

# Rain Scatter Propagation on the Microwave Bands

OZ1FF

**Is it possible to make DX on  
Rain Scatter from Scandinavia?**

Presensation at the  
25. Nordic VUSHF Meeting

Gavelstad, Norway

07.06.2003



# OZ1FF



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- **1962: Licensed as OZ9KY**
- **1962: QRV 2m**
- **1964: Licensed as OZ1FF**
- **1964: QRV 70 cm**
- **1965: QRV 23 cm**
- **1977: QRT**
- **1998: QRV 2m+70cm**
- **2000: QRV 23+3cm**
- **2001: QRV 13cm**
- **2002: Member of EDR's VHF-Committee**

# Station

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<b>Band</b>	<b>TRX</b>	<b>PreAmp</b>	<b>PA</b>	<b>Antenna</b>
432-438	FT-847	LNA 435	250 W	2x23 el.
1296-1298	FT-847/MKU13G2	SP23	40 W	2x44 el.
2320-2322	FT-817/MKU23G2		10 W	67 el.
10368-10370	FT-817/MKU10G2	NE32584	6 W	65 cm dish
24048-24050	???	???	2 W	???

# Antenna Tower

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- Tower: 18 m free-standing steel tower, tiltable
- Rotator: Create 5-1



03-06-10

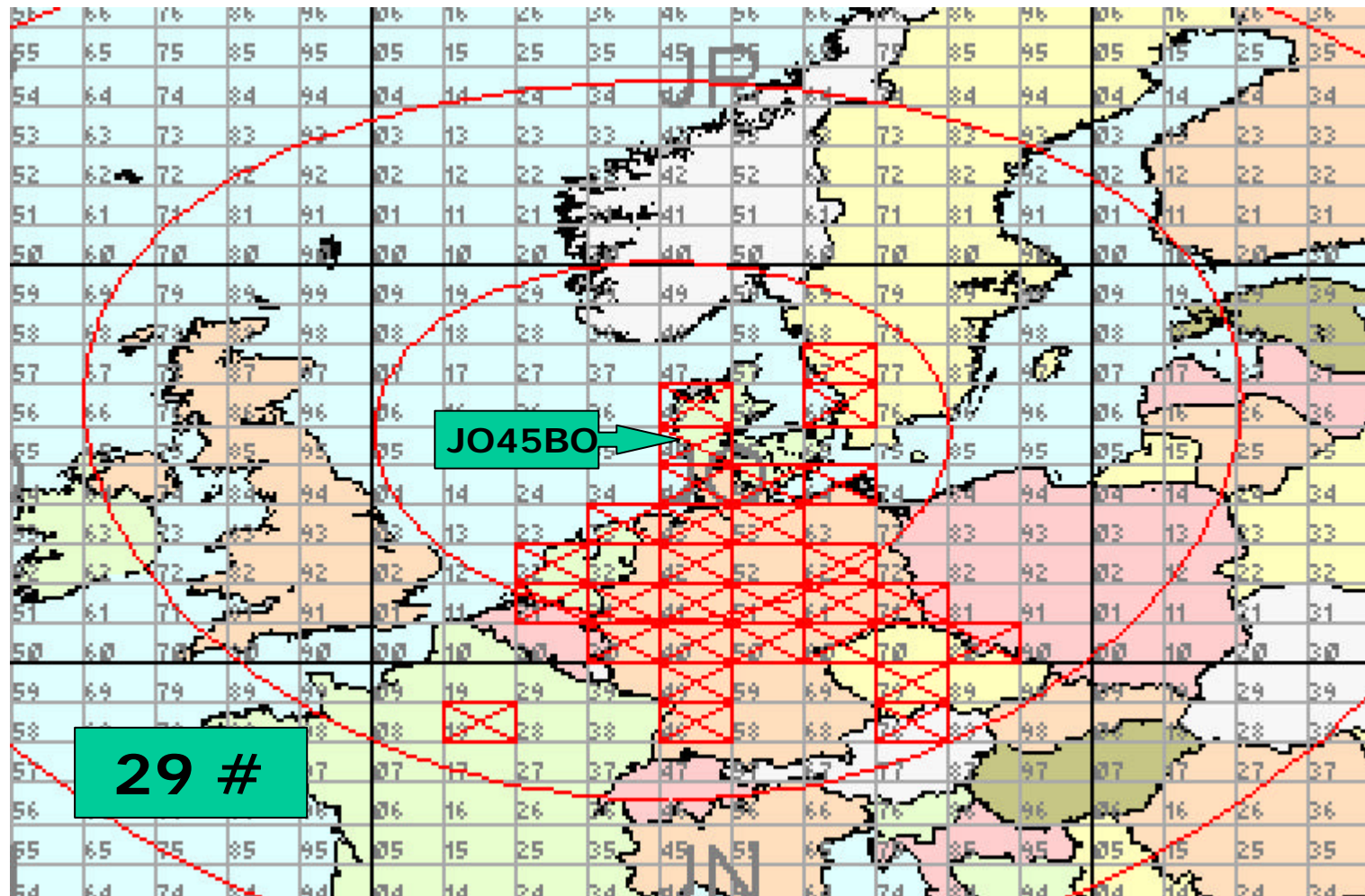
# QTH – JO45BO

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# # Worked on 10 GHz RS

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# Background

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- Radar produces echoes from rain clouds
- Weather radar has been a tool for meteorologists and pilots for more than 30 years
- First 10 GHz QSO over the Alps via "Cloud Scatter" in 1988
- 10 GHz: "A bad weather band"
- 1995: LX1DU Cloud Scatter Beacon
- Late 90-ties: Heavy RS activity in Central Europe each summer

# Scattering

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- **Scattering is the process by which signals interact with the transmission medium in a way that causes the signals to go in directions different from the original direction**
- **Interaction between the RF energy and particles in the troposphere cause the scattering**



# Scattering

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- **Scattering increases by a factor of the fourth power of the frequency, until the wavelength approaches the dimension of the particle**
- **Once the particle is as big as 1/10th the wavelength this fourth power factor begins to reduce, and when the particle is the size of a wavelength and larger, the scattering efficiency remains constant**

# Scattering

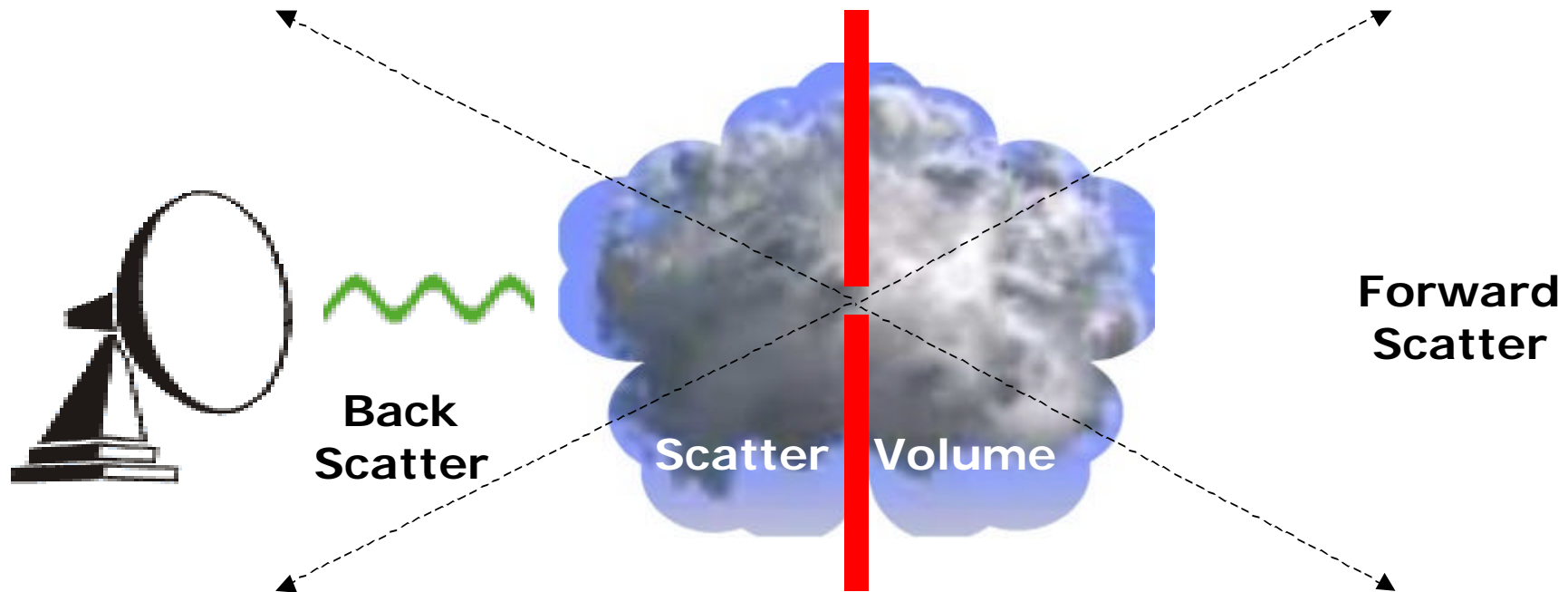
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- **10 GHz is the optimal band for Rain Scatter**
- **5,7 GHz -12 dB lower reflectivity**
- **3,4 GHz -19 dB lower reflectivity**
- **24 GHz – atmospheric losses plays a role**

# Rain Scatter

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Horizontal Polarization



# Signal Quality

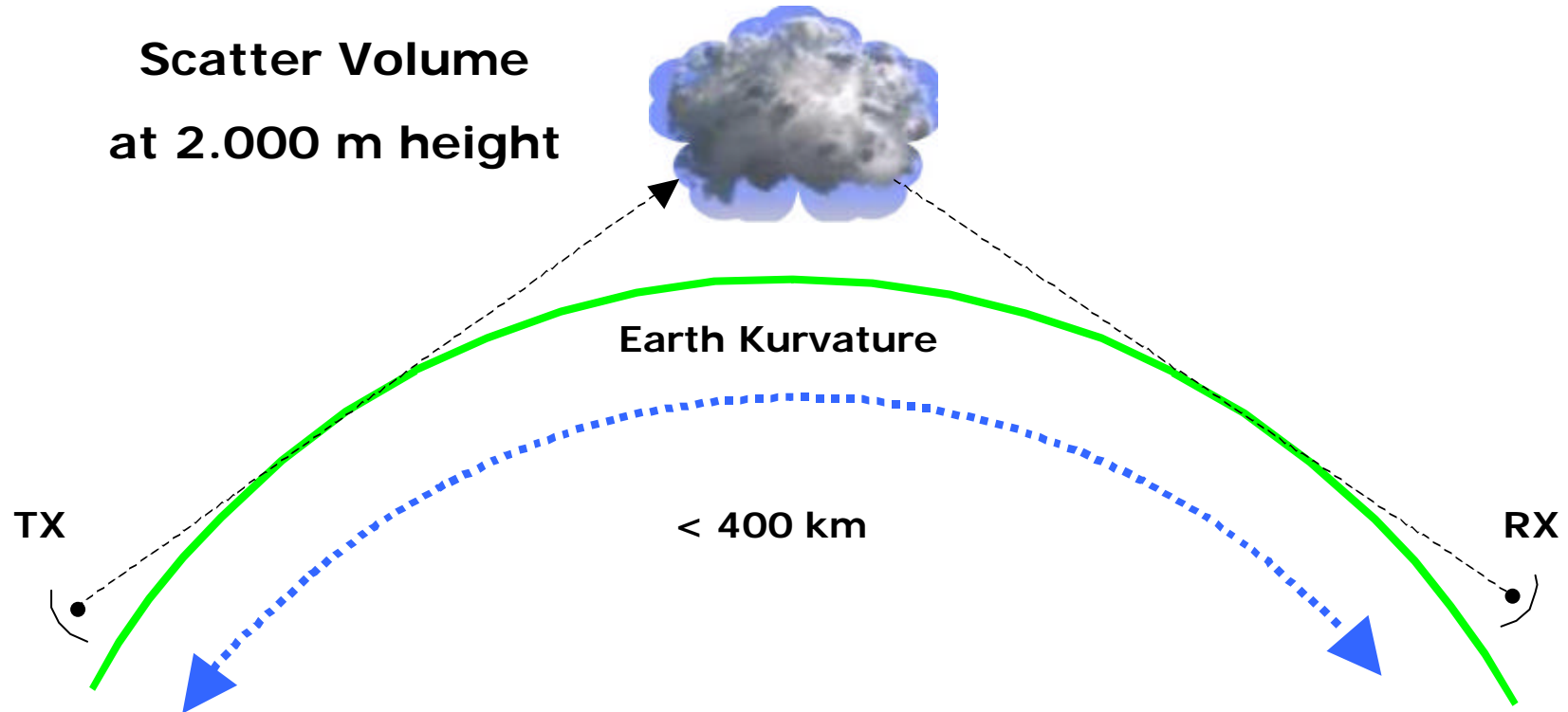
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- Received signal consists of many separate signals = distortion
- Forward scattered signals are less distorted
- Back and side scattered signals are very distorted
- Doppler shift



# Range

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Scatter Volume  
at 2.000 m height

Earth Kurvature

TX

< 400 km

RX

Scatter Point: The point with the highest reflectivity

**RX/TX**

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- **Nearly any station will do the job**
- **RX: NF < 2 dB**
- **TX: Power > 1 W**
- **Frequency accuracy: < +/- 5 kHz**
- **Modes: CW/SSB/NB-FM**

**QTH**

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- **High-elevated QTH is not essential, but**
- **Free take-off (clear horizon) is important**

# Antenna

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- **45 – 90 cm dish**
- **Azimuth/elevation rotator**
- **Azimuth rotator with variable speed and without play**

Beam



# Rain Scatter - When



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- **When it's raining/snowing- 200 to 500 kms away**
- **Best through April to September in Central Europe**
- **Best through June to August in Scandinavia**
- **Late afternoon until early evening**

- **How to monitor RS activity and find the scatter point?**
  - **Beacons**
  - **DX-Cluster**
  - **World Wide Converse**
  - **Precipitation Maps**
  - **Lightning Maps**
  - **RS List**

## Connection through Packet Radio/Internet

10358150.0	OZ1CTZ	18-Jun-2002 2030Z	53s jo31>jo46 tks new #!	<PA0BAT>
10368920.0	DB0VC/B	18-Jun-2002 2028Z	~53s jo54>jo33 qtf 71 & 57°	<PA3CEG>
10368100.0	OZ1CTZ	18-Jun-2002 2021Z	call dc9yc 54rs 032	<DL3YEE>
10368917.0	DB0VC/B	18-Jun-2002 2020Z	55s jo54>jo31 qtf058	<PA0BAT>
10368884.0	HB9G/B	18-Jun-2002 2019Z	529 JN36>JN58 381km	<DL1GGT>
10368115.0	DL2RG	18-Jun-2002 2020Z	jo62kn 59s/82°	<PA3CEG>
10368090.0	DL1RG/P	18-Jun-2002 2009Z	jo62kn qtf88° hrd agn 59	<PA3CEG>
10368130.0	DL4IB	18-Jun-2002 2006Z	579 jo31>jo64 tks new #!	<PA0BAT>
10368901.0	SR6NCI	18-Jun-2002 1953Z	59 tropo jo80jg jn78dk	<OE5VRL>
10368100.0	DK2AN/P	18-Jun-2002 1943Z	59S jo51>jo46	<OZ1CTZ>
10368100.0	DK8ZP	18-Jun-2002 1940Z	jo40>jo46	<OZ1CTZ>
10368970.1	SK7MHL/B	18-Jun-2002 1933Z	still 54rs qtf035	<DL3YEE>
10368124.0	OZ1CTZ	18-Jun-2002 1928Z	53s JO46OE><JO42XD	<DL1CF>
10368085.0	OZ1FF	18-Jun-2002 1918Z	58s fm hrd qtf44 in jo31rl	<DH8AG>
10368095.0	OZ1FF	18-Jun-2002 1907Z	55s jo45bo<>jn49ej new #,dxc	<DL3IAS>
10368350.0	OZ1FF	18-Jun-2002 1857Z	heard jn49ej, no qso qrm :-	<DL3IAS>

# DX-Cluster



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OZ1CTZ 10368835.0 SK0SHH/B	52S jo89>jo46	1414 31 Jul 2002
OK1JKT 10368856.0 SR0CWK/B	54s jo90ns>jo60ok qtf088	1353 31 Jul 2002
OZ1CTZ 10368835.0 SK0SHH/B	41S jo89xj>jo46oe 630km	1320 31 Jul 2002

**But no SM-stations!!!**

# World Wide Converse

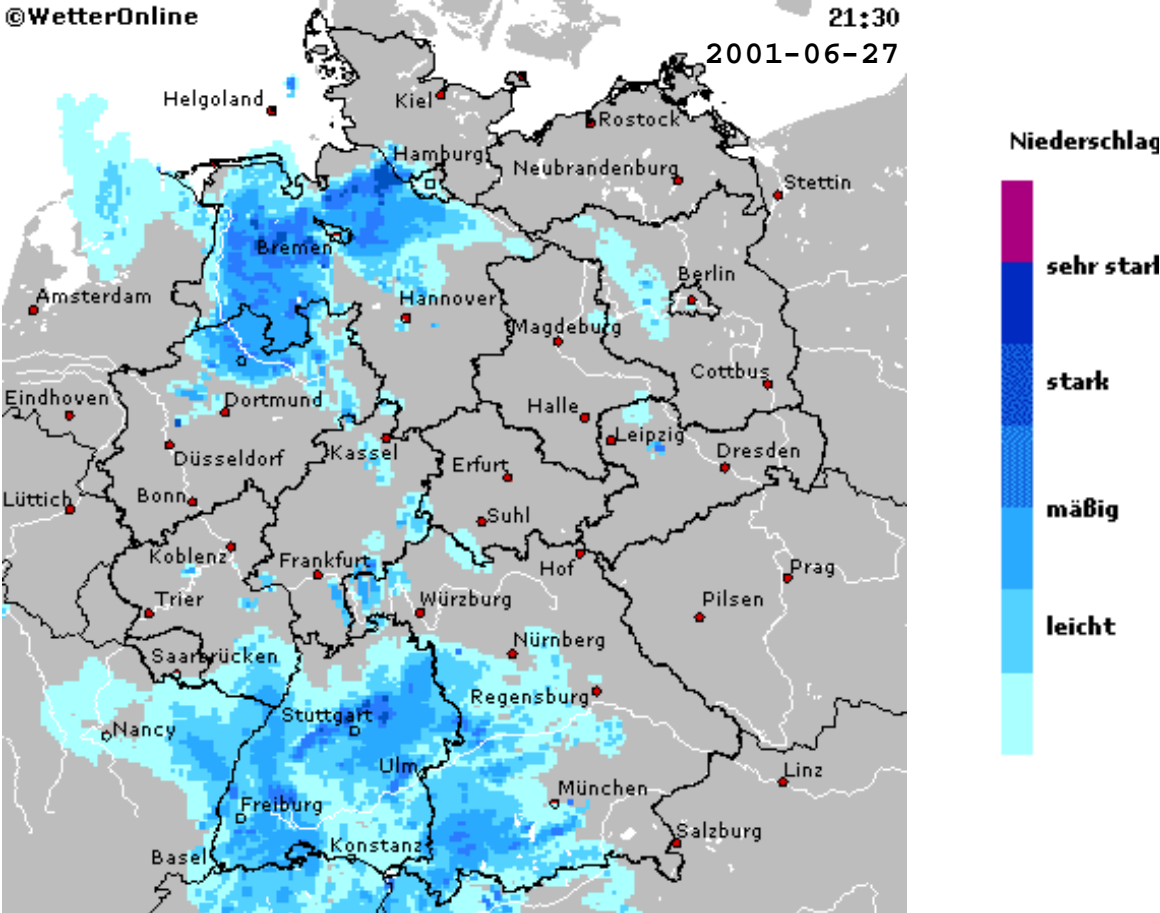


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## Connection through Packet Radio/Internet on ch. 10368:

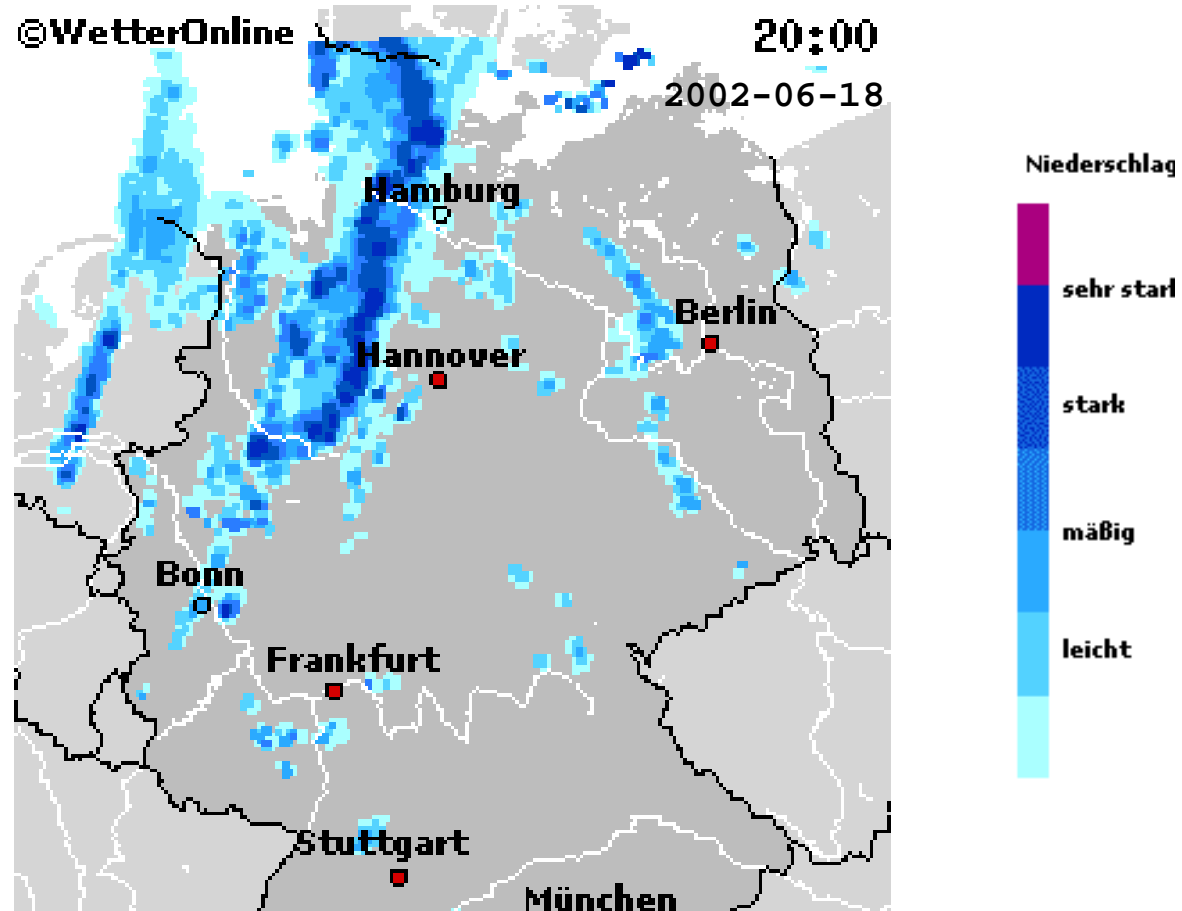
:>6DKW: GM MAURICE  
<f6dkw>: <oz1ff>:Gm kjeld, only white noise here..  
:>6DKW: WKD OK2BLE IN JN99FE 967KMS THIS MORNING  
<f6dkw>: <oz1ff>: tropo I presume? quite fine DX!  
:>6DKW: RGR ON TR  
<\*ok1jkt\*>: Kjeld loc ok2bfh,ble is jn99fn  
:>1JKT: RGR KAREL, JUST HIT WRONG KNOB  
:>1CTZ: STADIG HER?  
<oz1ctz>: 1ff>> RRR ...  
:>1CTZ: SKAL JEG QSP TIL OK2BFH??  
<oz1ctz>: 1ff ..det maa du gerne..hvad er hans QRA ..???  
:>1CTZ: JN99FN  
:>1CTZ: 59++++ PAA 70 CM  
<oz1ctz>: 1ff>> ok ..jeg er QRV pÖ 3 .100 hans retning ...  
:>1CTZ: KALD NU .100 TIL JN99FN!!  
<oz1ctz>: 1ff rr tx nw  
:>1CTZ: OK2BFH 59+++ PAA 3 CM CLG CQ  
:>1CTZ: HAN ER CA 2,5 KHZ FOR LAVT  
<\*dl6nci\*>: hello Kjeld, test 3cm to jo50vi?  
<oz1ctz>: 1ff>> ...kun sus ...sri...  
<oz1ctz>: rrrrrrrrr qso  
:>1CTZ: LYTTER MED!!  
<oz1ctz>: worked ok2bfh ...!!!! 962 km ....  
:>1CTZ: CONGRATS, DU MANGLER ET PAR KM I ODX  
:>1CTZ: VAR HER MED 59++++ INDEN DU KOERTE HAM  
<dl6nci>: ctz congrats Brian and Jan!  
:>6NCI: RGR, RUFÉ AUF .100  
<oz1ctz>: ok1bfh 55 qsb here ..ufb

# Weather Radar



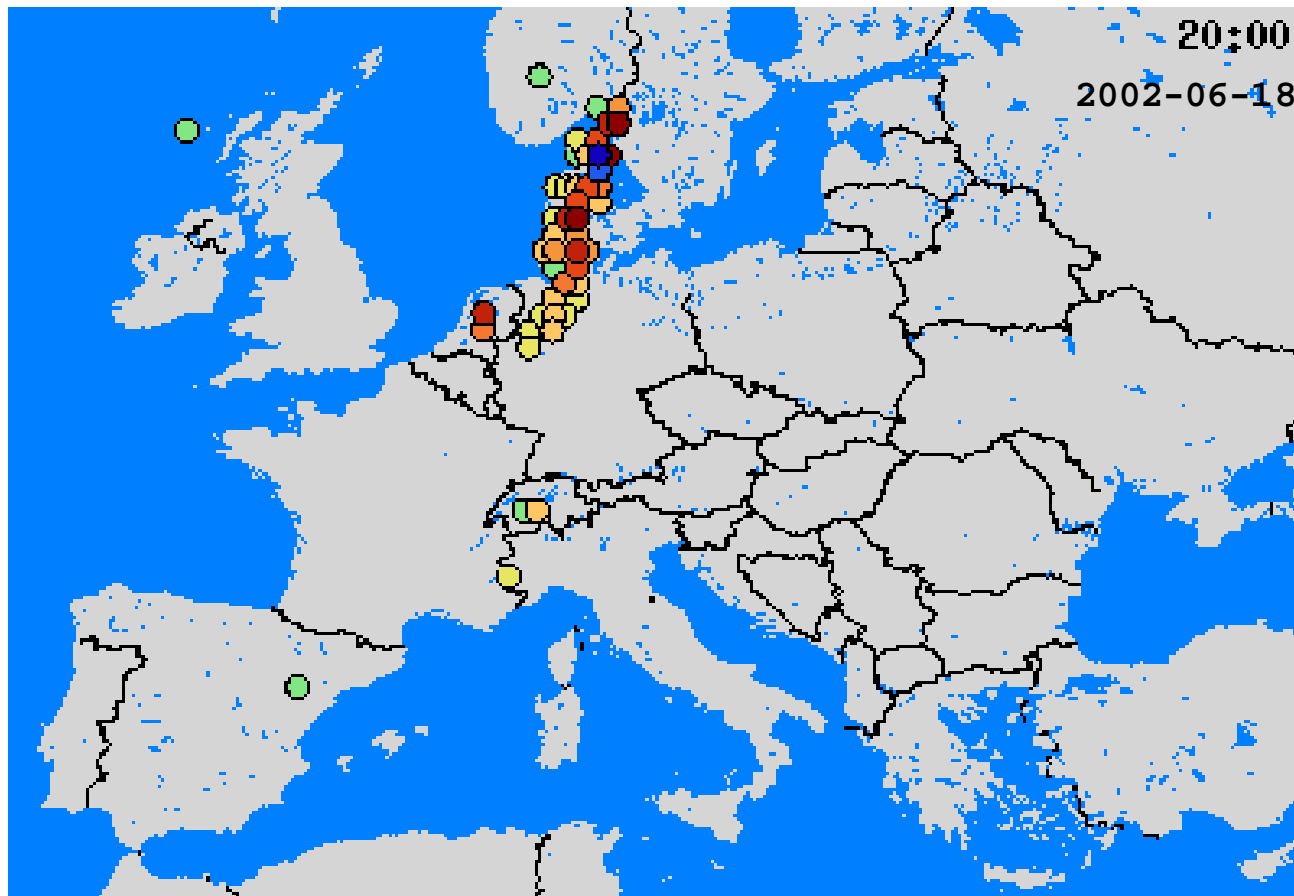
# Weather Radar

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# Lightning Map

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[www.wetteronline.de](http://www.wetteronline.de)

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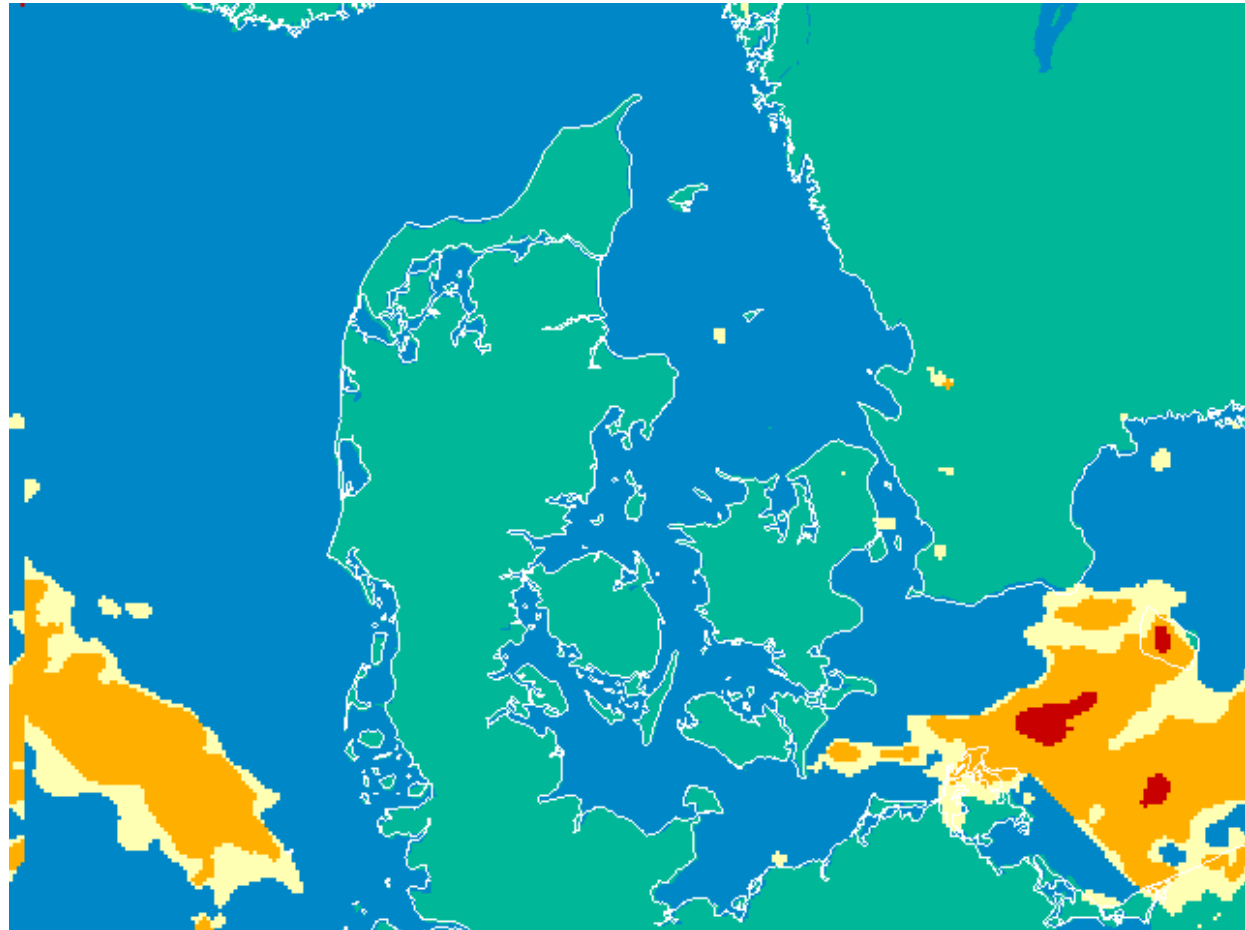
# Weather Radar

OZ1FF



User-ID: 21940201

Pass-word: mdu55hnx



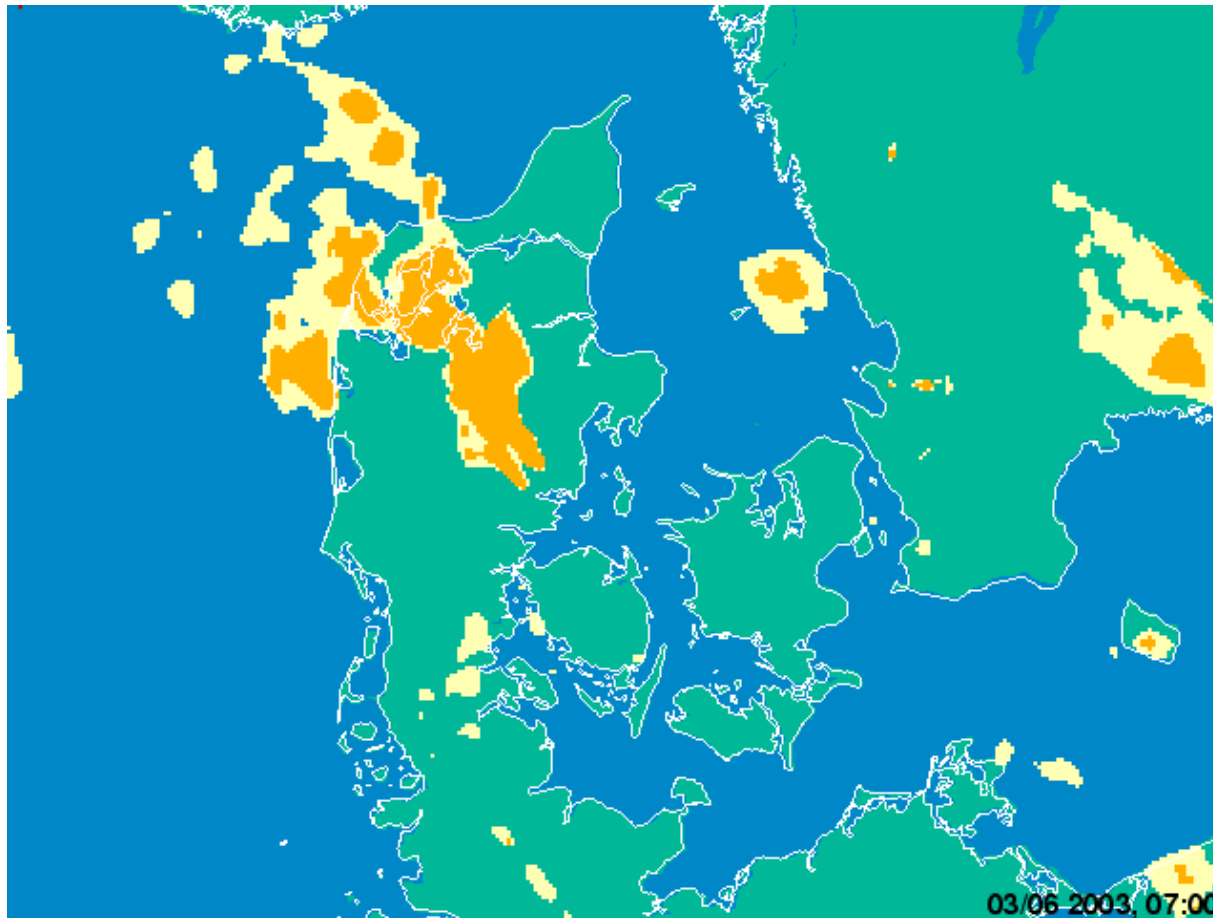
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<http://skoda.emu.dk/skoda-cgi/dmi>

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# Weather Radar

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03-06-10

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# RS List



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From: <http://www.gsl.net/dq1vl>

## 10 GHz: More than 150 stations

DB1BX	Rudi	jo32ot	5W	60cm	1dB	38ASL	05932/1861z.Zt. QRT
DB4CE	Dieter	jn57dr	12W	80cm	?	715ASL	0831/17142
DB6DY	Eberhard	jo31ri	5W	70cm	1.0dB	120ASL	02331/925211
DB6NT	Michael	jo50ti	10W	90cm	1.5dB	700ASL	* 09288/8232
DC6RW	Udo	jn49hl	6W	68cm	1dB	100ASL	06203/46040 + Fax492161
DC6UW	Norbert	jo44vj	20W	1.5m	1dB	70ASL	04356/351 + Fax 1625
OZ1CTZ	Brian	jo46oe	2W	70cm	?	99ASL	+45/86861314
		<a href="mailto:oz1ctz@post3.tele.dk">oz1ctz@post3.tele.dk</a>					
OZ1FF	Kjeld	jo45bo	5W	65cm	.7dB	23ASL	+45/73526050-SMS
		+4540211119 <a href="mailto:oz1ff@mail.dk">oz1ff@mail.dk</a>					
OZ2TG	Steen	jo65fp	1W	60cm	3.0dB	12ASL	0045/4536163877
SM6EAN	Mats	jo57wq	6W	65cm	2.0dB	60ASL	0046/31294274
SM6ESG	Morgan	jo67cc	40W	50cm	1.5dB	25ASL	0046/034083360/QRL034
		0481987					
SM7ECM	Andy	jo65nq	8W	90cm	2.5dB	33ASL	0046/40465606 <a href="#">Anders.</a>
		<a href="mailto:Pettersson@ecs.ericsson.se">Pettersson@ecs.ericsson.se</a>					
SMOSBI	Pontus	jo99cf	6W	85cm	.65dB	75ASL	0046/708331509 GSM
		<a href="mailto:pontus@altin.se">pontus@altin.se</a>					

# Operation

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- **Listen, call, turn antenna**
  - **Listen, call, turn antenna**
    - **Listen, call, turn antenna**
      - **Listen, call, turn antenna**
        - » **Listen, call, turn antenna**
- **QRG: 10368,050 – 10368,500 MHz**
- **Call in CW, not too long**
- **Band can be very crowded, so don't make FM QSO's around .100**

# Soundfiles

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- **SK7MHL/B – JO65OR/319 km**
- **OK1JKT – JO60OK/667 km**
- **PA0BAT – JO31FX/418 km**
- **DL5YET – JO41EV/413 km**

# RS DX Records on 10 GHz



**1998: PA3CEG - OE5VRL/5  
JO33FB – JN78DK: 753 km**

**2001: F6DKW - OZ1FF  
JN18CS – JO45BO: 861 km**

**2001: DK1KR heard SM3BEI  
JO53HW – JP81NG: 901 km**

**2002: DL6NCI - IW4CJM/P  
JO50VI – JN72MA: 959 km**

# Rain Scatter on Microwave



**Join the fun**