Koninklijk Nederlands
Meteorologisch Instituut
Ministerie van Verkeer en Waterstaat

KNMI and aviation services

EASA 8 sept 2010

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Outline

1. KNMI and aviation services (in operational and research services)

2. Research program Knowledge for Climate for aviation (called Hotspot Schiphol)

3. Thunderstorm related issues regarding operations and research

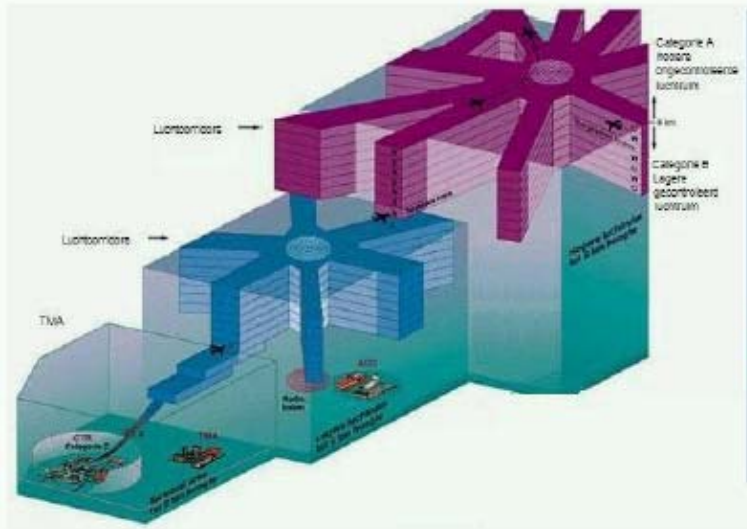
KNMI general

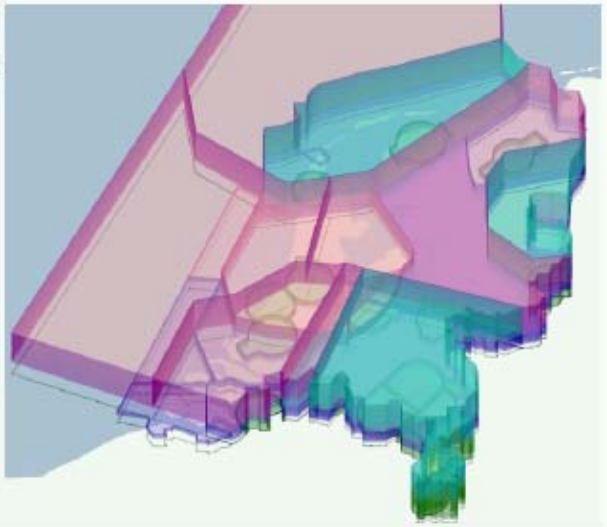
KNMI was founded on 31 January 1854 by Prof. C.H.D. Buys Ballot (1817-1890)

KNMI is the National Meteorological Institute in the Netherlands for:

- weather (public, aviation, maritime),
- climate research (climatology and scenarios)
- seismology.

KNMI aviation services





- Amsterdam Flight Information Region,
- airports EHAM, EHRD, EHGG, EHBK
- VFR land and sea (platforms)
- METAR, TAF, SIGMET, LLFC land and sea
- Probability Forecast Schiphol
- Central Forecasting Office, if needed at EHAM/ATC

Aviation, climate and climatechange

Knowlegde	Influence	10-30 yr	1-7 yr	3-36 hr	realtime
General		•*Safety* •*Environment* •*Strategy*	*Decision strategy*	•*Operations* •*Maintenance* •*Handling*	•*Punctuality* •*Satisfaction*
Wind	•*Pref.runway* •*Capacity* •*Volume yr*	•*Planning airport* •*Ruway direction*	*Planning capacity*	•*Runway in use* •*Guidance* •*Safety*	*Capacity and Planning* •*Safety*
Precipitation	•*Runway* •*Capacity*	•*Design* •*Runoff cap*	*Planning capacity*	•*Capacity* •*Operations* •*Safety*	*Capacity and planning* •*Safety*
Water	•*Storage* •*Runoff* •*Quality*	•*Storage cap* •*Water quality* •*Drainage*	*Model*	*Red. cap.* •*Safety*	*Aquaplane* •*Safety*
High temp	•*Sealevel* •*Salinity* •*Capacity*	•*Storage* •*Safety* •*Runway length*	*Runway length*	•*Safety* •*Cooling cap.*	•*Comfort*
Fog and TS	*Capacity*	*Atm. electricity*	*Forecast RVR/TS (Harmonie)*	•*Operations* •*Capacity* •*Safety*	*Nowcasting Operations* •*Safety*
Low temp	•*Freezing* •*Rhime* •*Snow*	•*Safety* •*Runway design*	•*De-icing* •*Glycol storage* •*Design*	•*Snow red.* •*Operations* •*Planning*	•*Braking action* •*Capacity* •*Safety*

Knowledge for Climate

Knowledge for Climate

Consortia

- Flood risk management
- Fresh water supply
- Rural areas
- Climate Proof Cities
- Infrastructure and Networks
- Climate Projections
- Governance of Adaptation
- Decision support tools

Hotspots

- Schiphol Mainport
- Haaglanden region
- Rotterdam region
- Major rivers
- South-West Netherlands Delta
- Shallow waters and peat meadow areas
- Dry rural areas
- Wadden Sea

Climatology and Climate Scenarios Schiphol

Kennis voor Klimaat

Mission

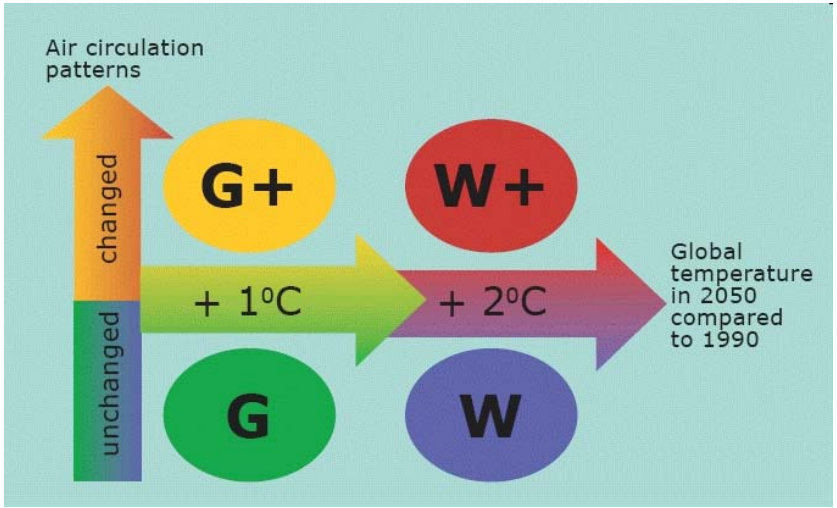
In the program Kennis voor Klimaat the Amsterdam Airport Schiphol is defined as one of the hotspots in the Netherlands for adaptation to climate change.

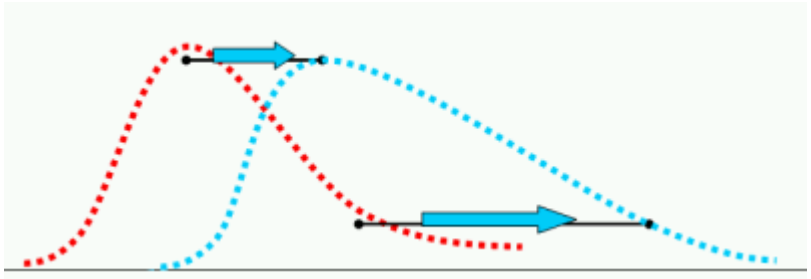
The mission of this project is to update climatology of Schiphol and to investigate the impact of climate change.

Click to enlarge

www.kennisvoorklimaat.nl
www.knmi.nl/samenw/kbs

KNMI-Climate services





2050		G	G+	W	W+
Global temperature rise		+1°C	+1°C	+2°C	+2°C
Change in air circulation patterns		no	yes	no	yes
Winter	average temperature	+0,9°C	+1,1°C	+1,8°C	+2,3°C
	coldest winter day per year	+1,0°C	+1,5°C	+2,1°C	+2,9°C
	average precipitation amount	+4%	+7%	+7%	+14%
	number of wet days (≥0,1 mm)	0%	+1%	0%	+2%
	10-day precipitation sum exceeded once in 10 years	+4%	+6%	+8%	+12%
	maximum average daily wind speed per year	0%	+2%	-1%	+4%
Summer	average temperature	+0,9°C	+1,4°C	+1,7°C	+2,8°C
	warmest summer day per year	+1,0°C	+1,9°C	+2,1°C	+3,8°C
	average precipitation amount	+3%	-10%	+6%	-19%
	number of wet days (≥0,1 mm)	-2%	-10%	-3%	-19%
	daily precipitation sum exceeded once in 10 years	+13%	+5%	+27%	+10%
	potential evaporation	+3%	+8%	+7%	+15%
Sea level	absolute increase	15-25 cm	15-25 cm	20-35 cm	20-35 cm

klimaatdesk@knmi.nl

Hotspot Schiphol

A. Windvisions: path measurement wind
with scintillometer (WUR)

B. Impact: Improving capacity with high resolution
non hydrostatic model,
link to amdar, mode-S

C. Climatology and scenarios:

Climatology and Climate Scenarios Schiphol

Kennis voor Klimaat

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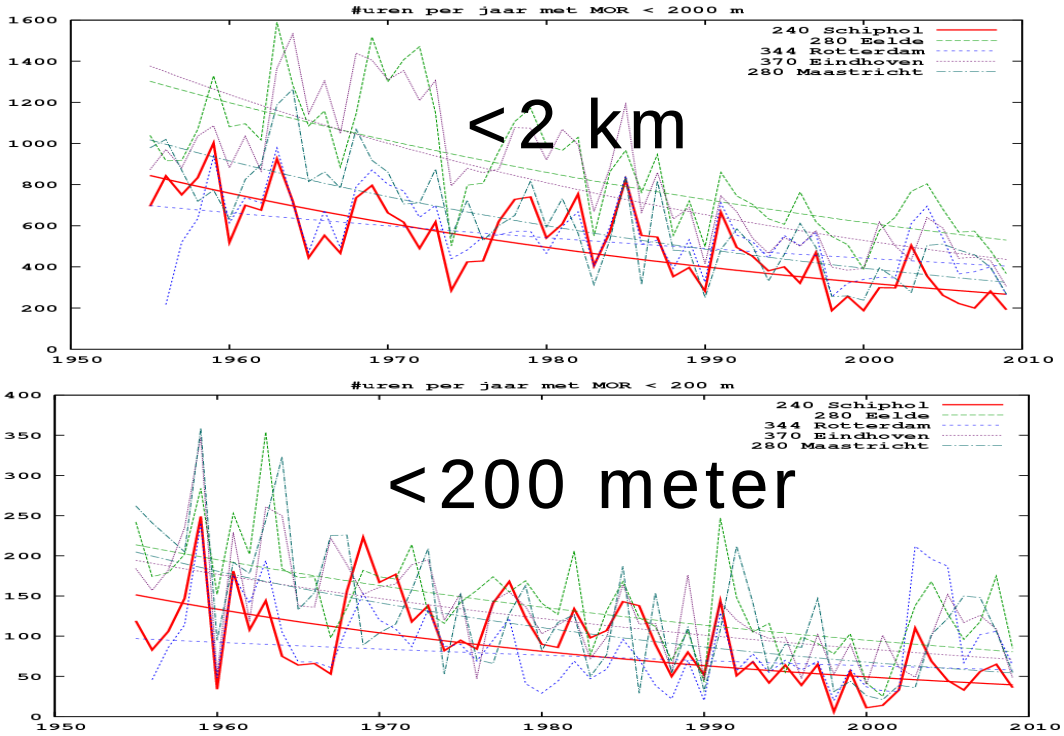
Click to enlarge

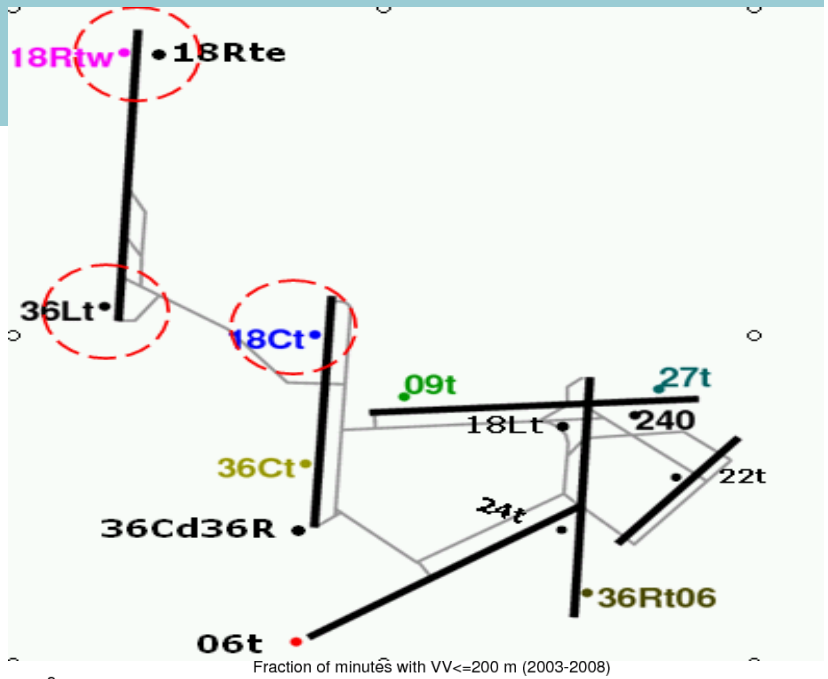
HSMS02 first results

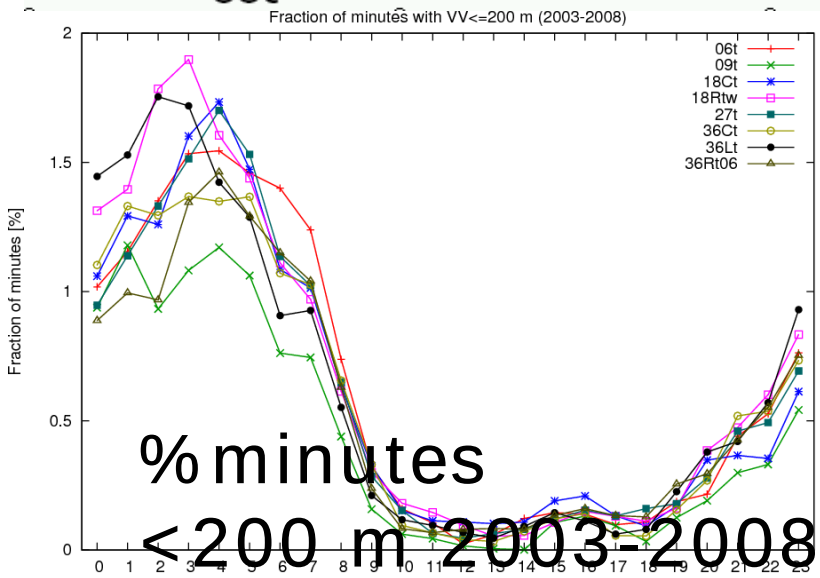
- Visibility: frequency LVP decreases, local differences identified
- Wind: climatology differences on local scale due to roughness
- Precipitation: return times established, identification sea/land
- Upper air: Reanalysis ERA-I usefull, inversions

- SOME EXAMPLES

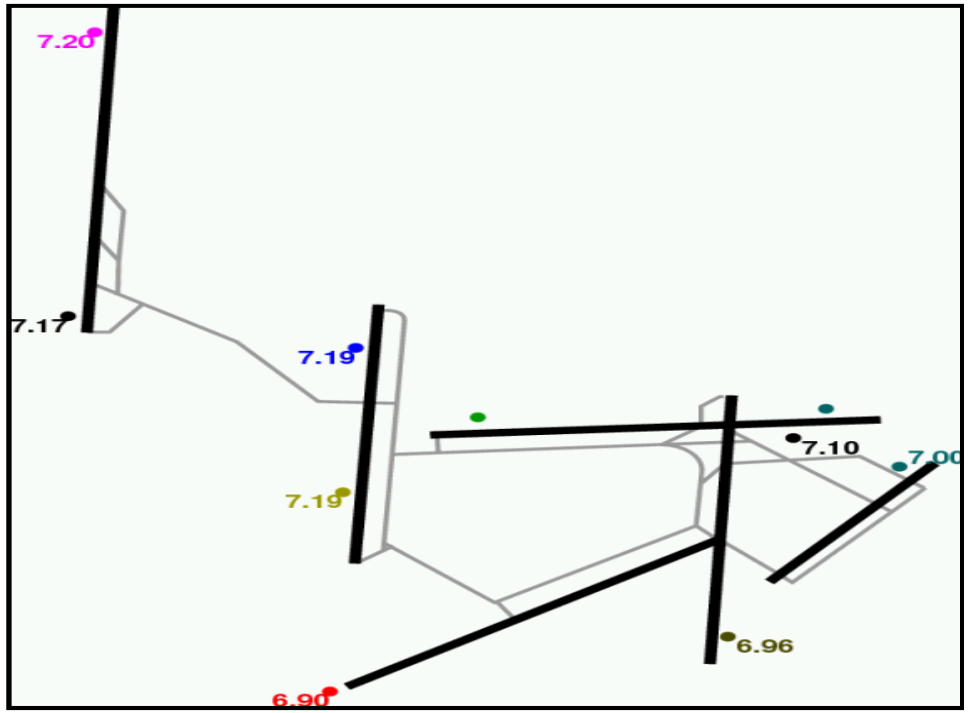
Visibilty (BZO-phases) #hours per year

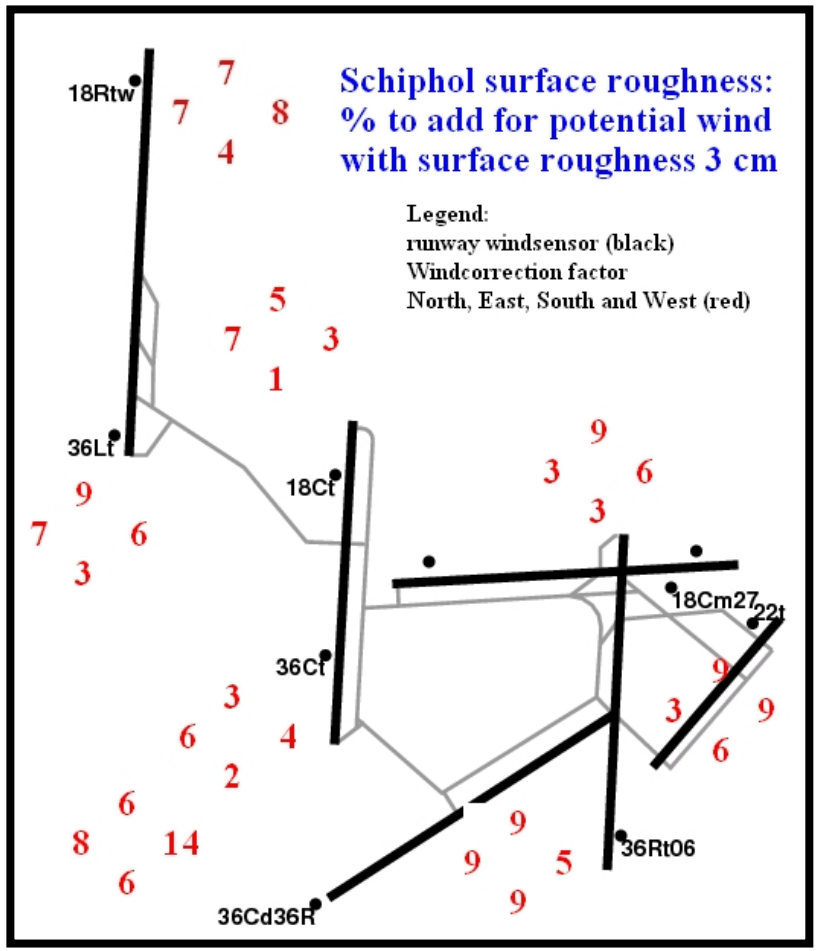






Wind measured and potential wind (Up)
FFmean (m/s) 2007-2009 and cor.factor for Up





Local winddeviation EHAM mainly due to roughness differences

Comparison OWEZ-ERA iul2005-dec2009

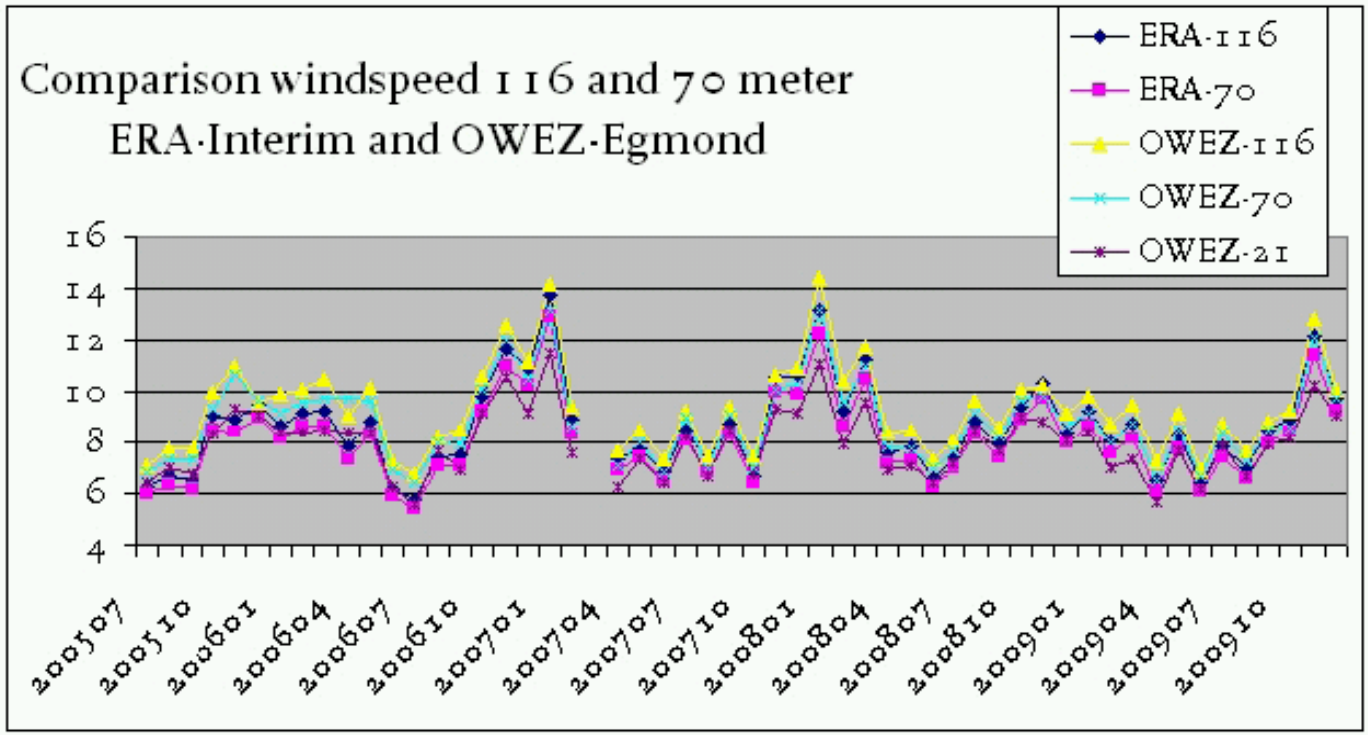


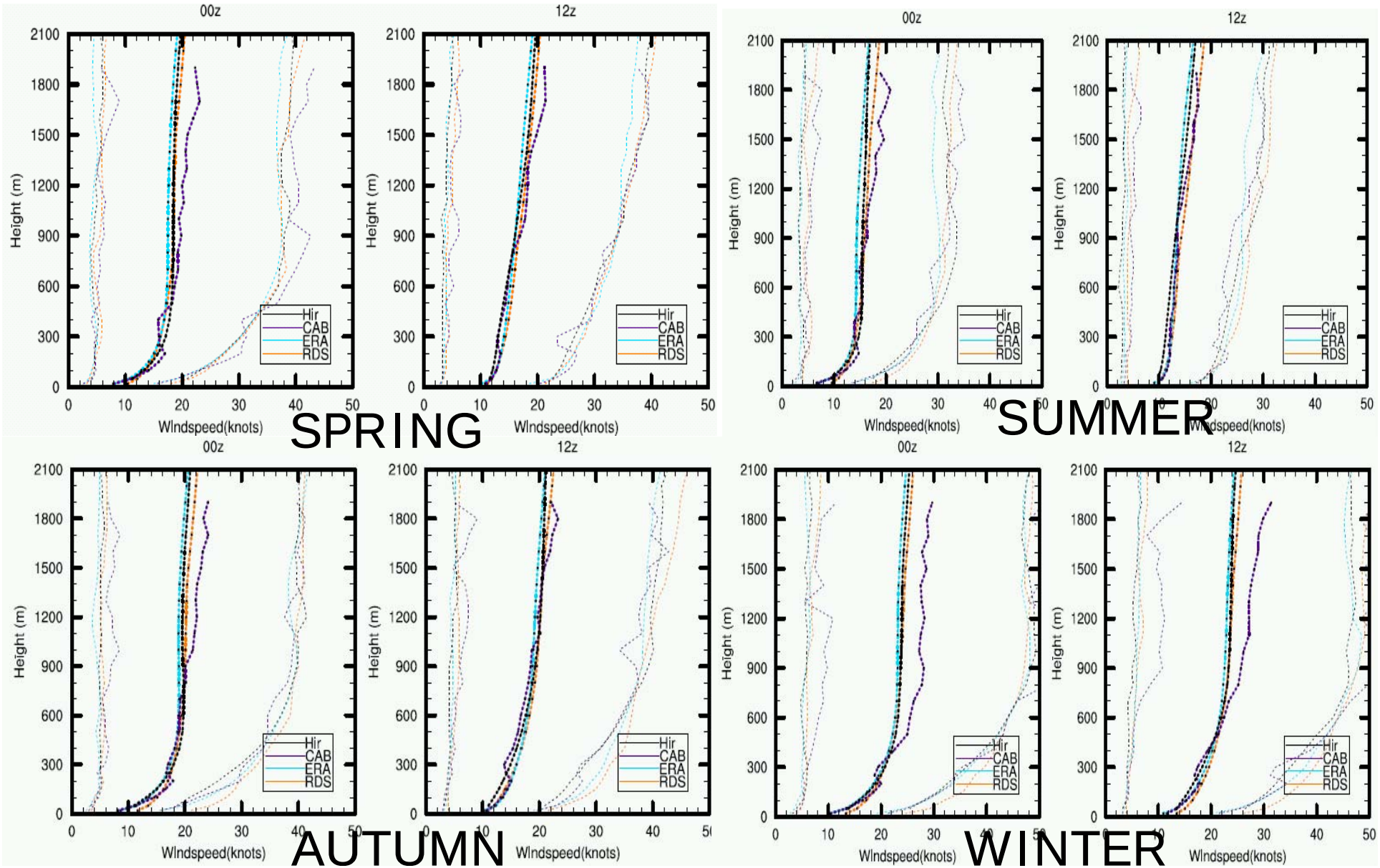
Figure 11. Comparing average windspeed per month from Noordzeewind and ERA-Interim. Windspeed in reanalysis is underestimated by 0.7 m/s (about 10%).

Comparison 2003-2005

at 00 and 12 UTC for the four seasons

ERA-HR-RDS-CAB

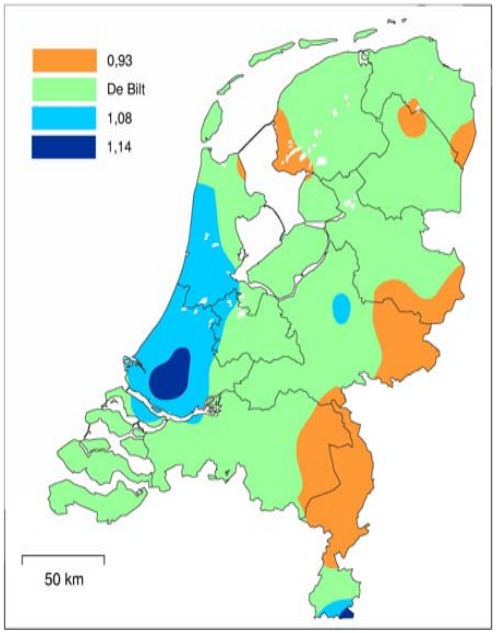
at 5, 50 and 95% windspeed

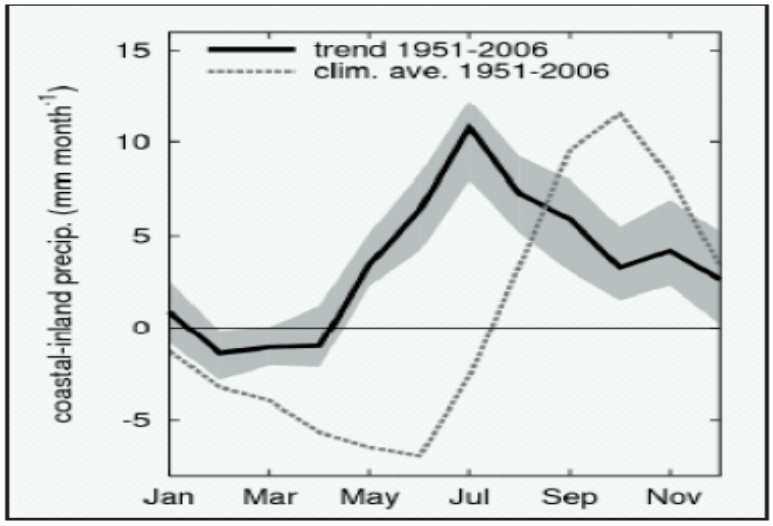


Precipitation EHAM

Schiphol

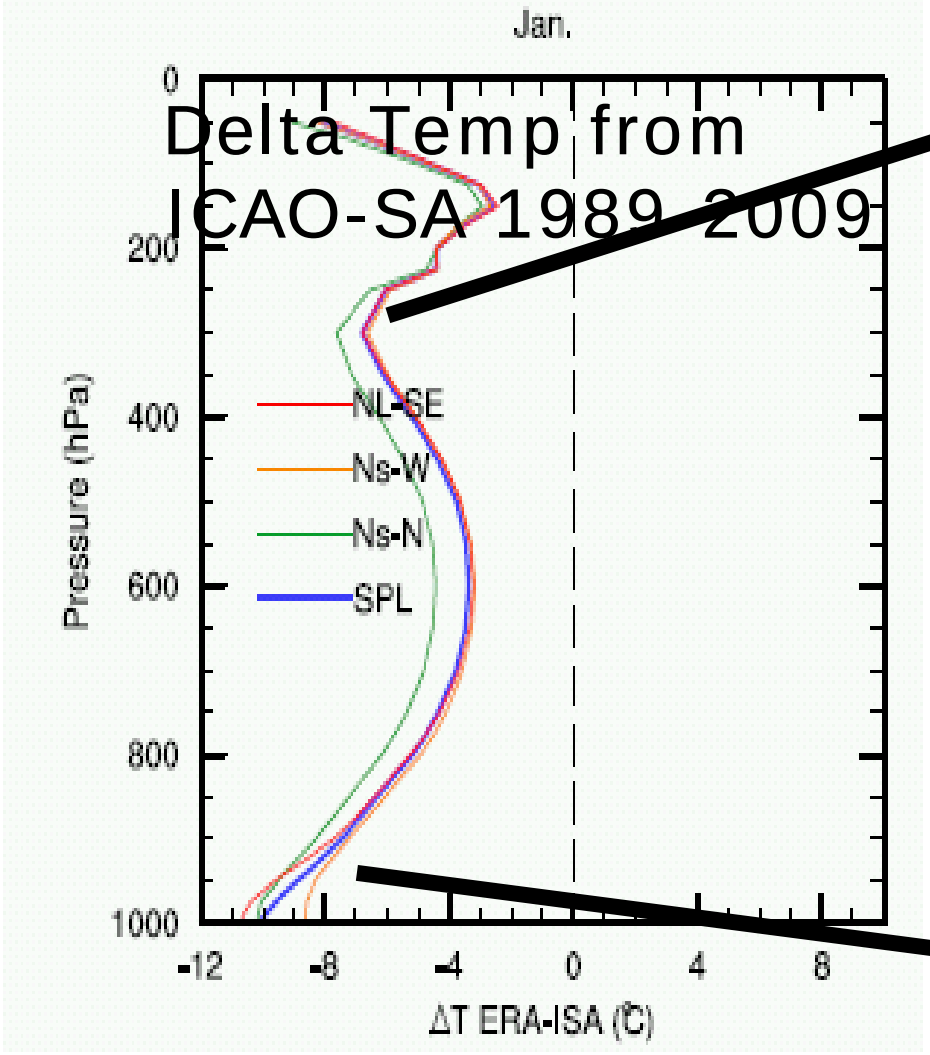
	minuten				uren					etmalen				
	5	15	30	60	2	4	6	8	12	1	2	4	7	10
10x per jaar	–	3	4	5	7	9	11	12	13	16	21	–	–	–
5x per jaar	–	4	6	7	10	12	14	15	17	23	28	–	–	–
2x per jaar	4	6	8	10	13	16	19	20	23	30	38	49	63	73
1x per jaar	5	9	11	14	17	21	23	24	27	36	44	56	71	86
1x per 2 jaar	7	11	14	18	21	25	27	29	32	42	52	65	82	98
1x per 5 jaar	9	15	19	23	26	31	34	36	40	51	63	77	95	113
1x per 10 jaar	11	18	23	27	31	36	39	41	46	58	70	86	106	123
1x per 20 jaar	12	21	27	32	36	41	45	47	52	66	79	96	116	134
1x per 50 jaar	15	26	32	38	42	49	53	56	61	77	91	108	129	146
1x per 100 jaar	17	29	37	43	48	55	59	62	68	85	99	118	137	154



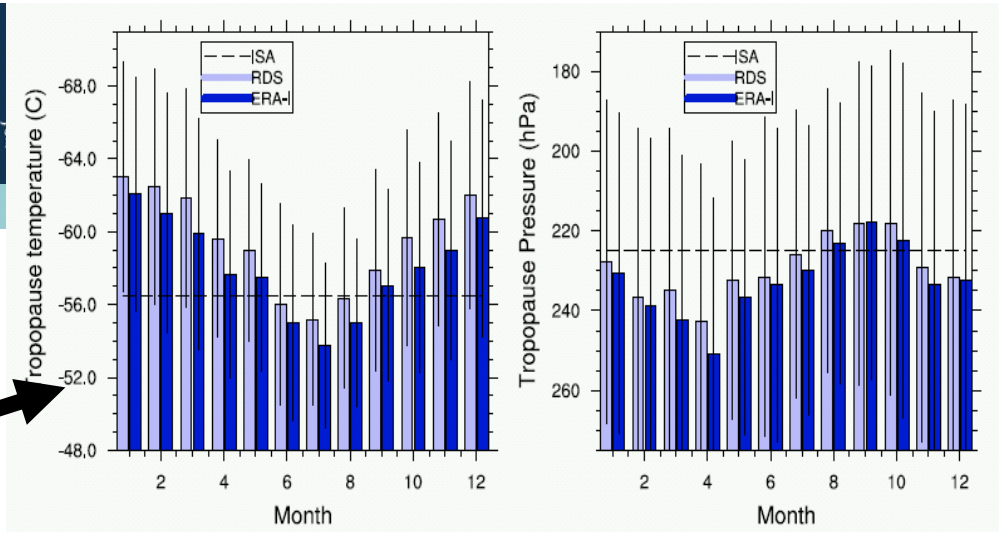


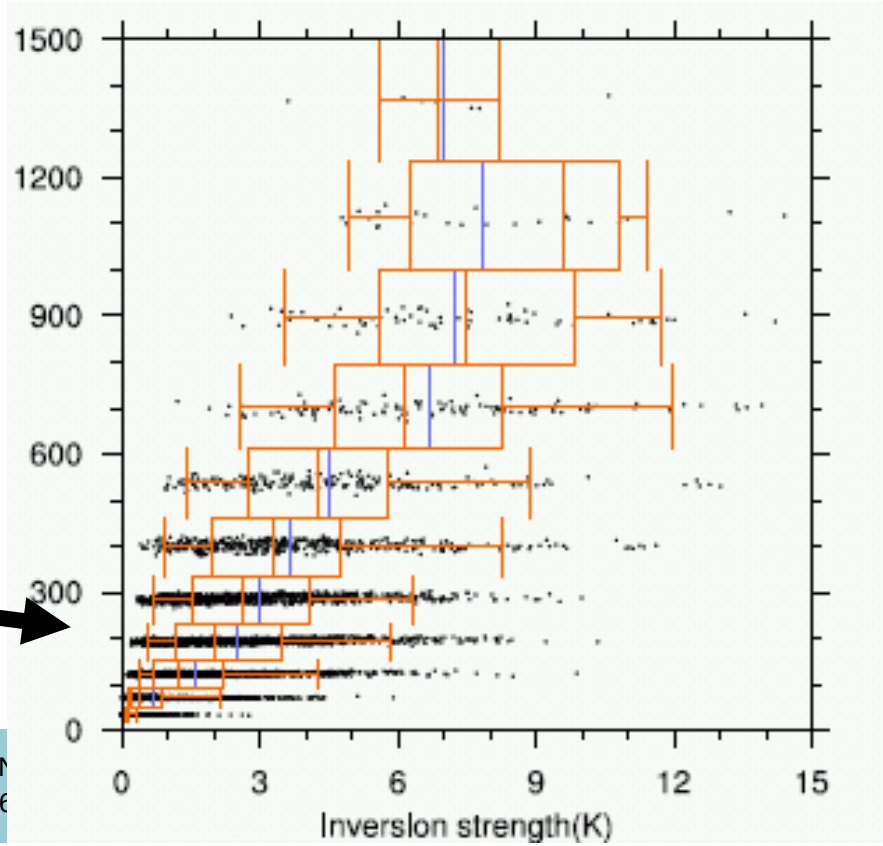
Lenderink:
Tsea and NW-flow

Upper air results



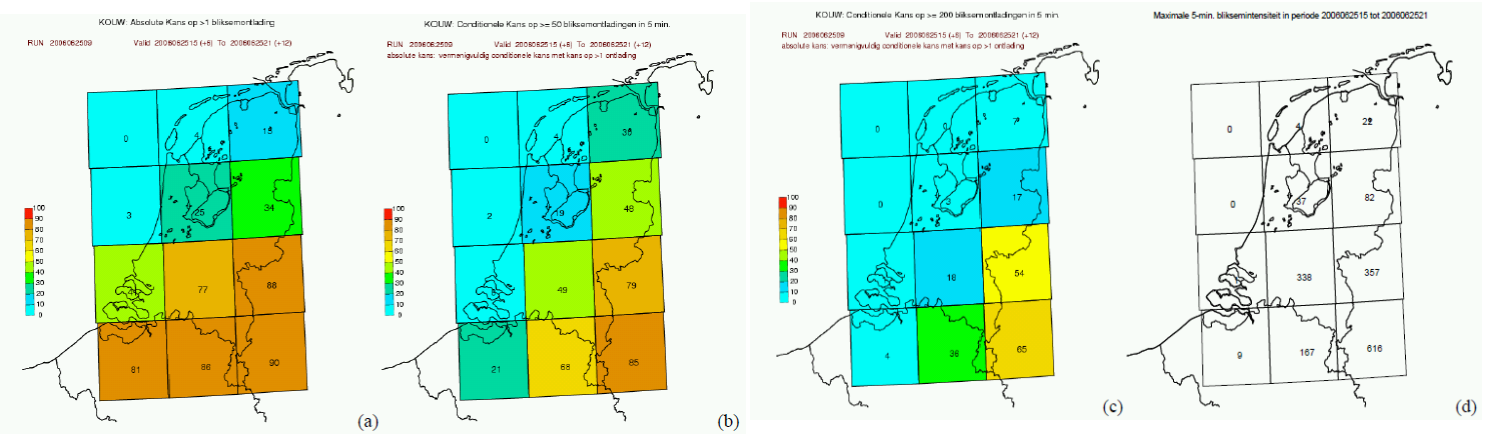
Delta Temp from ICAO-SA 1989-2009





Thunderstorms

- Observations: sounding, synop/metar, Doppler-radar (hail), lightning
- Model: Hirlam, post-proces KOUW, indices
- Research: Atmospheric electricity (veenvds@knmi.nl)
- Products: Metar, TAF, sigmet, LLFC, AIL, guidance AAS/LVNL



KOUW: % risk > 1, 50 or 200 TS and # in 5 min
In wintertime (CB with low tops) risk AIL

Atmospheric electricity reseach

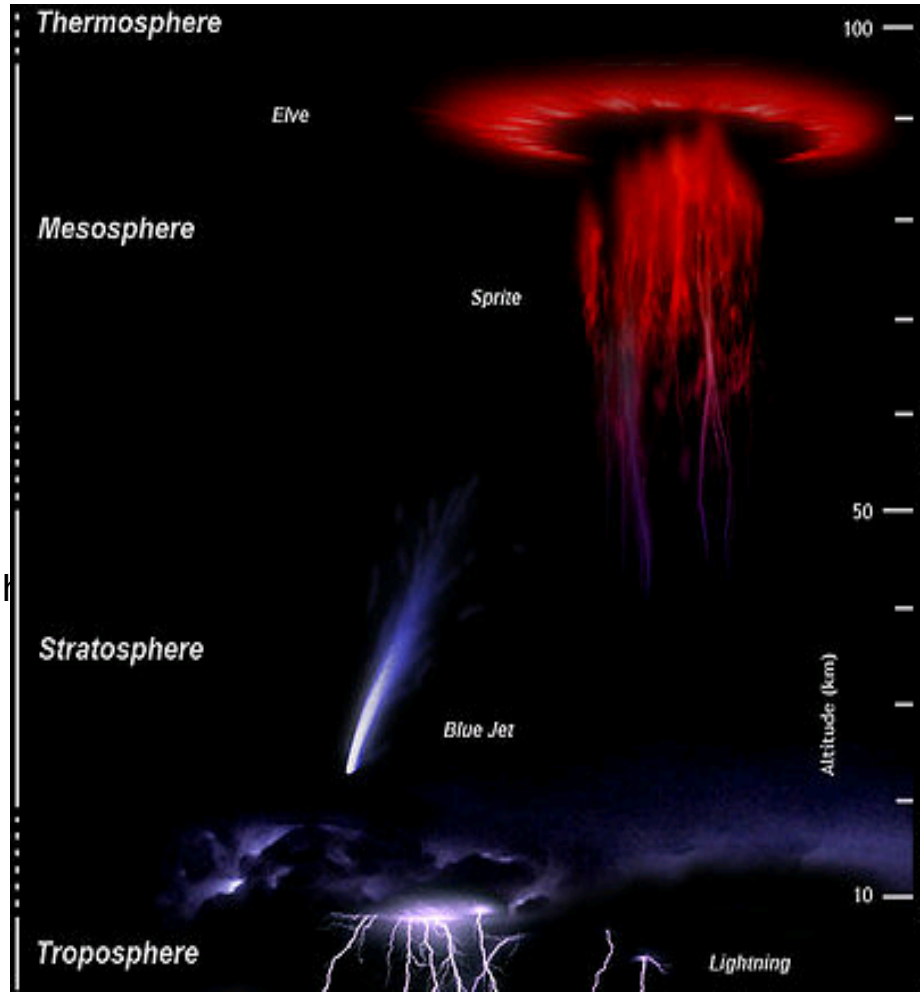
veenvds@knmi.nl

Thunderstorm (TS): Poor climatology

- TS is related to charge distribution (graupel meets ice-chrystal)
- Electric forces can alter dynamincs and precipitation in CB
- But during TS sudden precip-increase (intensity >200 mm/hr during seconds)
- Risk blue jet?
- Atm.electricity charging is computable

Experiment in HARMONIE (non hydrostatic):

- Model electric field, enhance ice christal growth on treshold (200kV/m)
- Compute when TS starts (400kV/m)
- Release of precip.intensity and dynamics
- Optimize TS/GR/FX/microburst-forecast
- Optimize climatology and effect of climate change



KNMI PROBABILITY FORECAST SCHIPHOL

	00	03	06
Visibility < 5 km and/or ceiling < 1000 ft (%)	30	40	15
RVR < 1500 m and/or ceiling < 300 ft (%)	0	0	0
RVR < 550 m and/or ceiling< 200 ft (%)	0	0	0
RVR < 350 m (%)	0	0	0
Winddirection (deg)	250	220	160
Windspeed (kt)	3	3	3
Gusts (kt)			
Standarddeviation winddirection (deg)	90	90	90
Standarddeviation windspeed (kt)	2	2	2
CB (%)	15	10	10
Thunderstorm (%)	0	0	0
Temperature (C)	20	19	22
Dewpoint (C)	17	18	19
Relative humidity (%)	83	94	83
Snow (%)	0	0	0
Moderate or heavy snow (%)	0	0	0
Freezing precipitation (%)	0	0	0
	00	03	06

	12	13	14
Winddirection (deg)	270	280	290
Windspeed (kt)	10	10	10
Gusts (kt)	15	15	15
Crosswind 18-36 (kt)	15	15	14
Crosswind 22-04 (kt)	11	13	14
Crosswind 24-06 (kt)	7	10	11
Crosswind 27-09 (kt)	0	3	5
Tailwind 18 (kt)	0	3	5
Tailwind 22 (kt)	-10	-8	-5
Tailwind 24 (kt)	-13	-11	-10
Tailwind 27 (kt)	-15	-15	-14
Tailwind 36 (kt)	0	-3	-5
Tailwind 04 (kt)	10	8	5
Tailwind 06 (kt)	13	11	10
Tailwind 09 (kt)	15	15	14

Wintertime: AIL

Summary

- KNMI: NMS in Netherlands, strong relations with aviaton
- Operations and research work in close harmony

- Research program: improving capacity, focus on climate(change)-proof decision-support in research Hotspot Schiphol
- Climatology and scenarios for local conditions and upper air

- Aviation needs ongoing research in climate and scenarios
- Thunderstorms: challenge for research

- HARMONIE: high resolution non hydrostatic modelling
- ICAO: stimulate climatology of TS and HR-reserach

Thank you, time for (some) questions

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