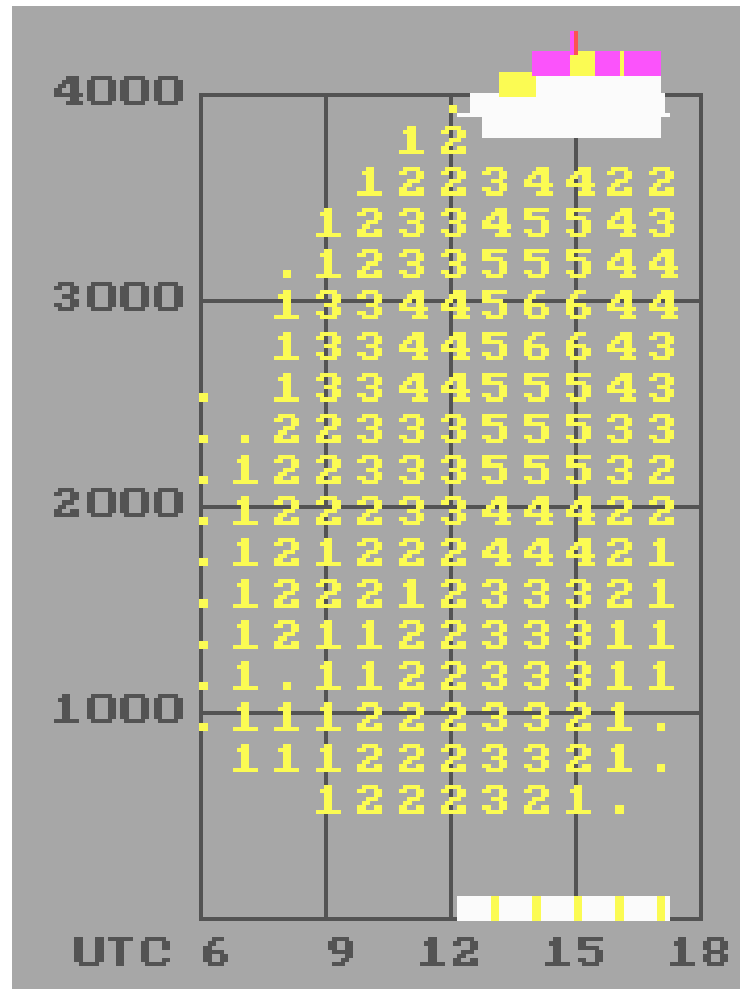
lon: 17.76 lat: 60.08 [TEMP Norr 00z,SYNOP 06z 2/17,TREND 00z]

t: 06:58 h z: 8400 m

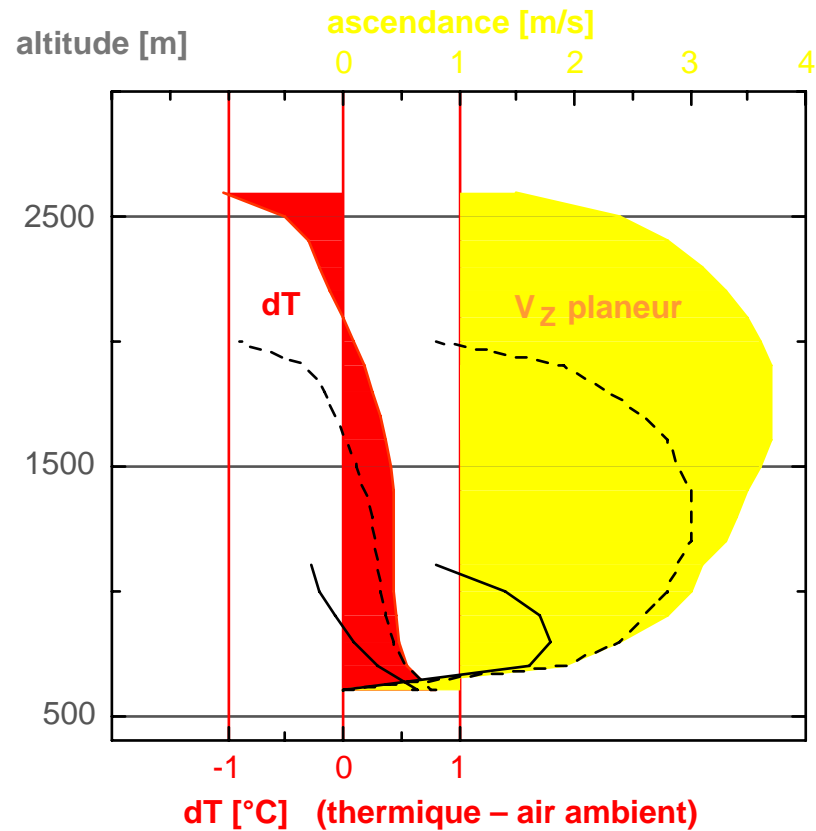
ALP THERM-REG THERM-TOPTHERM



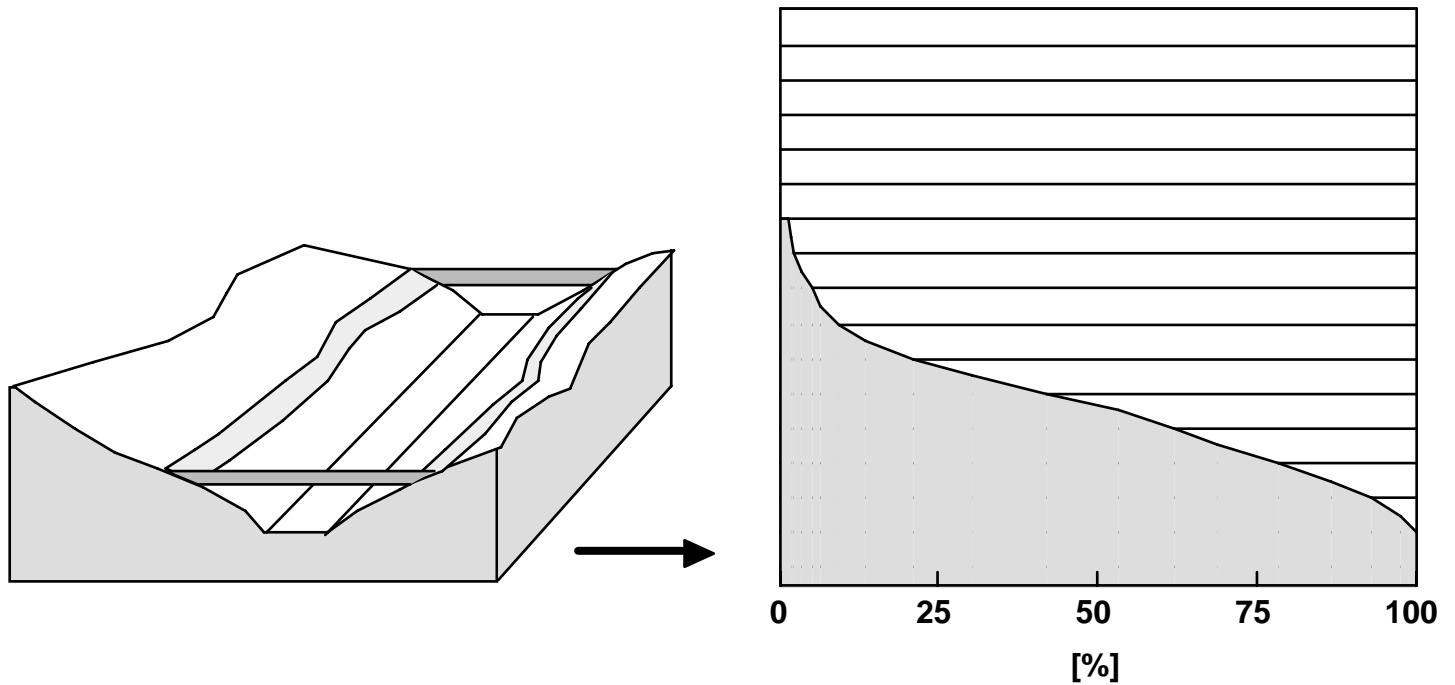
t-z Cross-section of lift rate



Buoyant parcels feed thermals



Atmospheric volume in complex terrain

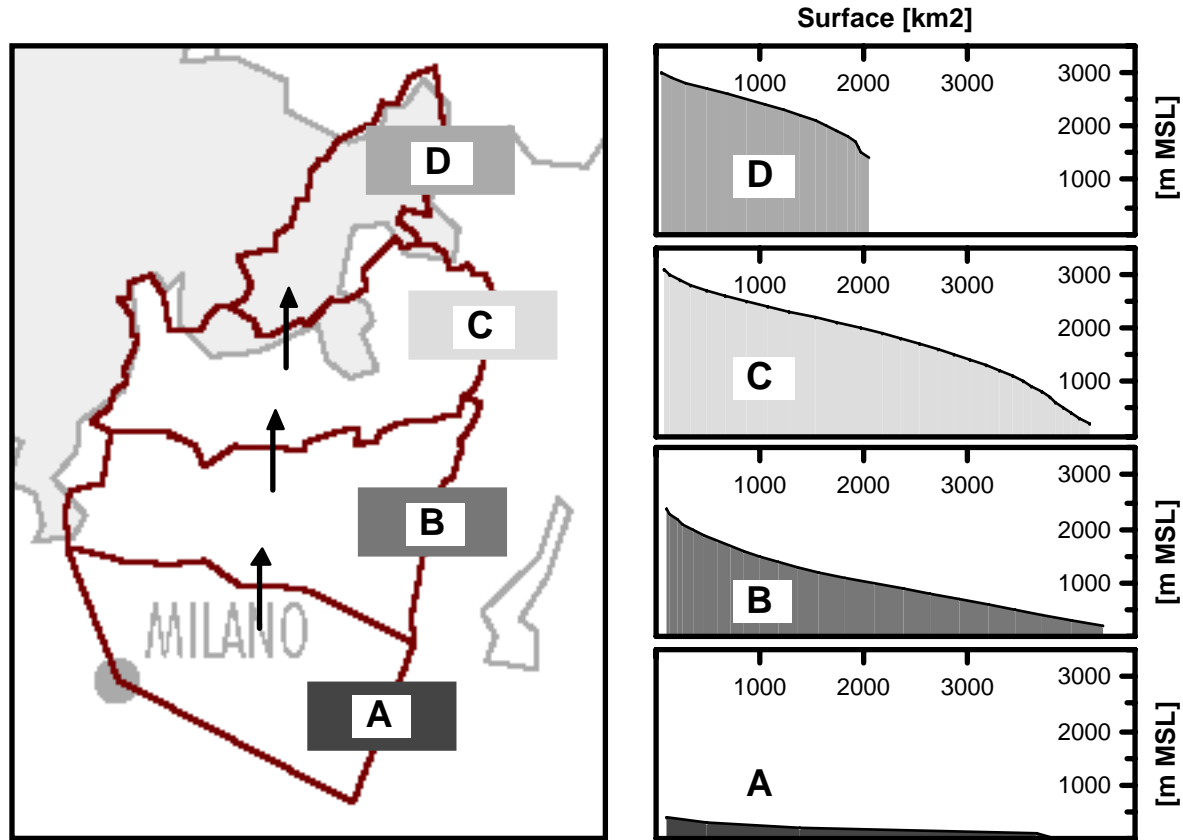


2D



1D

Regional Area-elevation Distribution

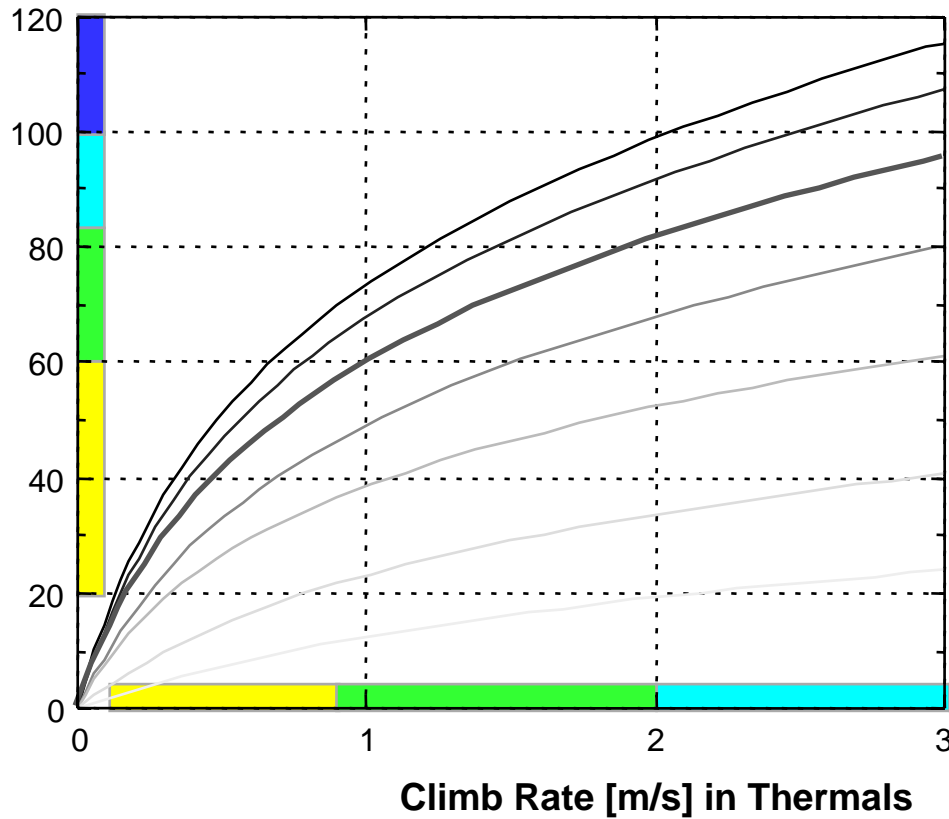


The **elevation** and the **surface parameters** (snow, vegetation) control the **heating** and **cooling** resulting from radiation

X-country Speed

X-country speed [km/h]

Handicap (BGR)



124 (1:53) 25 m

114 (1:47) 18 m

100 (1:39) 15 m

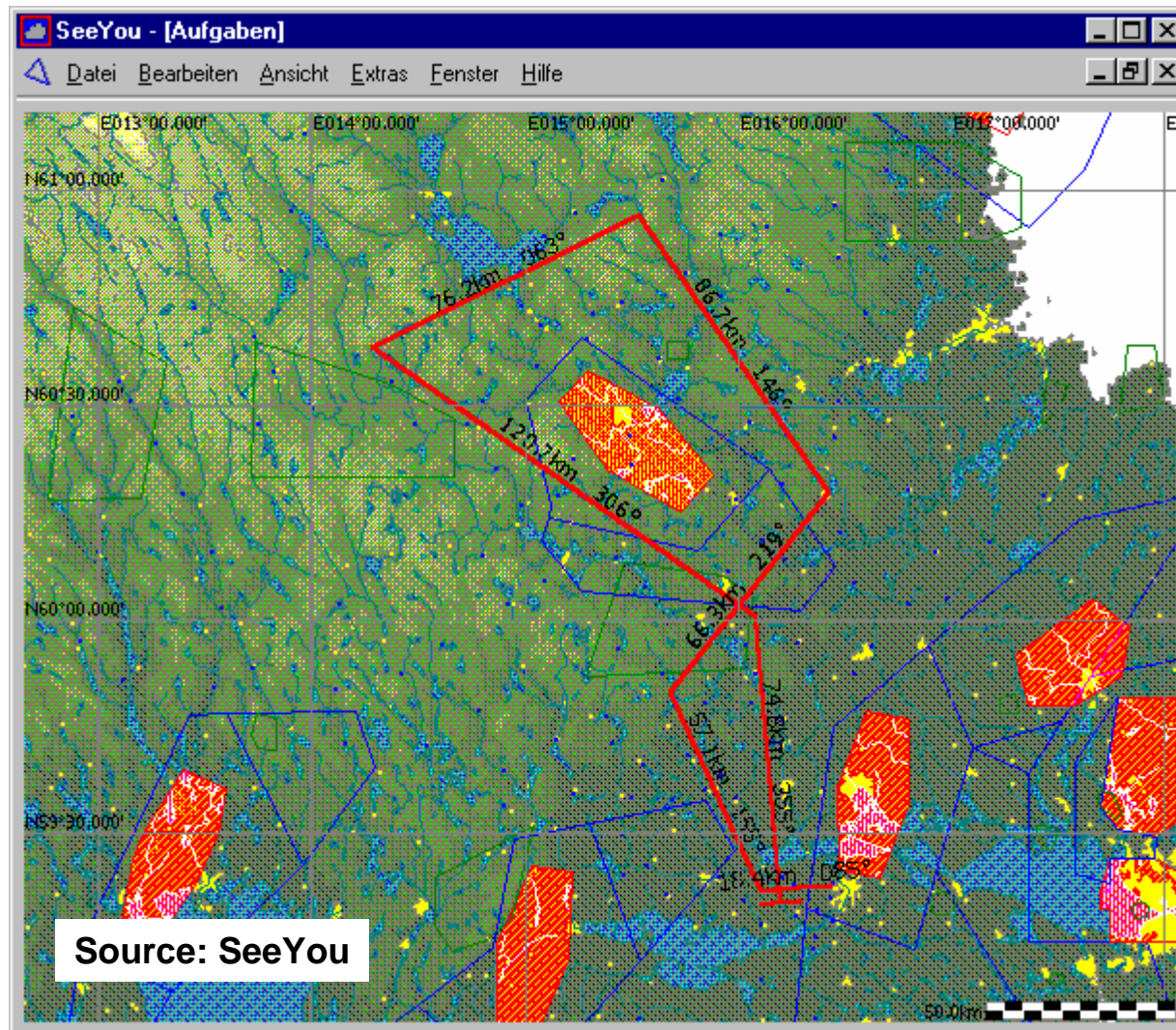
84 (1:30) 15 m old

77 (1:27) Archaeopteryx

50 (1:12) Hangglider

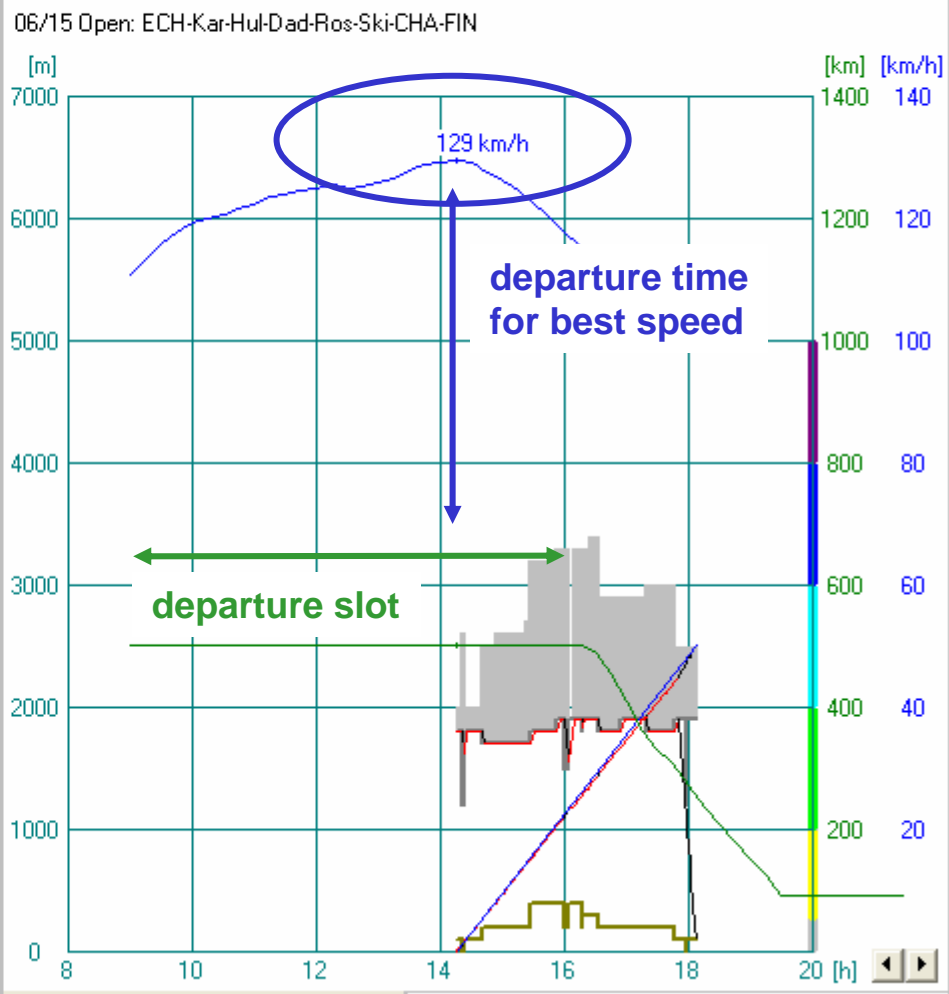
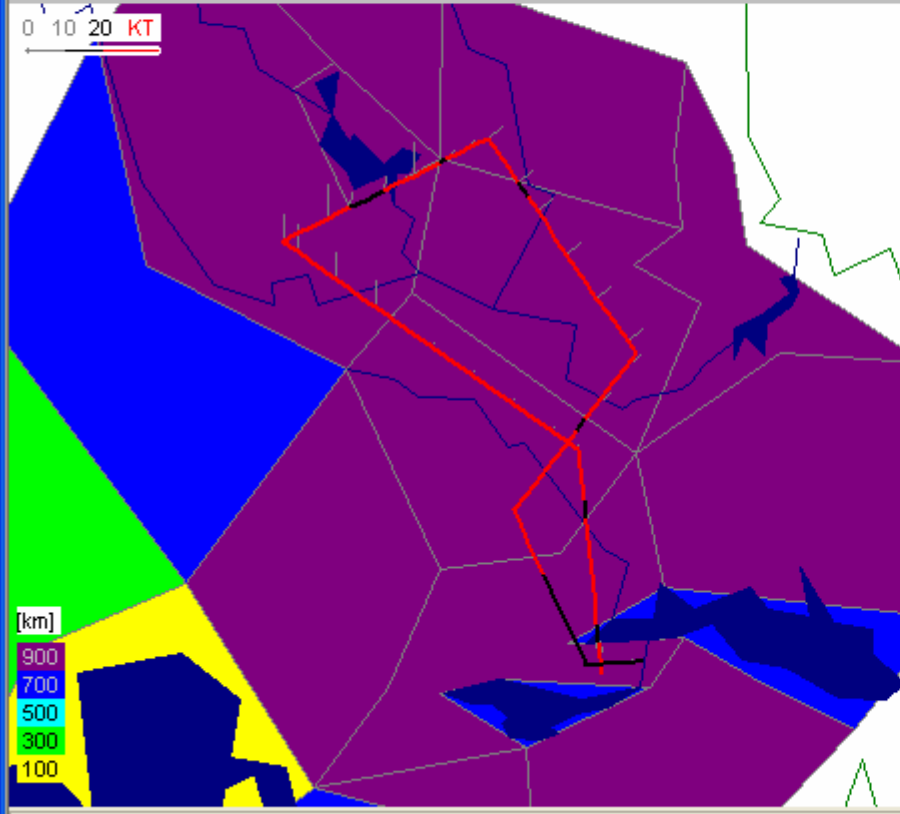
38 (1: 5) Paraglider

Setting a Task



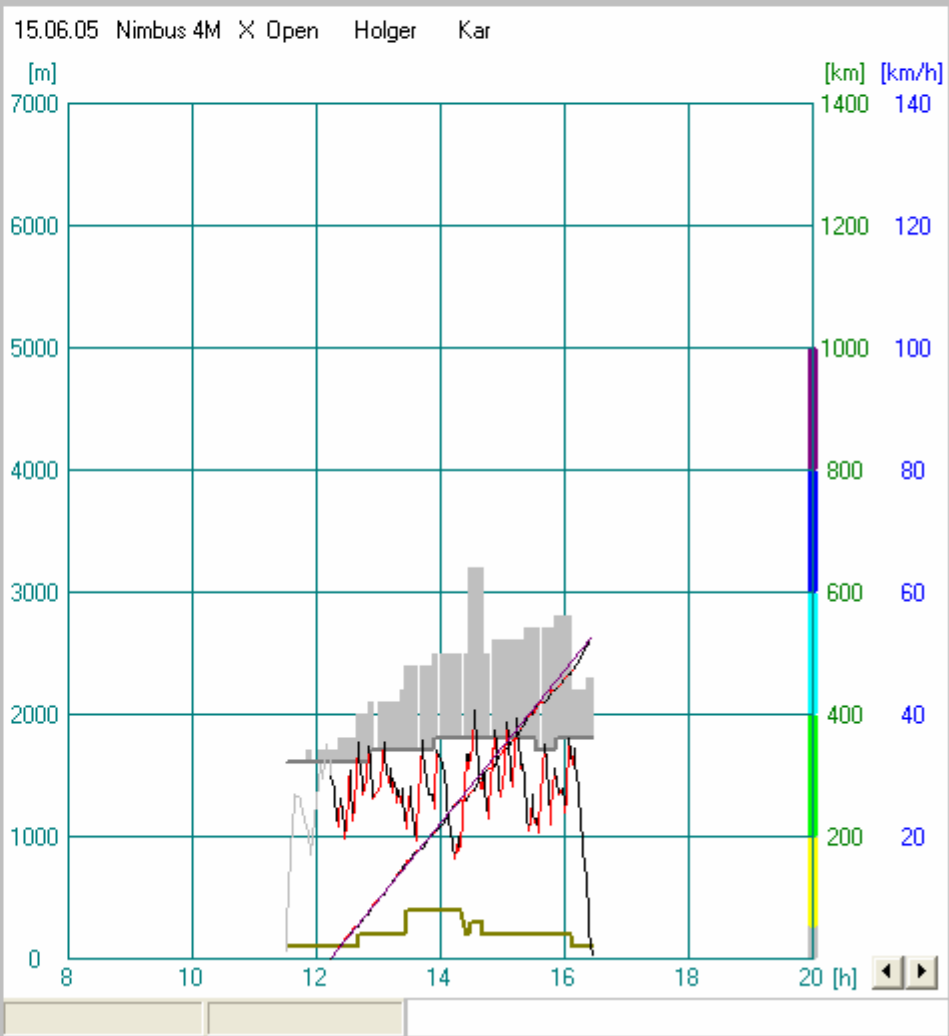
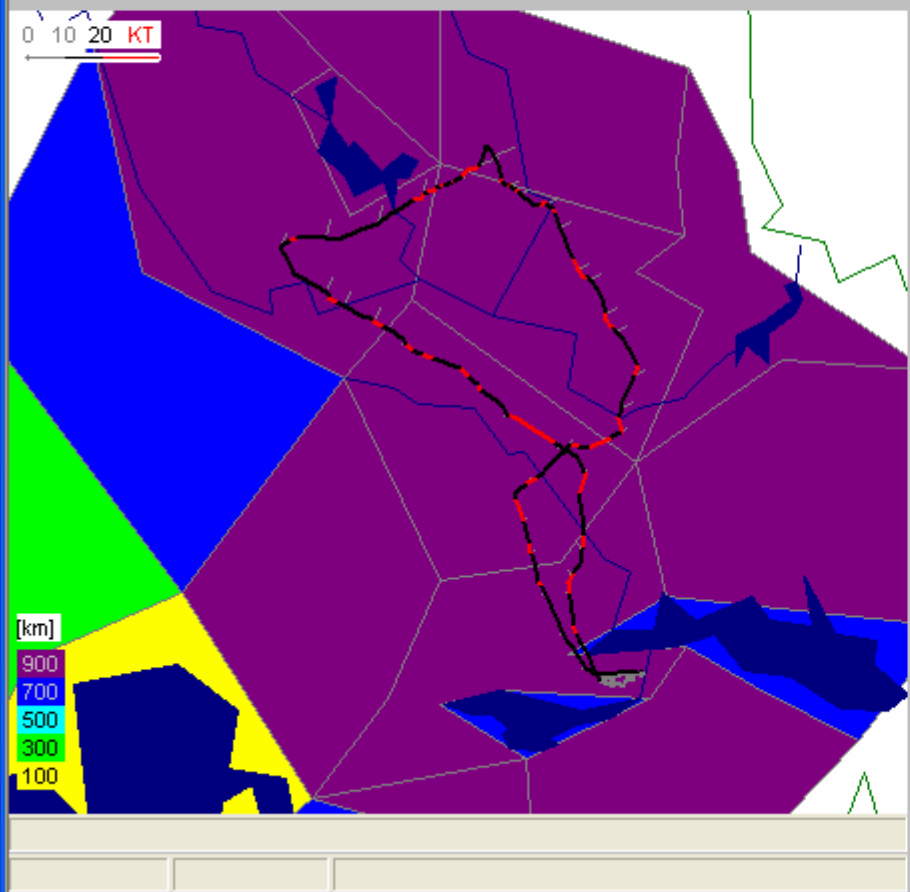
km	hh:mm	hh:mm	km/h	km	Épreuve
295	14:00-16:19	127		06/14	15m/Standard: BRÄ-Mok-Lud-Vir-
384	13:15-16:19	125		06/14	18m/Open: ECH-Mok-Fel-Gra-CHA-
364	14:45-17:39	125		06/15	15m: BRÄ-Kar-Jar-Kar-CHA-FIN
368	14:45-17:40	126		06/15	18m: CHA-Kar-Jar-Kar-CHA-FIN
500	14:15-18:06	129		06/15	Open: ECH-Kar-Hul-Dad-Ros-Ski-
303	14:00-16:22	128		06/15	Standard: BRÄ-Vas-Mal-Gun-CHA-
433	14:00-17:27	126		06/16	15m: ALP-Kop-Kar-Nas-Ulv-CHA-F
451	14:00-17:36	125		06/16	18m: CHA-Kop-Fla-Nas-CHA-FIN

AAT Départ: 1800 Classe de planeur: libre Indice: 130 [kg/m²]: 44 FM@km/h: 56@103
 inverse



km	hh:mm	hh:mm	km/h	km	Vol
500	14:15-18:11	127	56f	x.igc	
526	12:14-16:26	125	56f	x.igc	

TopTask
 Départ: 20
 Classe de planeur: libre
 Indice: 130
 [kg/m²]: 44
 FM@km/h: 56@103



km	hh:mm	hh:mm	km/h	km	Vol
500	14:15-18:11	127	56f	x.igc	
526	12:14-16:26	125	56f	x.igc	

TopTask

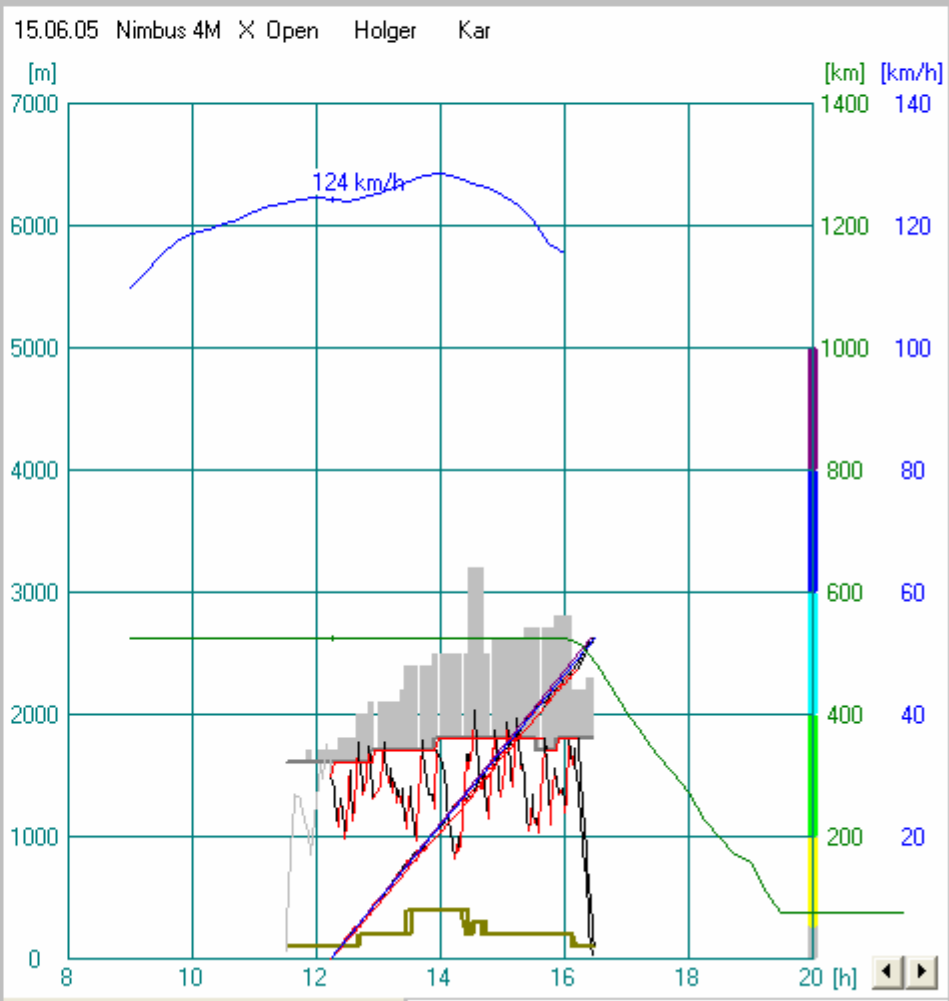
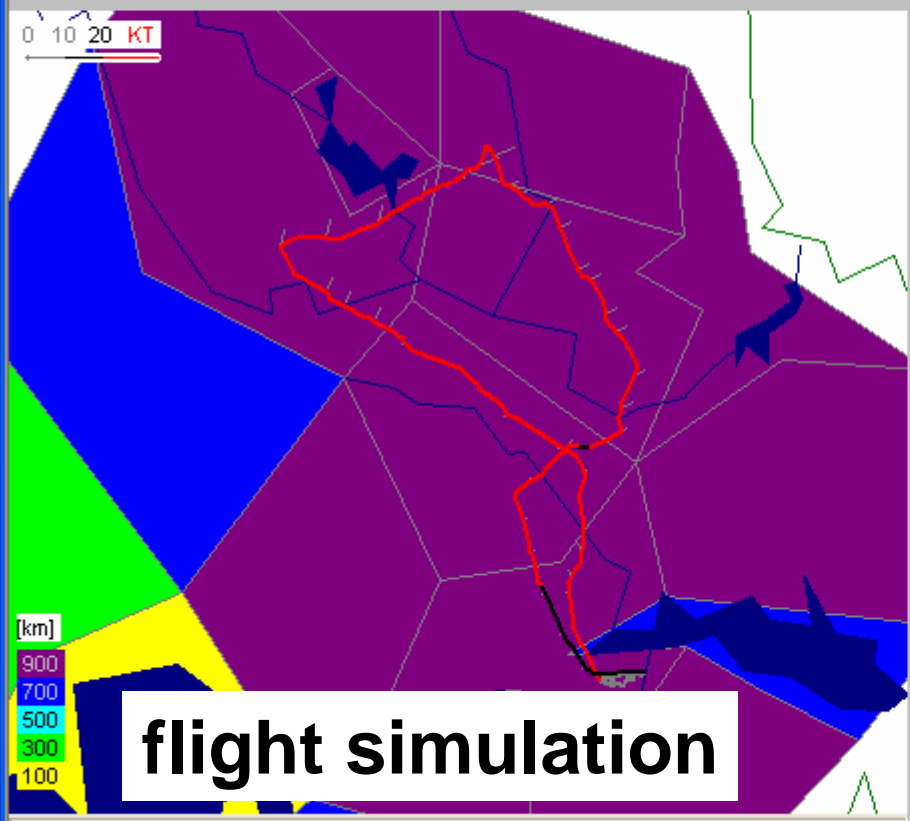
Départ: 20

Classe de planeur: libre

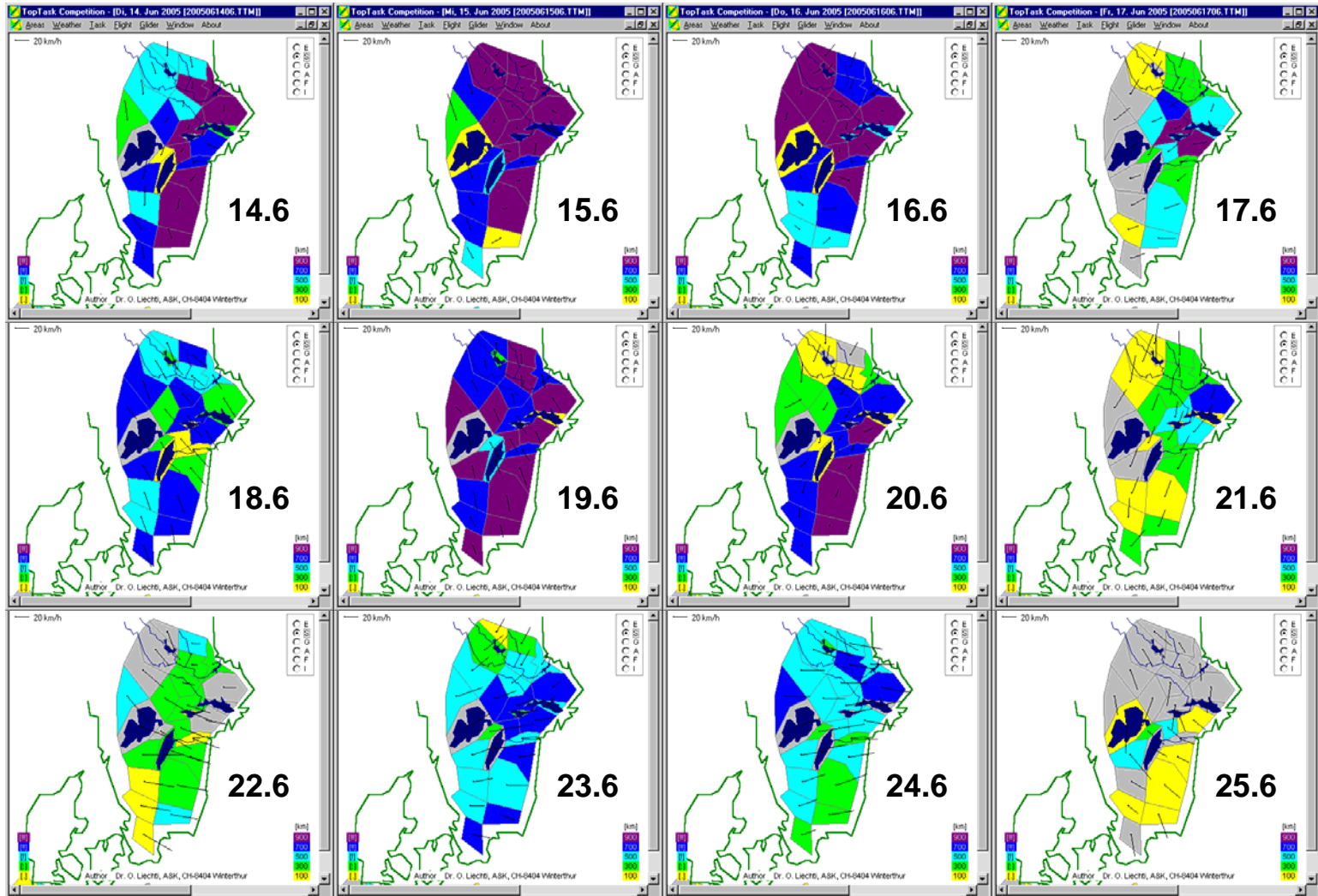
Indice: 130

[kg/m²]: 44

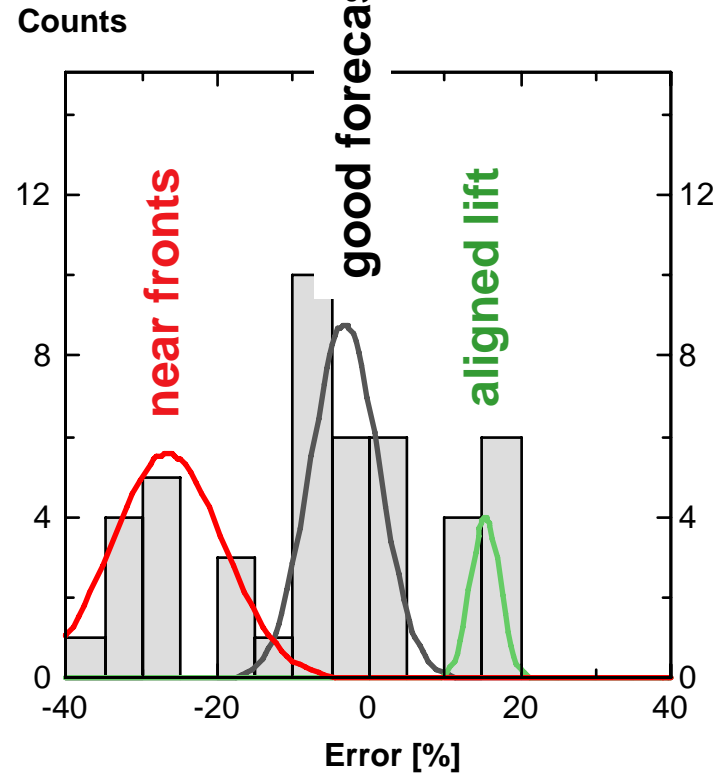
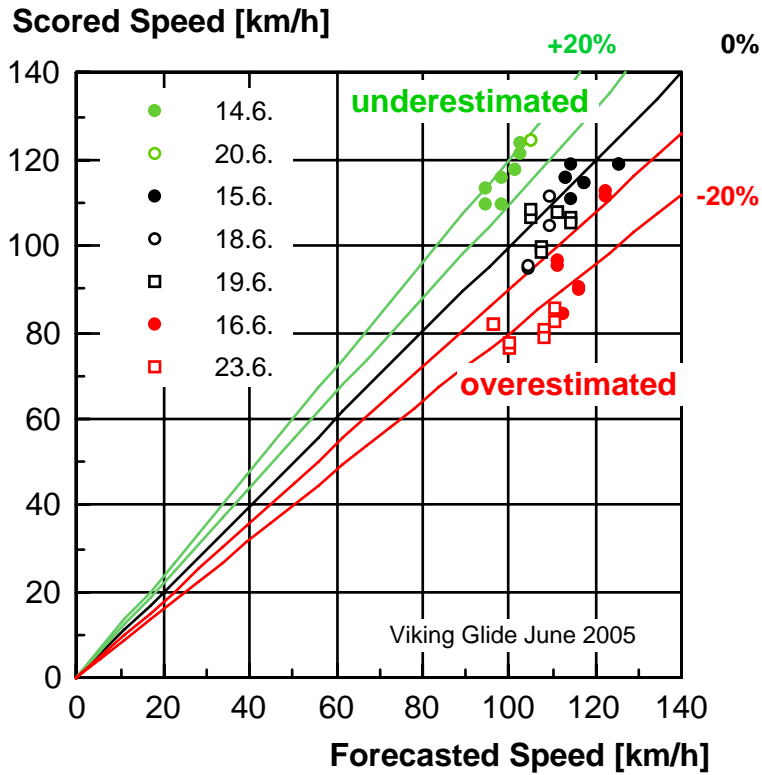
FM@km/h: 56@103



VikingGlide 2005

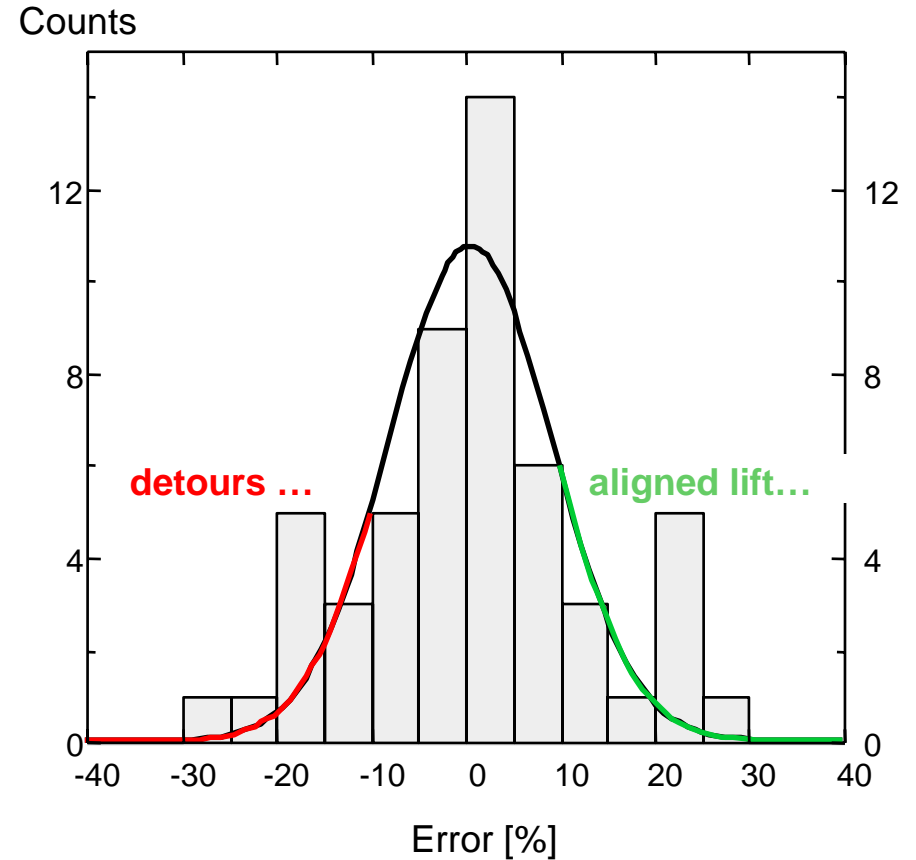
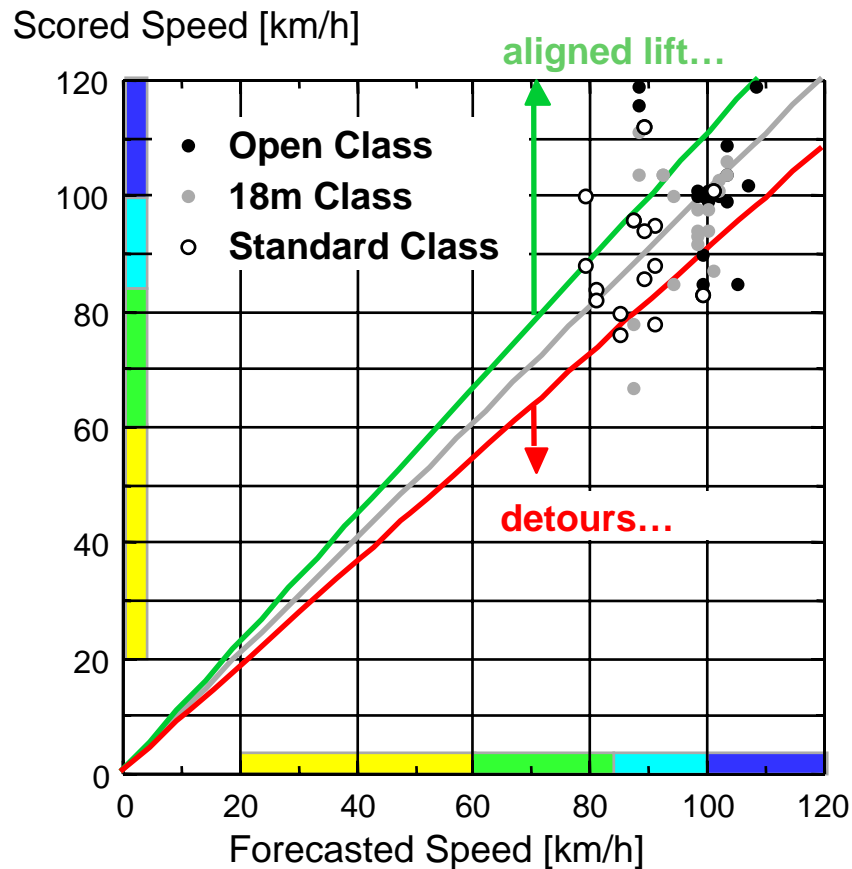


Verification



46 scored flights @ Viking Glide 2005
(7 days, 23 tasks, 1. and 2. place)

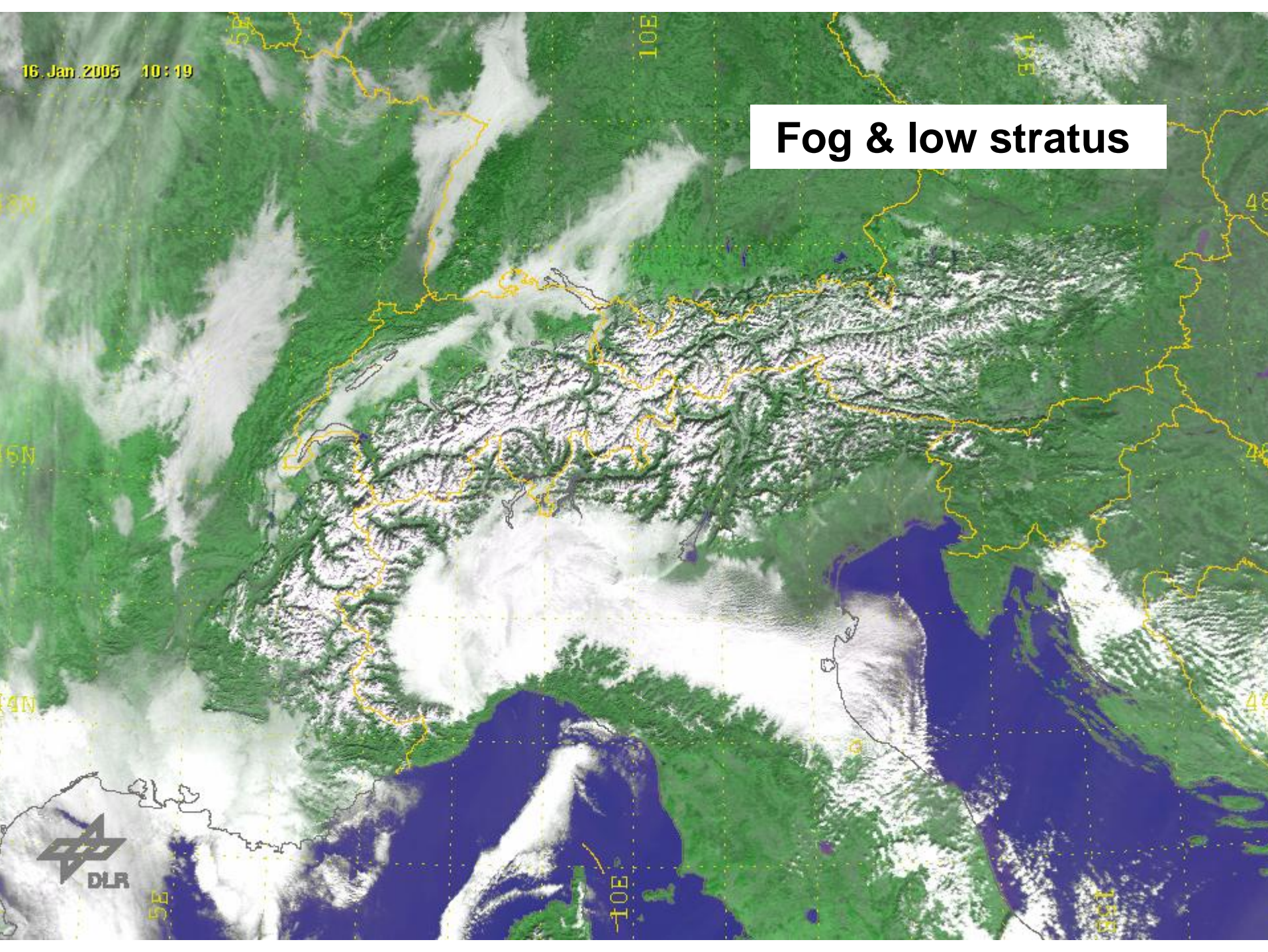
Verification of TopTask



54 scored flights @ Swiss Glide 2004
(9 days with 3 tasks, 1. and 2. place)

16 Jan 2005 10:19

Fog & low stratus





19 12:15



Talwiesen-Str.



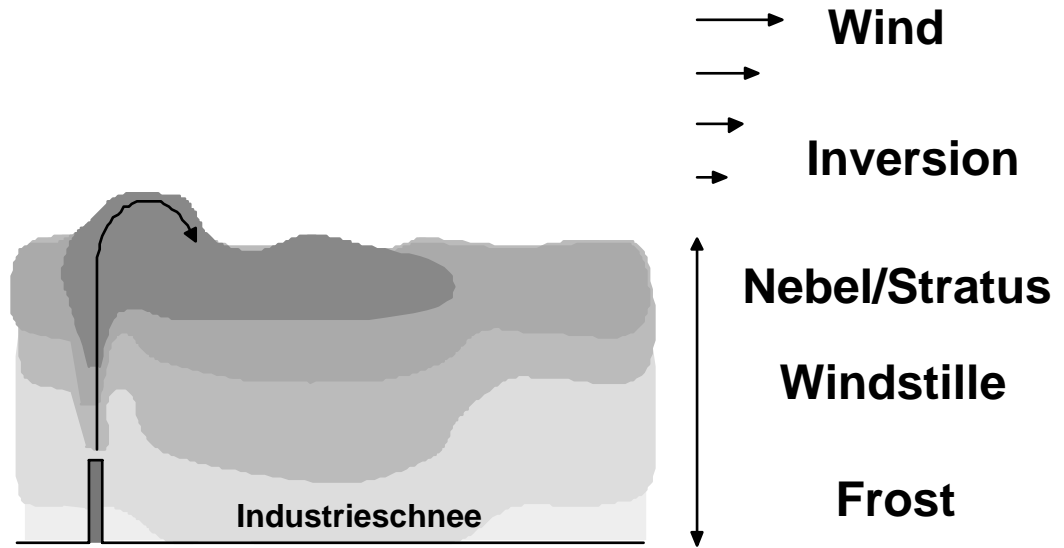
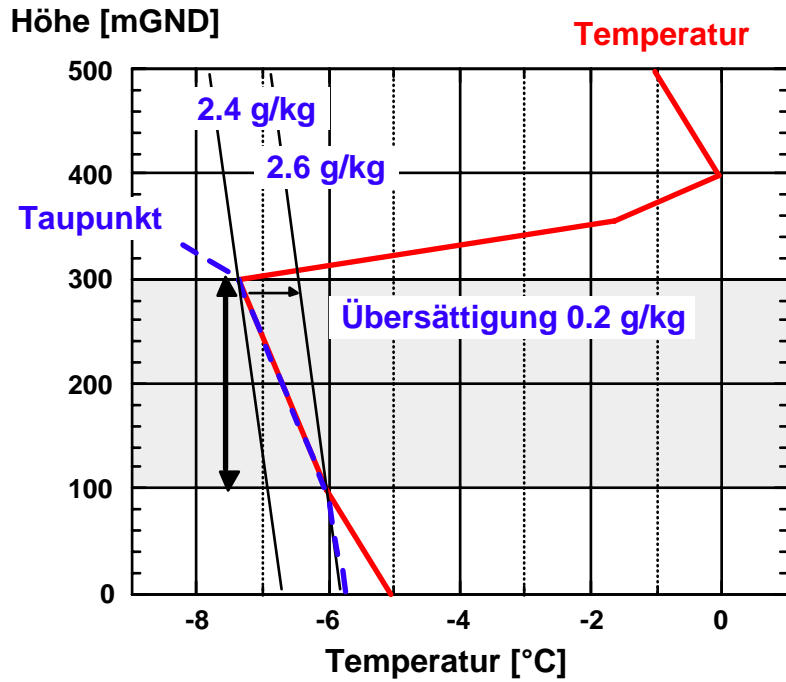
zusammen
Zusammen

19 12:08

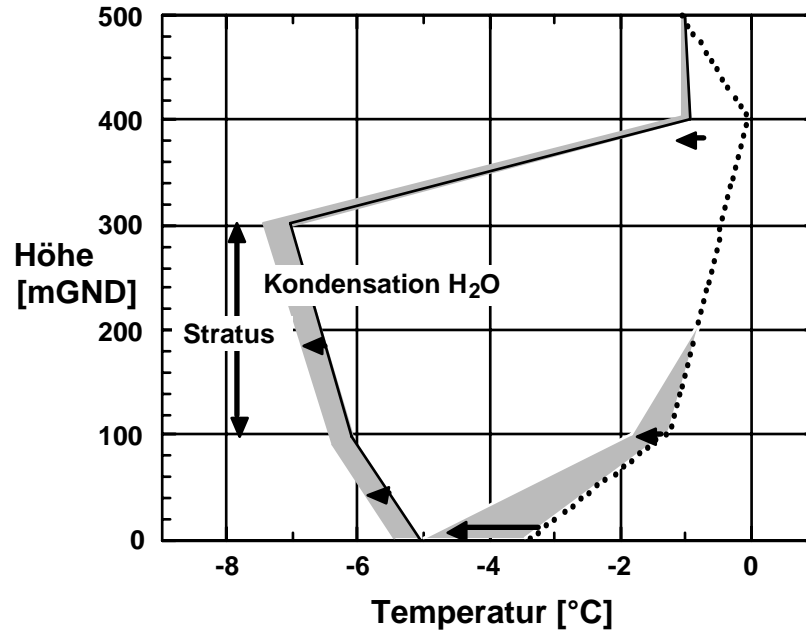


19 11:49

Weather conditions for „industrial snow“ in CH



nocturnal cooling rates



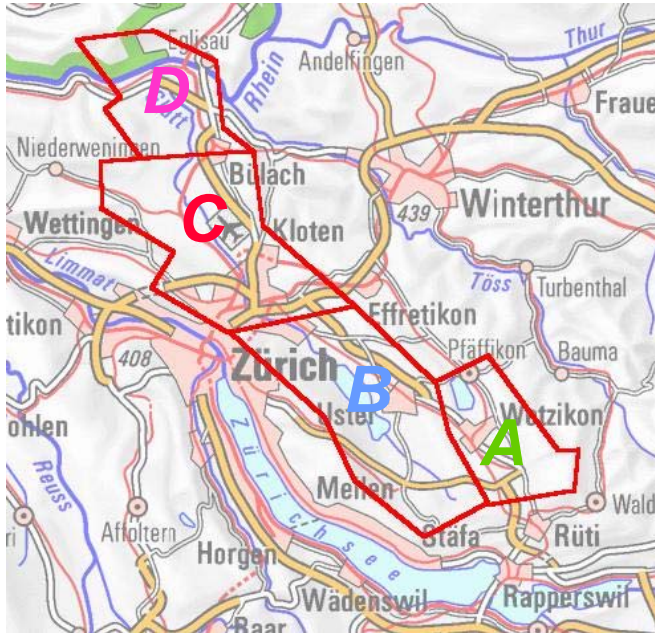
Nebel: $-0.1^{\circ}\text{C}/\text{h}$





klar: $-0.6^{\circ}\text{C}/\text{h}$

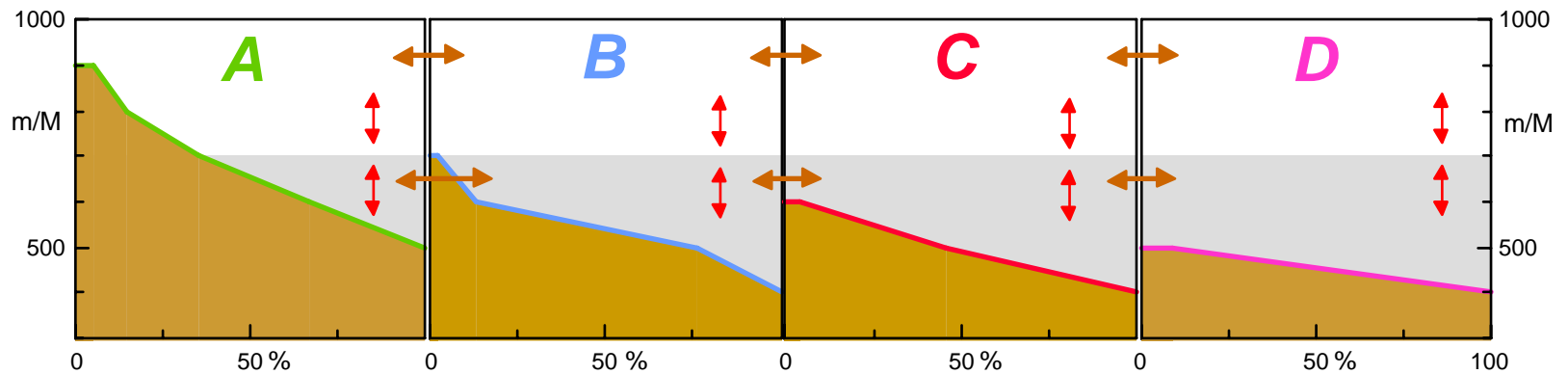
Simulation of low stratus in complex topography

- LW radiation of unsaturated and saturated air**
- convective mixing**
- topographical volume effect**
- local drainage by differential cooling**

topographical boundary layer model (tBM)

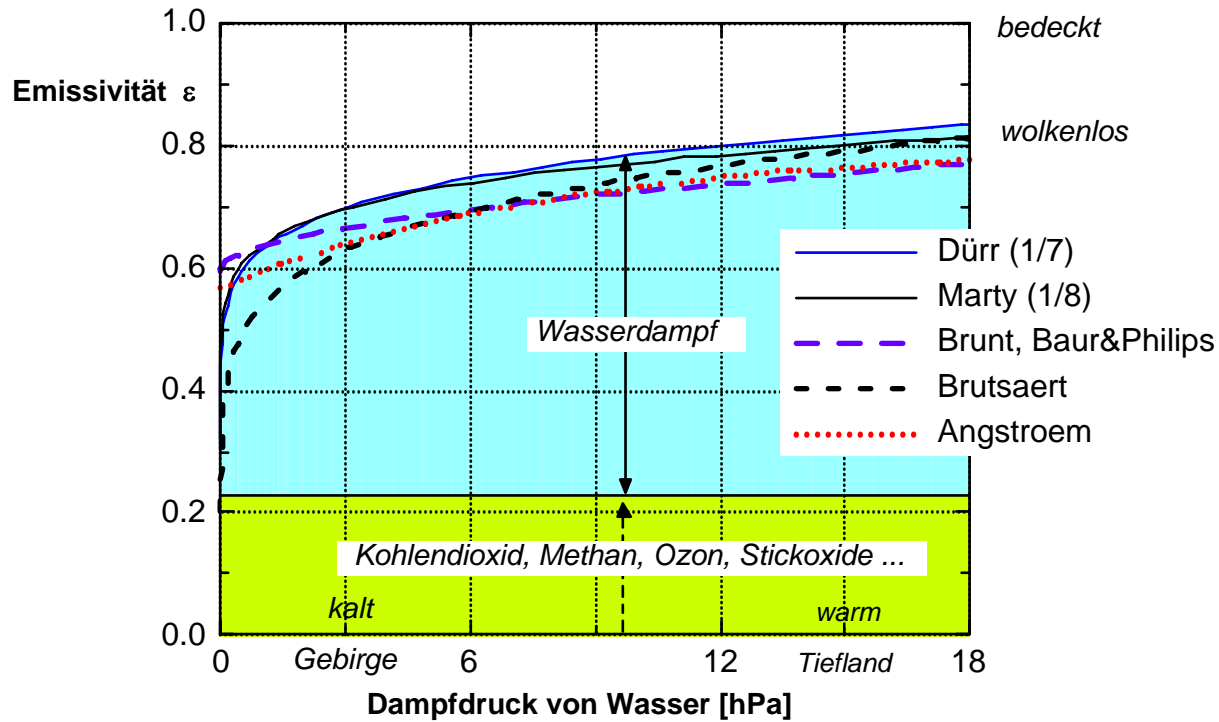


-  radiation (SW, LW)
-  volume effect
-  convection (1-D)
-  local winds (2-D)

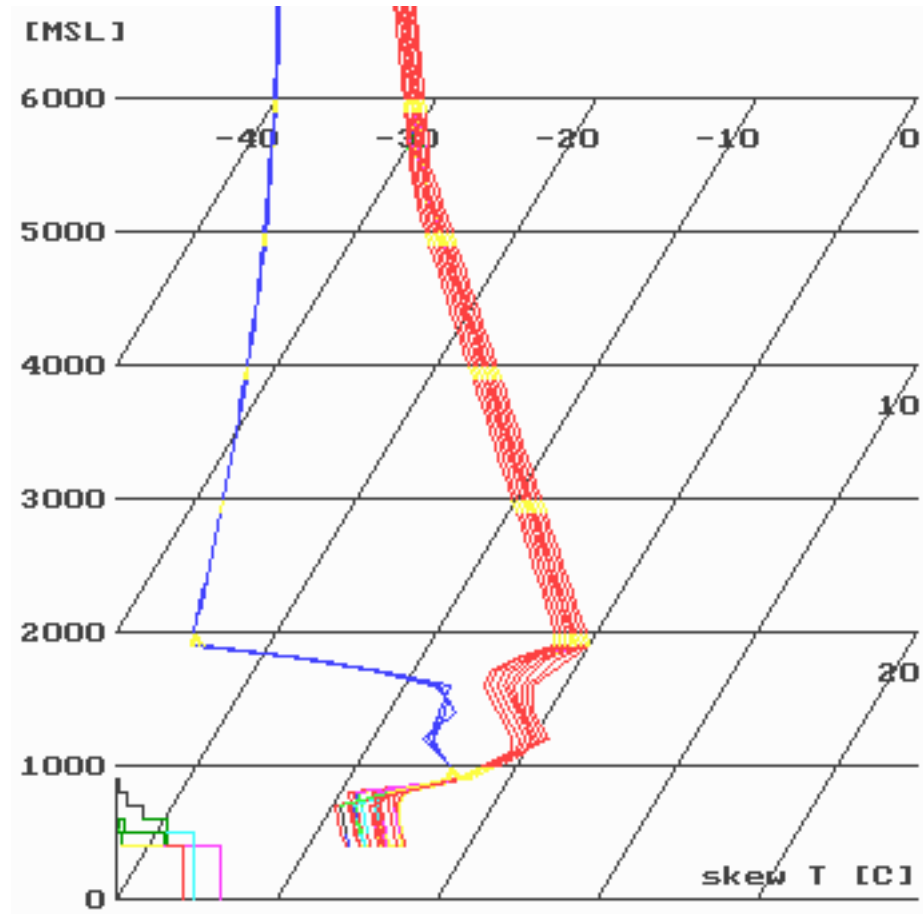


LW radiation of moist air

$$I = \varepsilon(\text{water vapour}) \sigma T^4$$



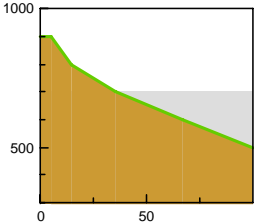
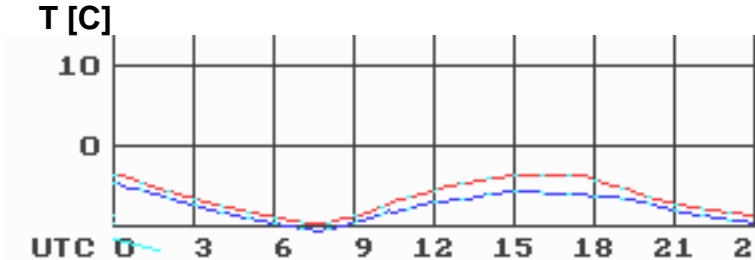
tBM Simulation (2-d, 24 h)



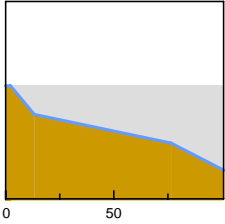
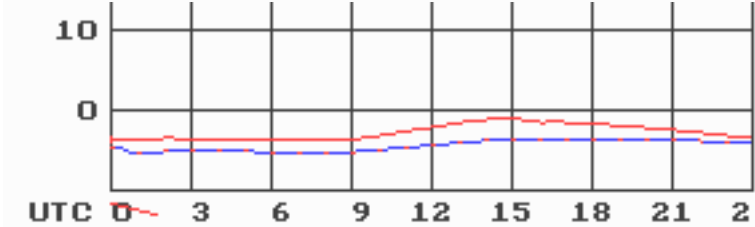
Flächen-Höhenverteilung
der Gebiete A, B, C, D

tBM Simulation (2-d, 24 h)

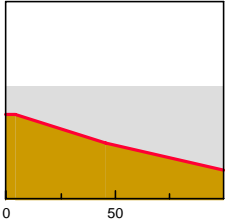
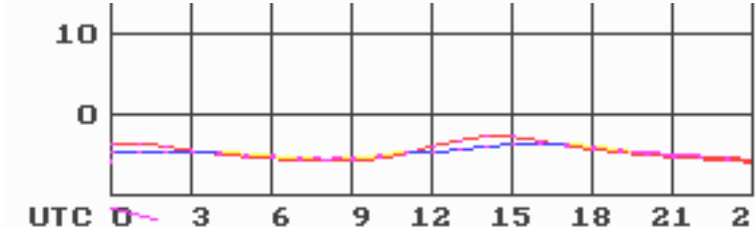
A



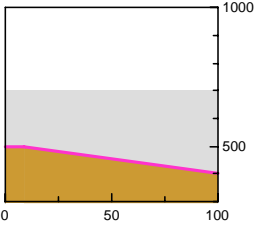
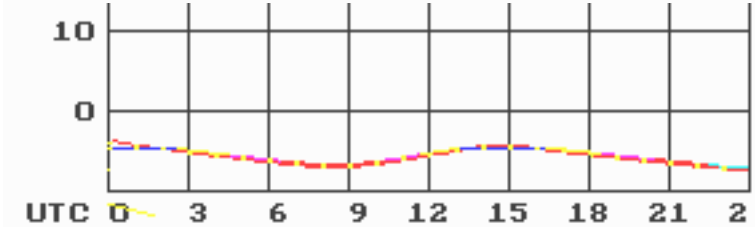
B



C

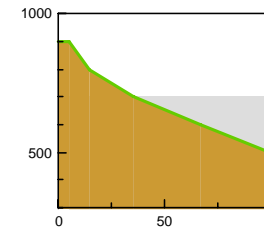
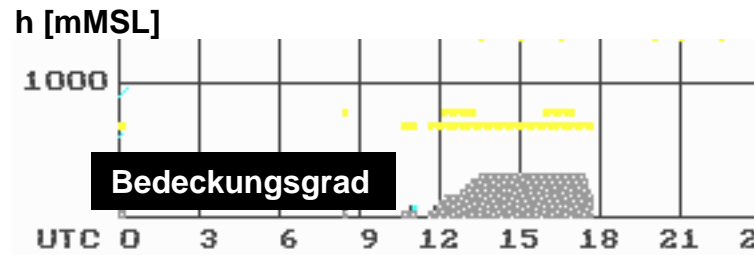


D

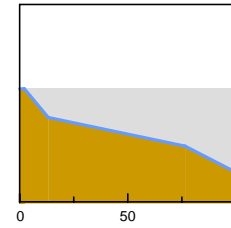
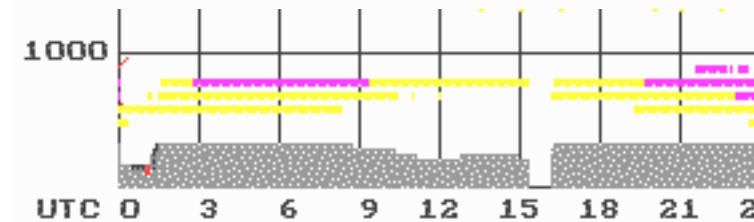


tBM Simulation (2-d, 24 h)

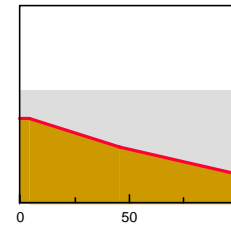
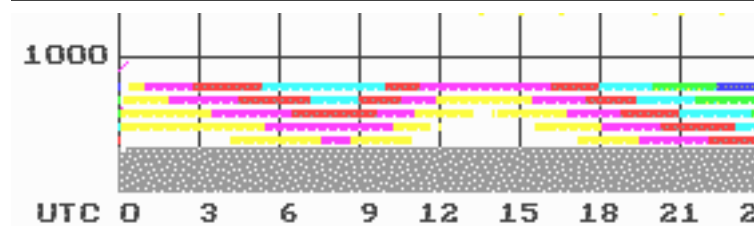
A



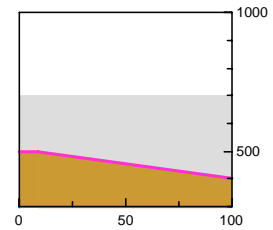
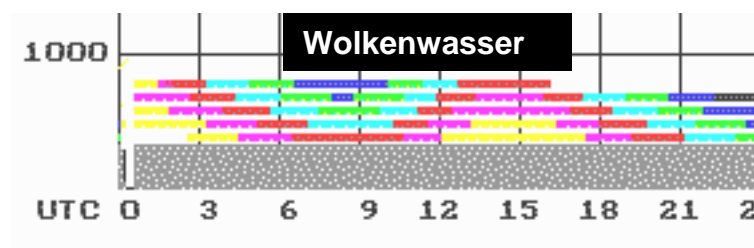
B



C



D



nocturnal cooling in clear conditions

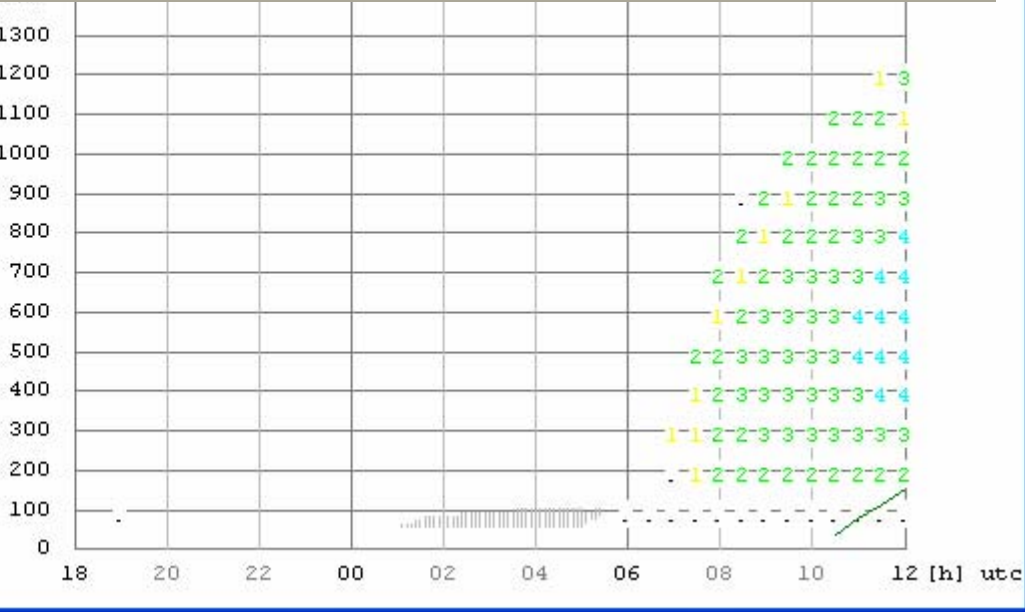
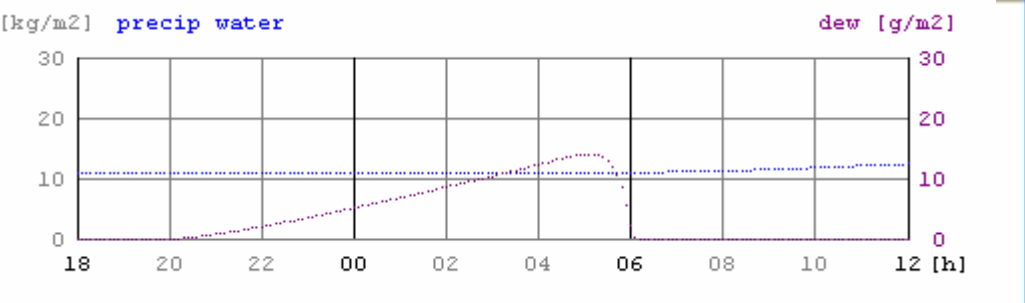
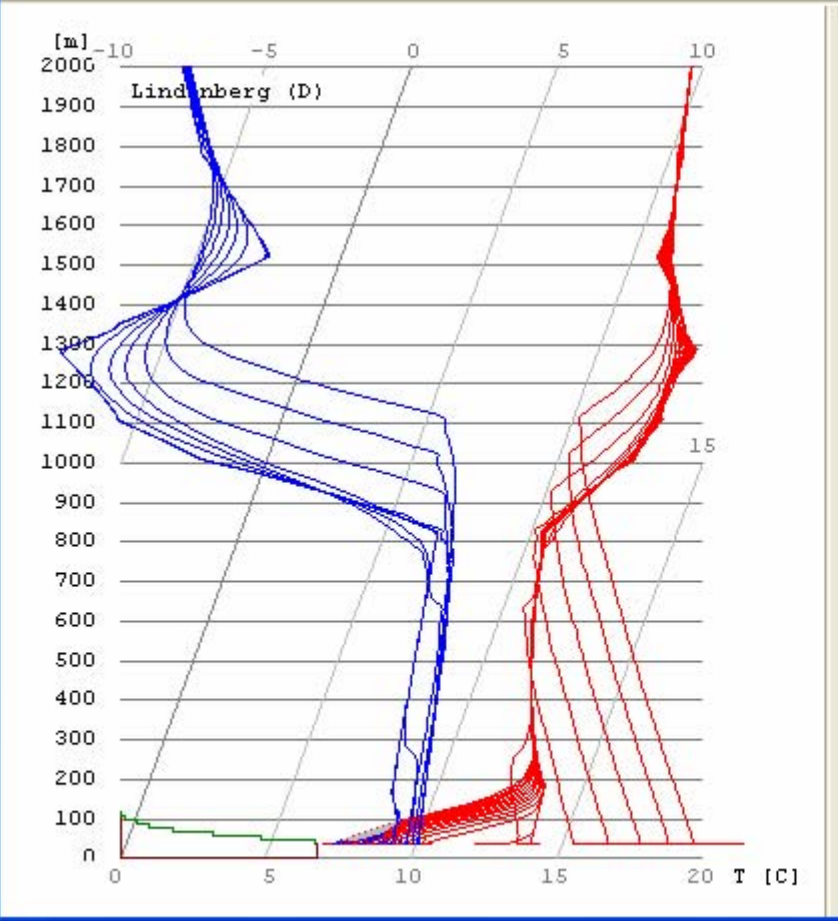
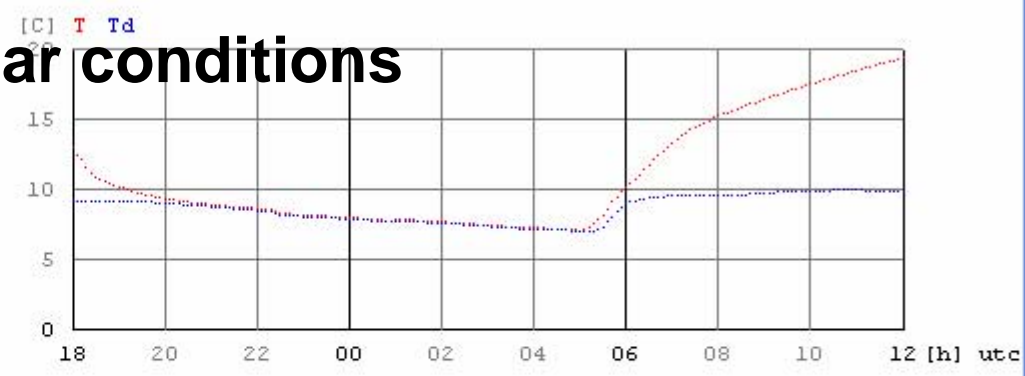
Verfügbare Daten

Datum: 980924 Gebiete: g1900 // Lindenberg D

Gewählter Modellauf

Datum: 980924 Gebiete: g1900 Diagramm: g1900

Initialize > >> FINISHED



Summary

- **parcel model for lift rate profiles in thermals**
- **climb rates of gliders in thermals are related to their cruising speed**
- **glider flight data allows for the tuning of the parcel model parameters**
- **the extension of the parcel model to nocturnal cooling asked for a finer vertical resolution (100m -> 10m) in order to resolve the vertical structure of the IR radiative fluxes ($\leq 50\text{m}$)**