

BALTEX BRIDGE Cloud campaign aircraft coordination plan

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1. Introduction

During the BBC campaign three aircraft are participating. In order to obtain well co-ordinated aircraft measurements a decision making protocol is required. During the BBC Aircraft Planning Meeting at KNMI on January 12, 2001 the initial flight patterns were discussed and agreed upon. These are described in the minutes of that meeting. The flight patterns have been discussed and agreed upon with the Air Traffic Control authorities in the Netherlands.

For the BBC campaign special SSR-codes are reserved for the three participating aircraft:

MERLIN IV	SSR7052
Paternavia	SSR7053
Cessna	SSR7054

In this document several aspects concerning the organisation of the aircraft measurements during BBC are described. Parts of the text have been copied from various earlier documents. In section 2 the organisation of the aircraft measurements are described (updated from BBC management plan). Sketches of the agreed flight patterns based on discussions during several meetings are presented in section 3. Some concluding remarks are presented in the last section.

2. Flight organisation

During the campaign the planning, organisation and decision making process to fly or not (and which pattern) has to be well organised. It is proposed that the Flight Planning Meteorologist (FPM) monitors the meteorological situation and has regular briefings with the operational meteorological department of KNMI. Based on his information he may propose a flight for the next day. If the forecast is such that a flight is feasible he will inform the two flight co-ordinators. In the discussion between the FPM and the two flight co-ordinators a decision is made to start the preparations for a flight and a suggested flight plan will be discussed.

If a flight is planned for the next day, the aircraft crew and the groups at Cabauw will be informed. A briefing will be given at both sites describing the meteorological information and the preliminary flight plans. After the decision for a flight on the next day is taken, the meteorological situation will be monitored continuously. A flight can be cancelled any moment after consultation of the FPM with the two Flight Planning Co-ordinators.

After discussions at the BBC planning meeting in De Bilt (March 1-2, 2001) the following schedule for the flight planning has been agreed upon:

08:30 LT

Flight Planning Meteorologist (FPM) consults Operational Meteorologist

10:00 LT

Briefing on Atmospheric Conditions for next days (Rotterdam and Cabauw)
Includes representatives of aircraft and Flight Planning Co-ordinator (FPC)
Preferably at Rotterdam airport or Delft University
Initial decision on flight-plan. Responsible for the decision is the FPC.

15:30 LT

Flight Planning Meteorologist (FPM) consults Operational Meteorologist

16:00 LT

Inform Air Force flight control on possible flights for the next day (general request)

17:00 LT

Briefing on Atmospheric Conditions for next days (Rotterdam and Cabauw)
Includes representatives of aircraft and Flight Planning Co-ordinator (FPC)
Preferably at Rotterdam airport or Delft University
Decision on flight-plan. Responsible for the decision is the FPC.

18:00 LT

Details for flights of the next day are given to Air Traffic Control Schiphol
Latest time to proclaim a day-off or an early flight.

Procedure for a flight:

- 3 hours before take off: Final consultation Meteorologists / MeteoInfo
- 2 hours before take-off: Final briefing on MeteoInfo (Rotterdam Airport).
- 1 hour before take-off: Final decision on details of flight plan (FPC)

During the flight there will be two main communication channels:

- Communication between FPC and mission scientist
- Communication between FPC and other experimentalists (Cabauw, De Bilt)

This requires 2 frequencies for communication

1. Air Traffic Control, Pilots
2. FPC, mission scientists

The mission scientist is responsible for the in-flight coordination between the three aircraft. Before take-off it will be decided who will act as the mission scientist for this specific flight. During the flight the mission scientist takes all decisions on flight plan changes within the limits discussed before take-off with the FPC. If the mission scientist plans to adjust the flight plan, he will try to contact the FPC through the radio and discuss the alternatives.

It will be tried to make the meteorological data and the proposed flight plans available in real-time on the CLIWA-NET website.

An overview of the FPM and FPC during the campaign is given in Appendix 1.

3. Flight Patterns

During discussion at the aircraft coordination meeting and the BBC planning meeting 4 basic flight patterns were agreed upon. These patterns are presented below.

For communication with air traffic control it was decided to use a regular grid on which we project the patterns. The coordinates and the grids are described in Appendix 2.

In general there is a preference to fly during the NOAA/AVHRR satellite overpasses. For this purpose a schedule of expected overpass times is available on the internet (www.knmi.nl/samenw/cliwa-net).

Meso-Scale Flight Pattern

Objective: Validation with in-situ measurements of the remote sensing instruments at all BBC network stations

Cloud type: Sc, Cu

Typical flight duration for one pattern:	200 kts	0.7 hr
	100 kts	1.4 hr

Pattern parameters:

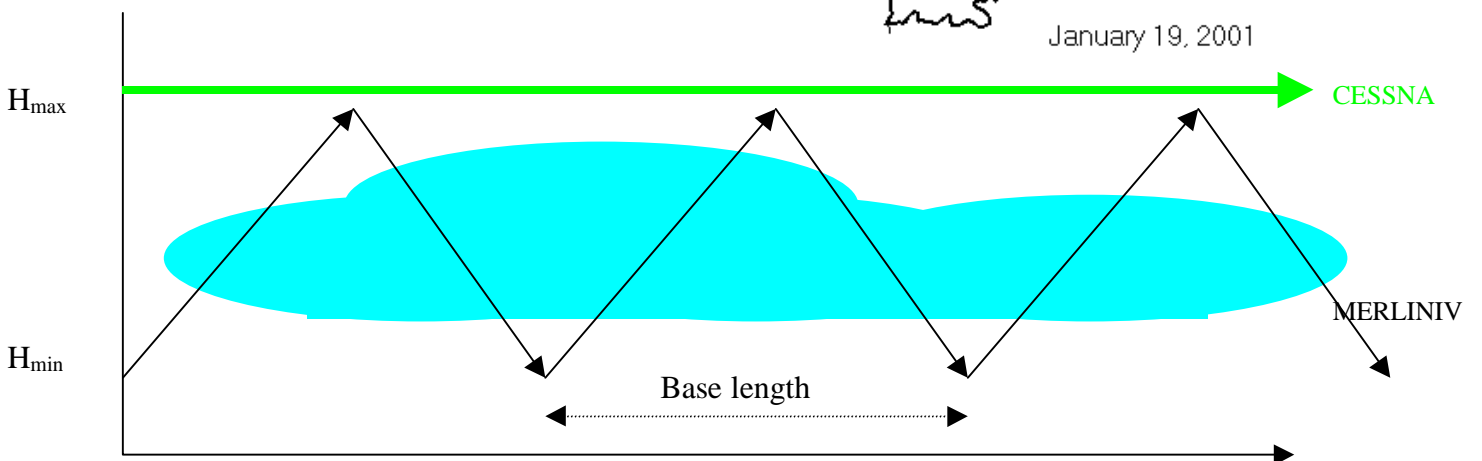
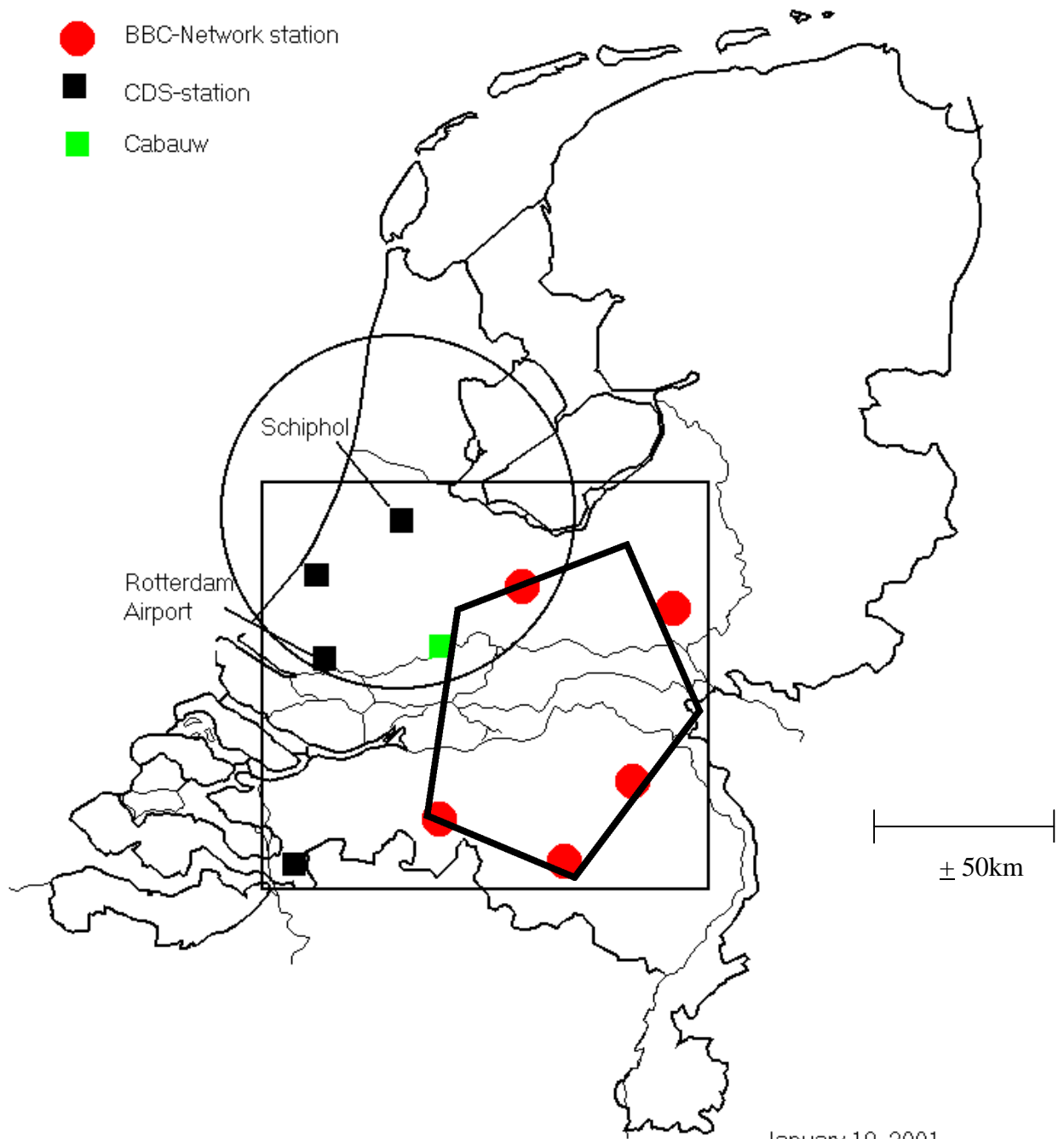
- Flight direction: Clock wise or Anti clock wise
- Base length (typically 16km)
- Max Altitude
- Min Altitude

Remarks:

- Coordinated flight between the MERLIN-IV and the CESSNA aircraft
- Strong preference to fly during satellite overpasses (NOAA/AVHRR, Envisat,..)

"MESO-SCALE" flight pattern

- BBC-Network station
- CDS-station
- Cabauw



"Dynamics" Flight Pattern

Objective: Sampling of cloud fields with MERLIN IV at different constant altitudes for the evaluation of the output from LES models

Cloud type: Sc, Cu; $N \geq 30-40\%$; Considerable vertical extend of the Cu ($>1\text{km}$)

Typical flight duration for one altitude:	200 kts	0.6 hr
	100 kts	1.2 hr

Pattern parameters:

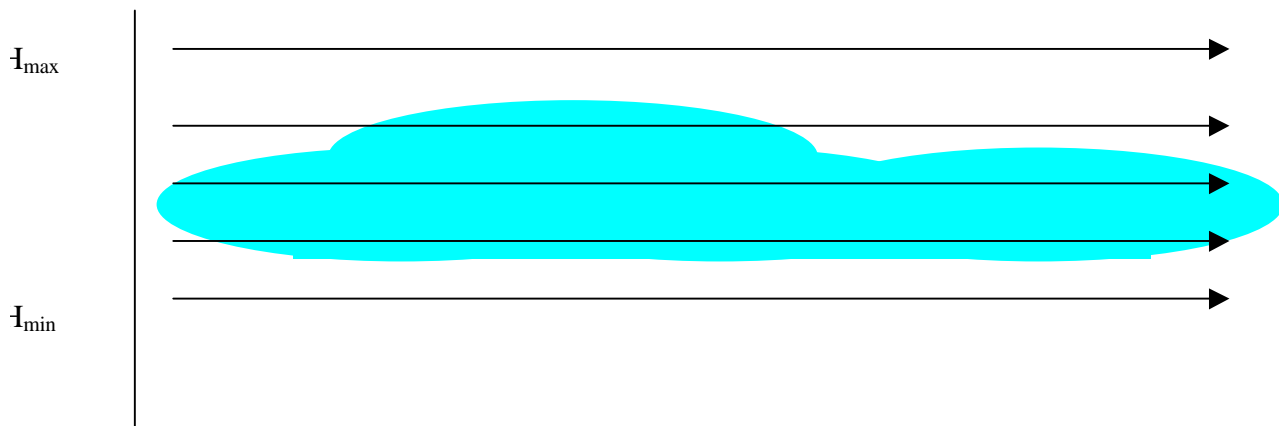
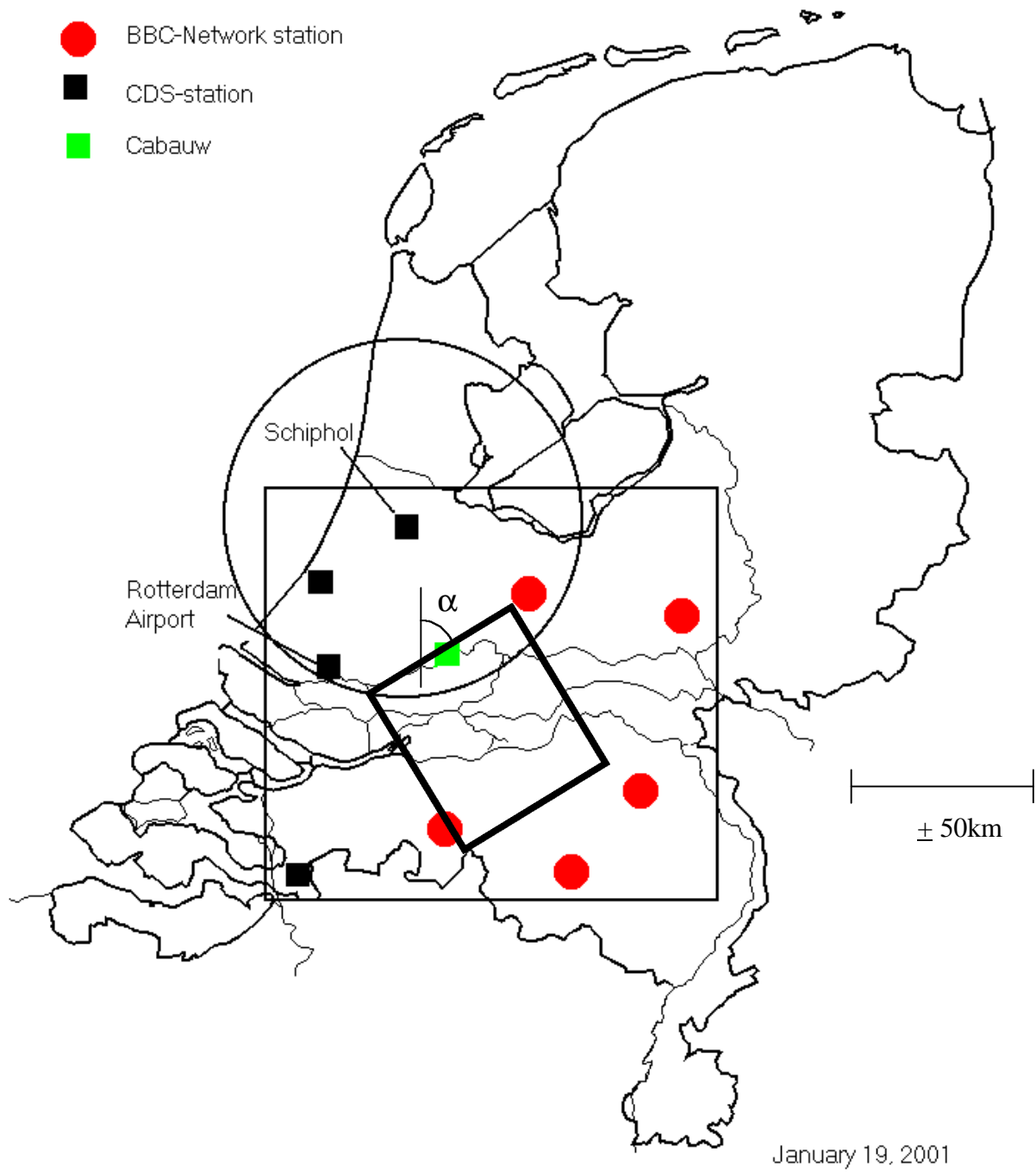
- Flight direction: Clock wise or Anti clock wise
- Track length (typically 50km)
- Number of altitudes and altitude heights
- Angle α of the leg over Cabauw

Remarks:

- Wind speeds should be small
- Possible combination with the "Cabauw Flight Pattern" (not necessarily over Cabauw)
- Important that the turbulence measurements in the MERLIN IV are working properly.
- The flights of the Paternavia may be coordinated with the MERLIN IV. This is not required for fulfilling the objective of this pattern.
- The Cessna aircraft needs to fly at four heights (high above clouds, just above, within and below clouds). Half a square at each altitude (because max. flight time is approx. 3 hours)
- Permission for low flights is required

"DYNAMICS" Flight Pattern

- BBC-Network station
- CDS-station
- Cabauw



"MICRO PHYSICS AND RADIATION" Flight Pattern

Objective: Measuring cloud microphysical parameters within the cloud by the MERLIN IV and the PATERNAVIA and radiation above and below the clouds by the Cessna.

Cloud type: Sc, Cu

Typical flight duration for one pattern:	200 kts	0.3 hr
	100 kts	0.6 hr

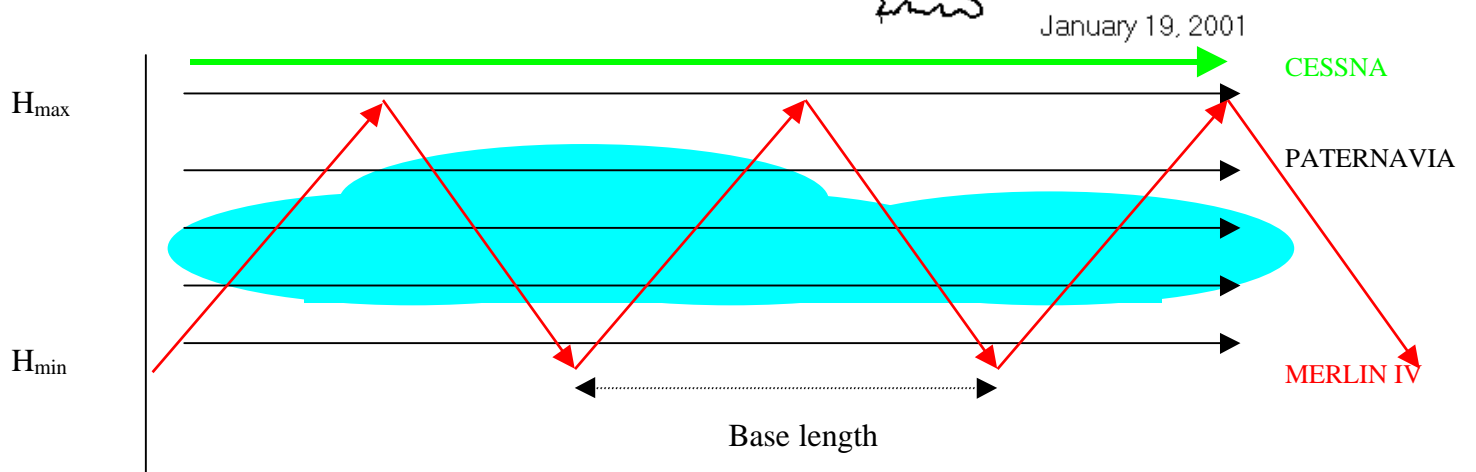
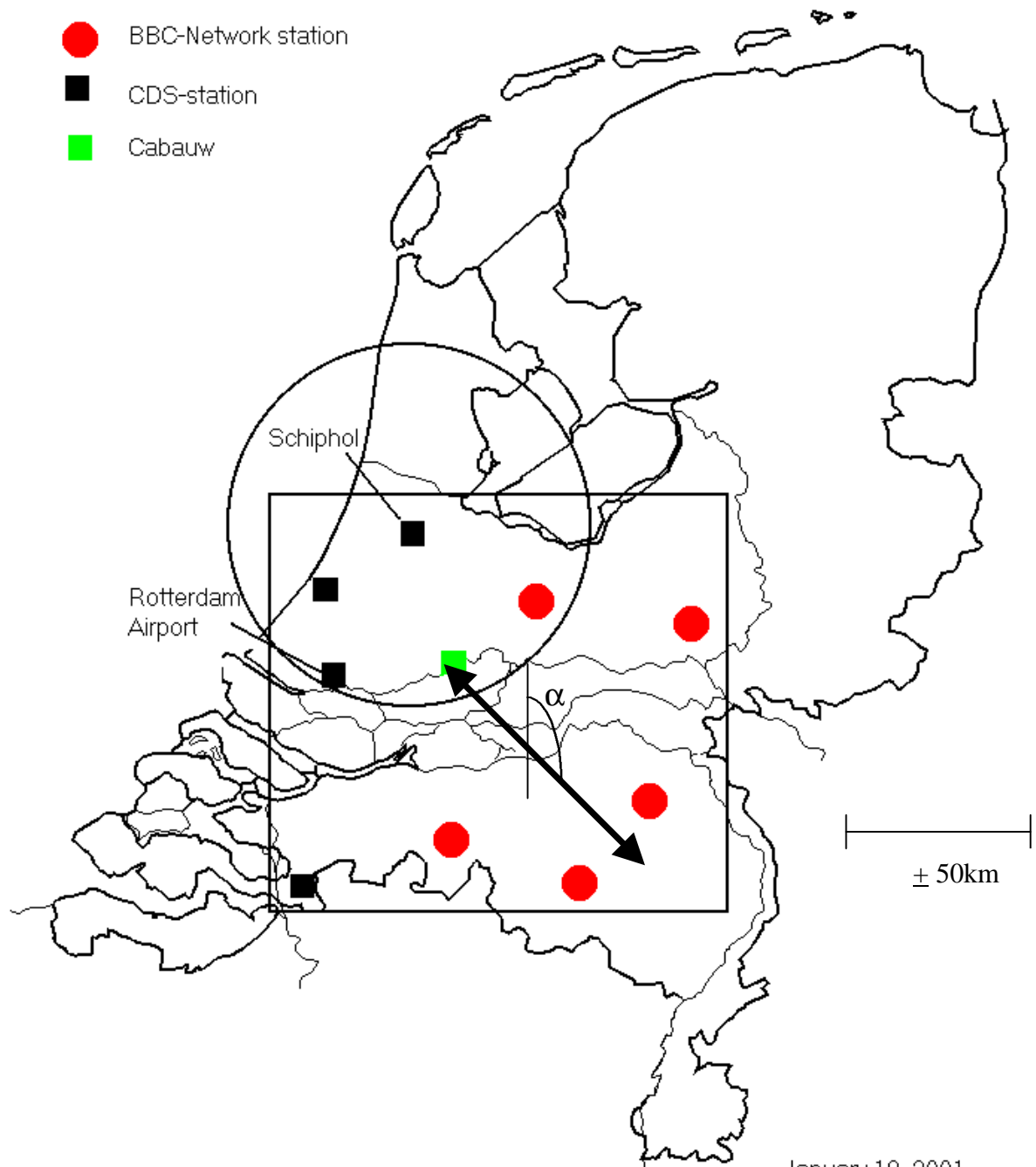
Pattern parameters:

- Track length (typically 50km)
- Base length (typically 16km)
- Number of altitudes and altitude heights
- Angle α of the track

Remarks:

- Both the PATERNAVIA and the CESSNA require low flights (as low as possible typically a few hundred meter).
- Accurate coordination between the aircraft is required
- Angle α will depend on the wind direction

MICRO PHYSICS AND RADIATION" Flight Pattern



"CABAUW" Flight Pattern

Objective: Measuring cloud microphysical parameters by the MERLIN IV and/or PATERNAVIA over the Cabuw site to validate remote sensing instruments.

Cloud type: Sc, Cu

Typical flight duration for one pattern:	200 kts	? hr
	100 kts	? hr

Pattern parameters:

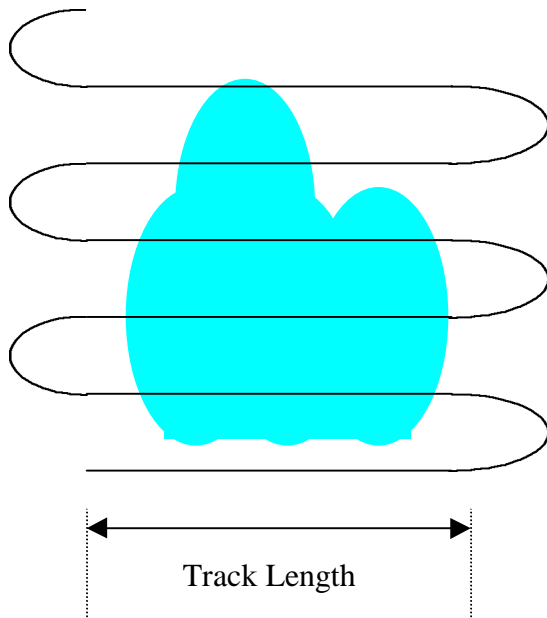
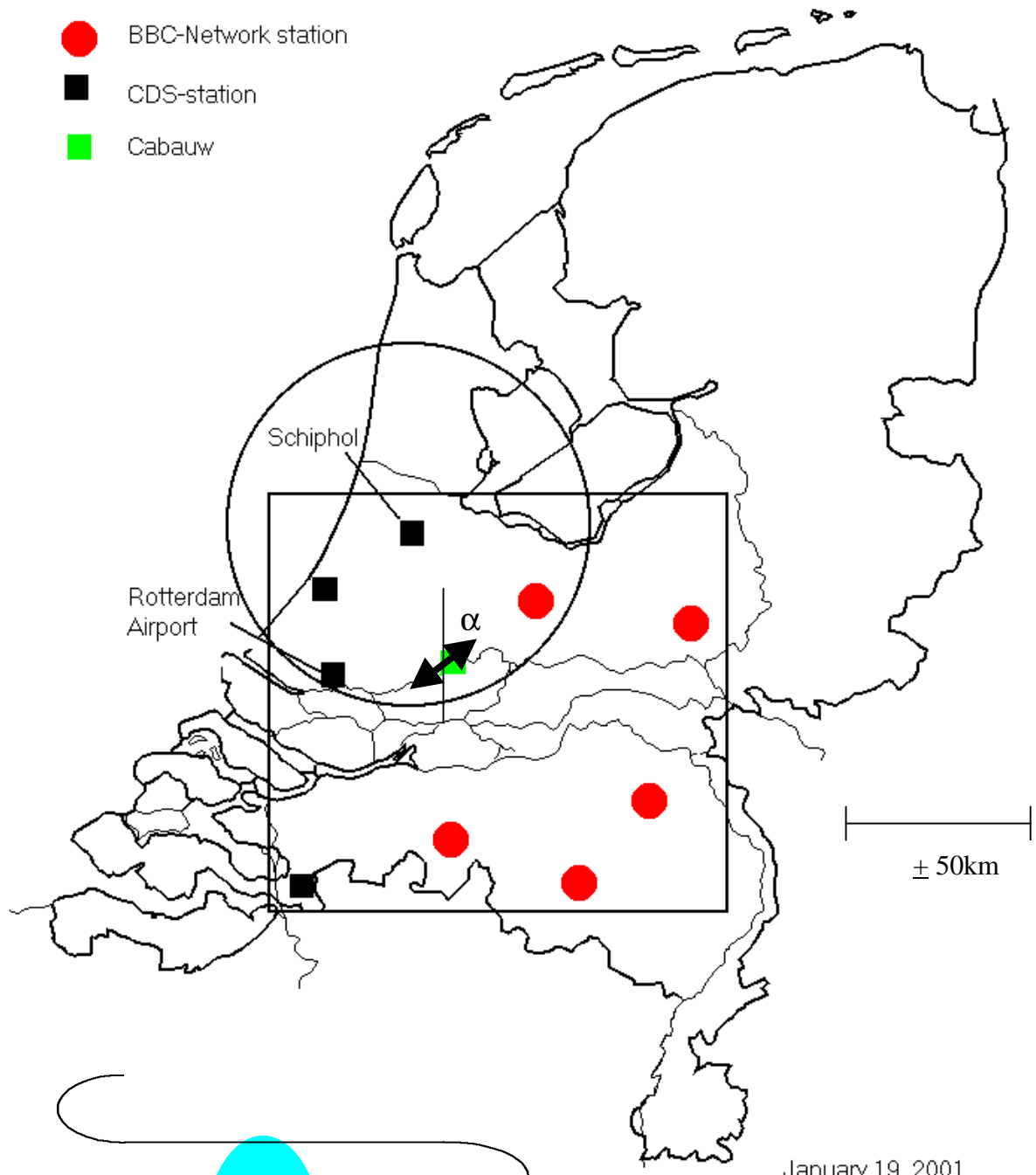
- Flight direction Top-Down or Base-Up
- Track length (typically 5 km)
- Number of altitudes and altitude heights
- Angle α of the track

Remarks:

- Both the PATERNAVIA and the CESSNA require low flights (as low as possible typically a few hundred meter).
- Possible combination with the "Dynamics Flight Pattern" (not necessarily over Cabauw).

"CABAUW" Flight Pattern

- BBC-Network station
- CDS-station
- Cabauw



APPENDIX 1: BBC FLIGHT PLANNING METEOROLOGISTS SCHEDULE

Version: 2

Date: September3, 2001

Date	Day	FPM	Contact	FPC	Contact	Remarks
3	Mon	P. Siebesma	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
4	Tues	P. Siebesma	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
5	Wed	P. Siebesma	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
6	Thurs	B. v.d. Hurk	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
7	Fri	R. Roebeling	06 52062573	A. Feijt C. Simmer/S. Crewell	06 20894707 +49 15112705243	
8	Sat	R. Roebeling	06 52062573	A. Feijt C. Simmer/S. Crewell	06 20894707 +49 15112705243	
9	Sun	P. Siebesma	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
10	Mon	A. Feijt	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
11	Tues	P. Siebesma	06 52062573	A. Feijt C. Simmer/S. Crewell	06 20894707 +49 15112705243	
12	Wed	P. Siebesma	06 52062573	A. Feijt C. Simmer/S. Crewell	06 20894707 +49 15112705243	
13	Thurs	R. Roebeling	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
14	Fri	R. Roebeling	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
15	Sat	R. Roebeling	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
16	Sun	B. v.d. Hurk	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
17	Mon	A. Feijt	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
18	Tues	E. van Meijgaard	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
19	Wed	E. van Meijgaard	06 52062573 C. Simmer/S. Crewell	+49 15112705243	
20	Thurs	E. van Meijgaard	06 52062573	A. Feijt C. Simmer/S. Crewell	06 20894707 +49 15112705243	
21	Fri	B. v.d. Hurk	06 52062573	A. Feijt C. Simmer/S. Crewell	06 20894707 +49 15112705243	
22	Sat	B. v.d. Hurk	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
23	Sun	E. van Meijgaard	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
24	Mon	E. van Meijgaard	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
25	Tues	E. van Meijgaard	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
26	Wed	A. Feijt	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
27	Thurs	P. Siebesma	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
28	Fri	B. v.d. Hurk	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
29	Sat	B. v.d. Hurk	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	
30	Sun	A. Feijt	06 52062573	A. van Lammeren C. Simmer/S. Crewell	06 52062567 +49 15112705243	

FPM : Flight Planning Meteorologist

FPC : Flight Planning Co-ordinator

APPENDIX 2: PROPOSED COORDINATE GRID FOR BBC CAMPAIGN

	1	2	3	4	5	6
A	52°10'N 04°50'E	52°10'N 05°05'E	52°10'N 05°20'E	52°10'N 05°35'E	52°10'N 05°50'E	52°10'N 06°05'E
B	52°00'N 04°50'E	52°00'N 05°05'E	52°00'N 05°20'E	52°00'N 05°35'E	52°00'N 05°50'E	52°00'N 06°05'E
C	51°50'N 04°50'E	51°50'N 05°05'E	51°50'N 05°20'E	51°50'N 05°35'E	51°50'N 05°50'E	51°50'N 06°05'E
D	51°40'N 04°50'E	51°40'N 05°05'E	51°40'N 05°20'E	51°40'N 05°35'E	51°40'N 05°50'E	51°40'N 06°05'E
E	51°30'N 04°50'E	51°30'N 05°05'E	51°30'N 05°20'E	51°30'N 05°35'E	51°30'N 05°50'E	51°30'N 06°05'E
F			51°20'N 05°20'E	51°20'N 05°35'E	51°20'N 05°50'E	51°20'N 06°05'E
S1	51°58'N 04°56'E		Cabauw			
S2	51°34'2.6"N 04°55'54.6"E	EHGR	Gilze-Rijen			
S3	51°27'0.5"N 05°22'28.3"E	EHEH	Eindhoven			
S4	51°39'25.9"N 05°42'28.2"E	EHVK	Volkel			
S5	52°3'35"N 05°52'0"E	EHDL	Arnhem-Deelen			
S6	52°08'N 05°17'E	EHSB	Soesterberg			
S7	52°06'N 05°11'E		De Bilt			

NOTE: Station S6 (Soesterberg) does not have a microwave radiometer during the campaign!!

