

# Accumulation and stable-isotope studies at Kohnen station, Dronning Maud Land, Antarctica, from 1999 through 2011.

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mit Förderung  
durch BMBF



ESF EuroPOLAR

25. Internationale Polartagung „Polargebiete im Wandel“,  
Hamburg, 17.-22. März 2013

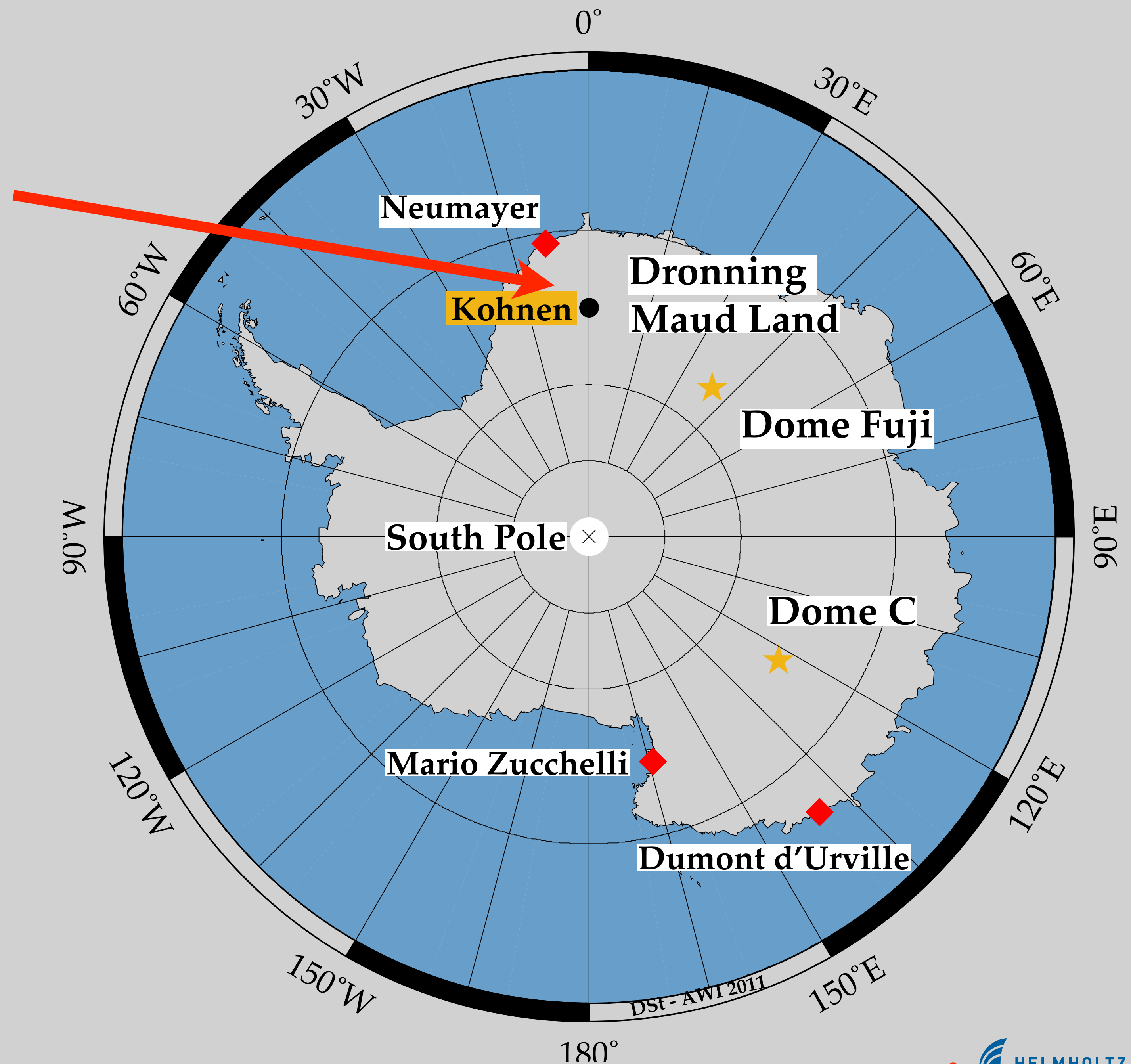


# Kohnen station

**75° S, 0° E, 2882 m**

German base (AWI),  
in operation on demand  
during summer months  
only

EPICA deep drilling  
EDML core  
2000-2006





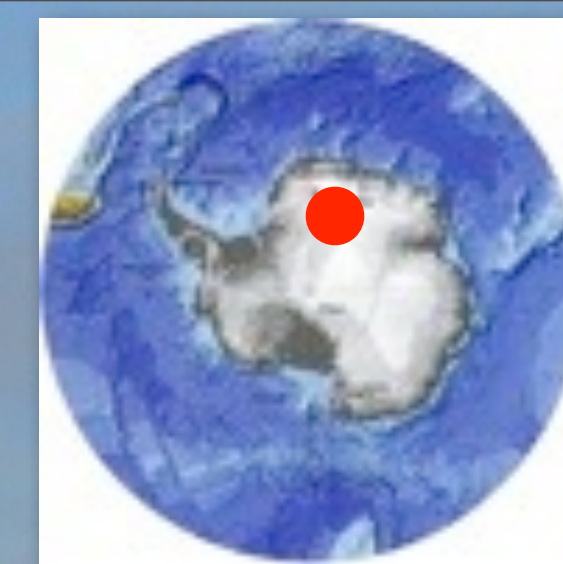


foto: hans oerter, 2006

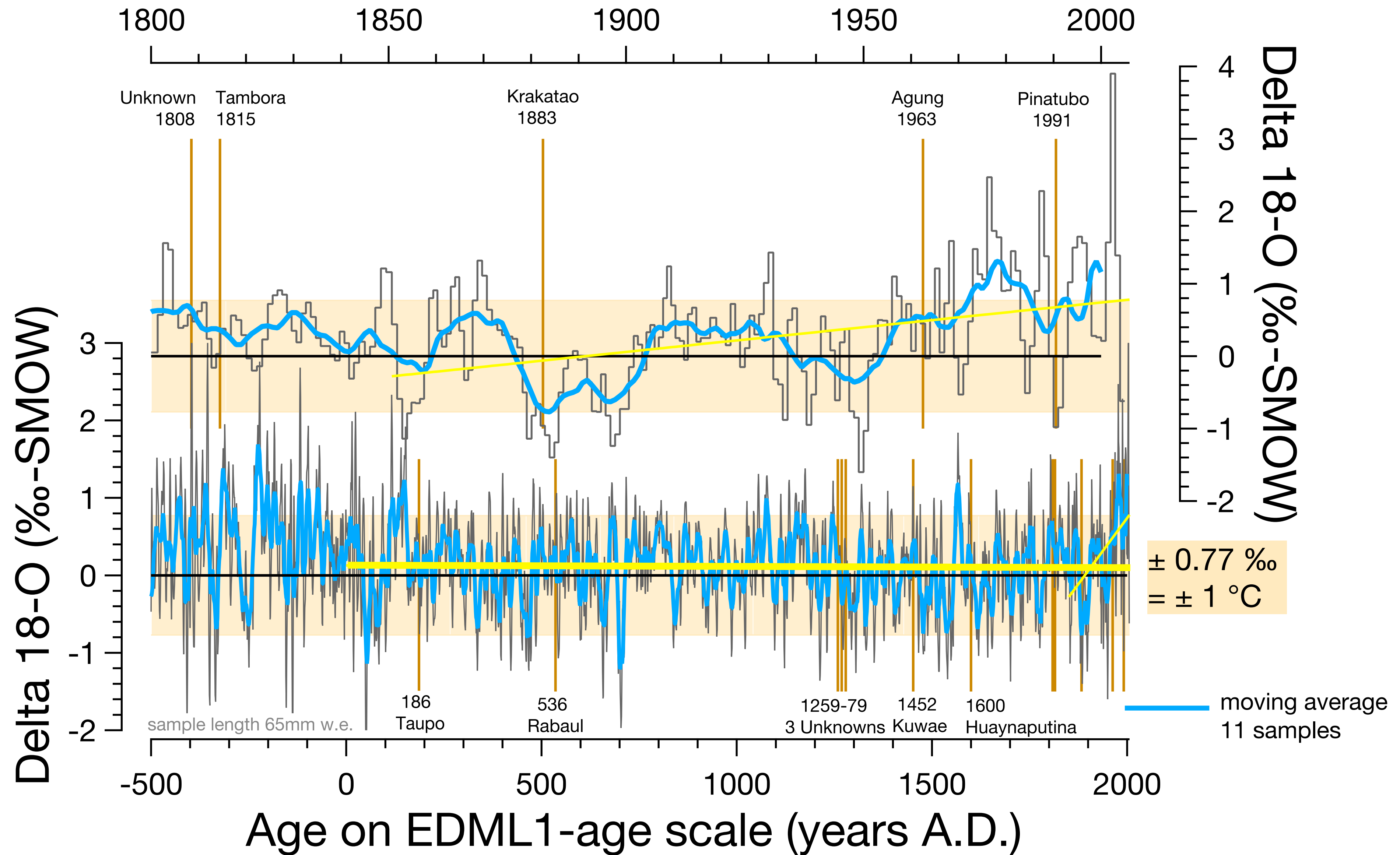
**Kohnen-Station**  
75°S, 0 °E, 2882 m

photo: hans oerter, 2006



# Composite of 5 cores from Dronning Maud Land until 2005

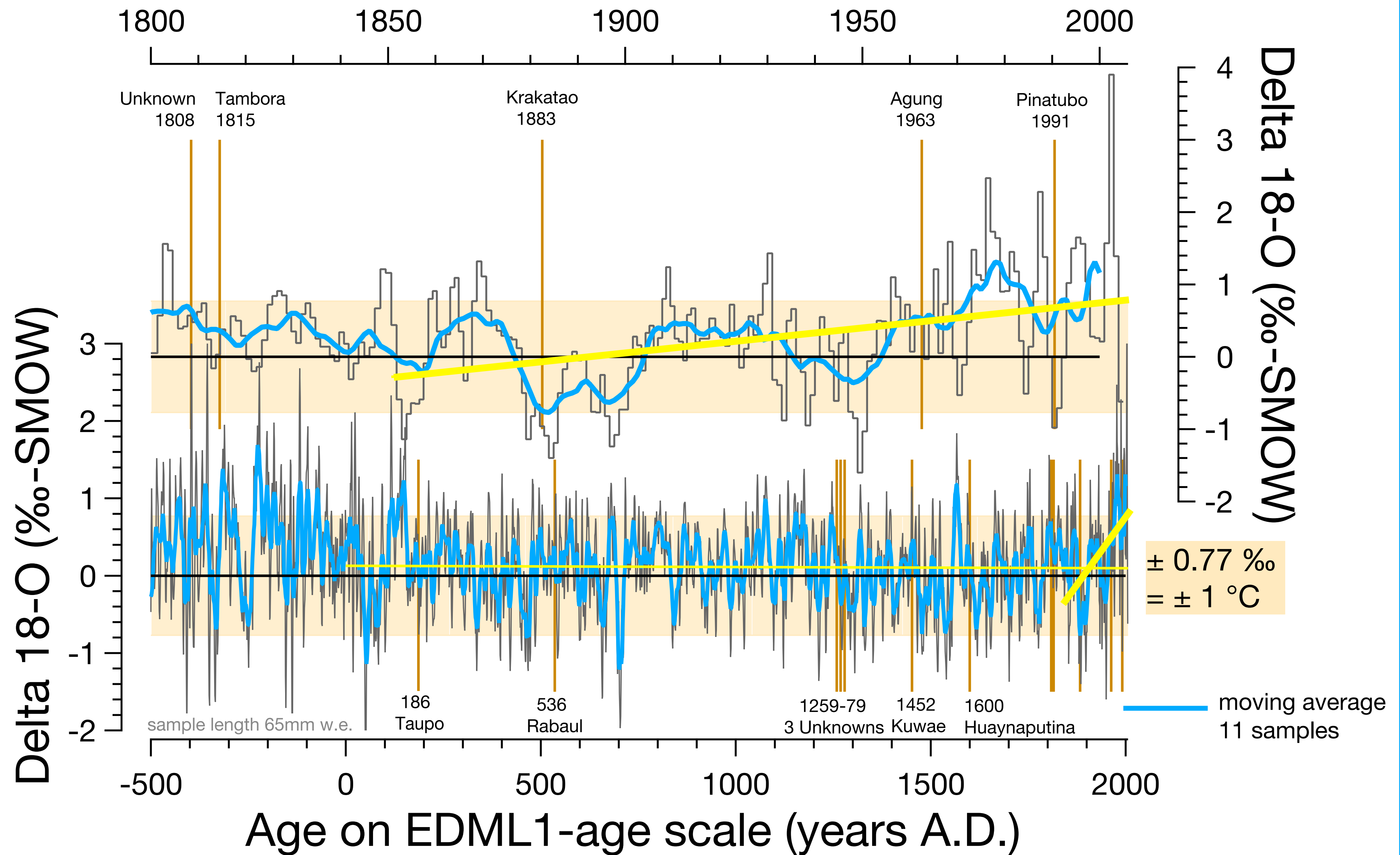
Deviation from mean 1259-1815 A.D.



Oerter et al.: SCAR OSC, Portland (2012)

# Composite of 5 cores from Dronning Maud Land until 2005

Deviation from mean 1259-1815 A.D.



Oerter et al.: SCAR OSC, Portland (2012)

# Sampling locations in the surroundings of Kohlen station

## The Pentagon: PEN1 - PEN5

installed: 1999/2000

observed until: 2010/11

## Snow height sensors

### HM01 - HM03, Univ. Utrecht

installed: 12.01.2000

observed until: 25.01.2008

DML05 = B32, drilled 25.12.1997

DML25 = FB9901/02, drilled 03.01.99  
SS9901, 05.01.99

Base = Kohlen station

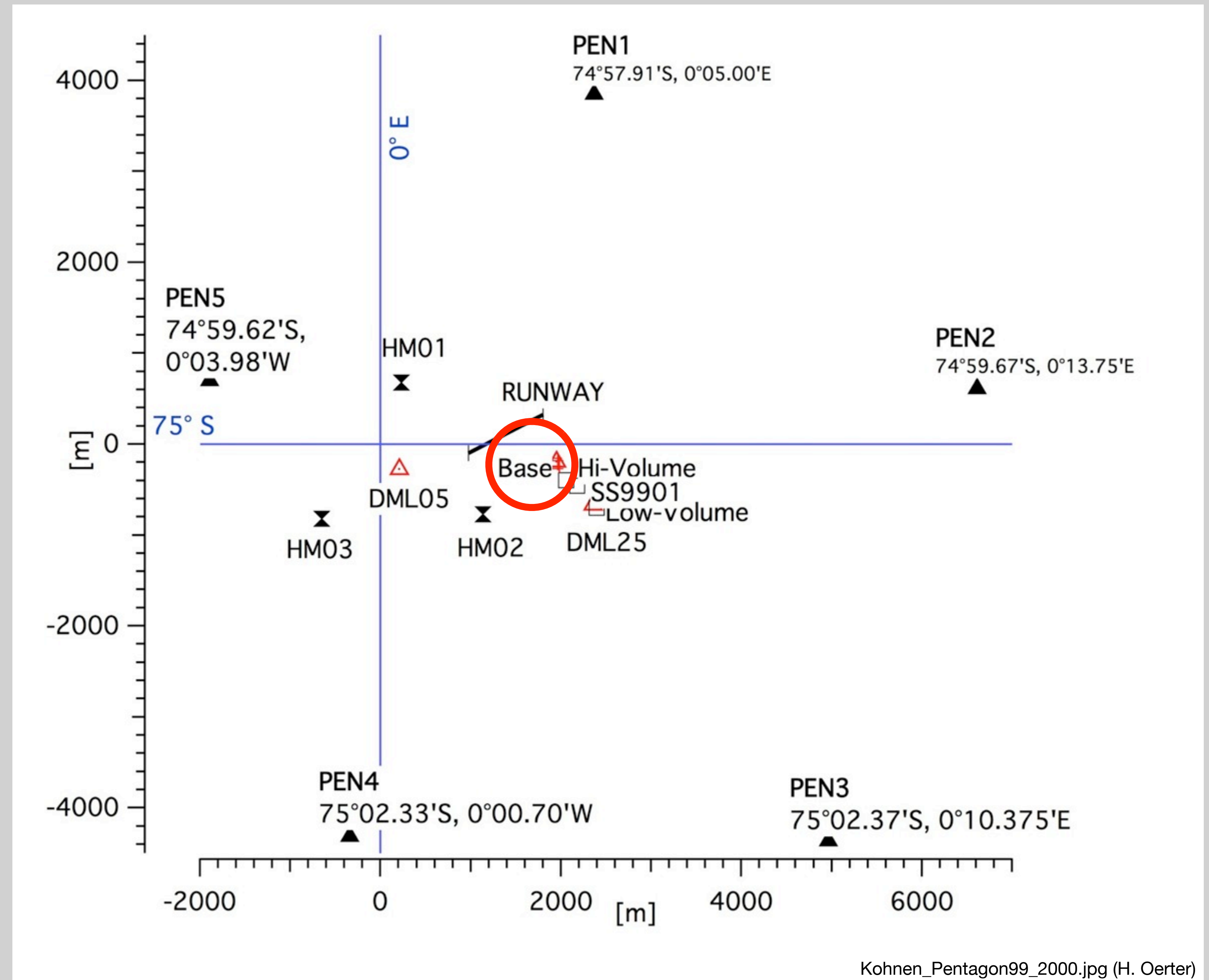






photo: hans oerter, 1998

Snow pit DML21, 04.01.1998

# Sampling a snow pit

Density

Stable isotopes ( $^{18}\text{O}$ ,  $^2\text{H}$ , d)

Ø ca. 5cm

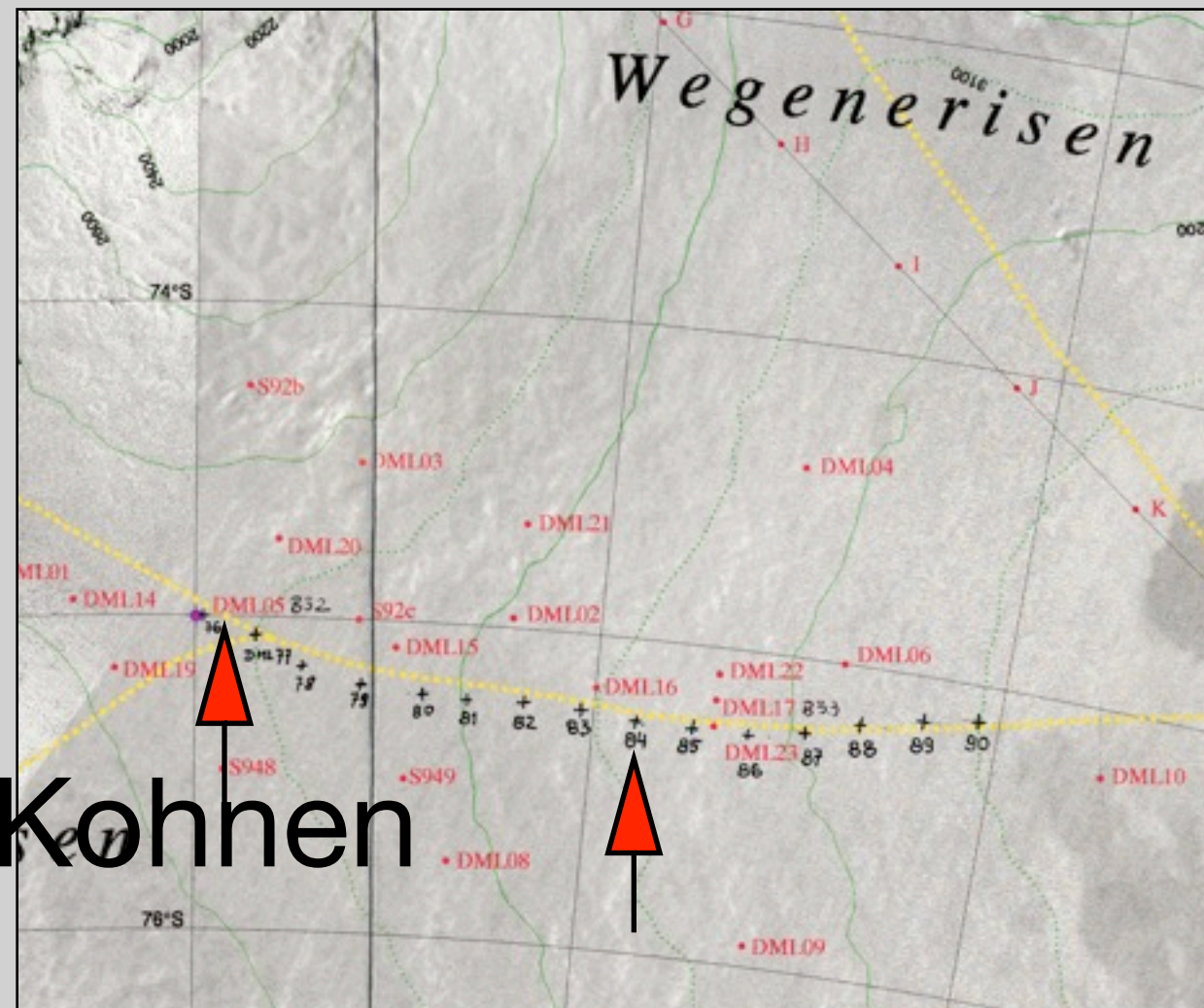
Volume  $500\text{cm}^3$

Major ions (aerosols)

Stratigraphic notes



# horizontal layering in the firn pack



Kohnen

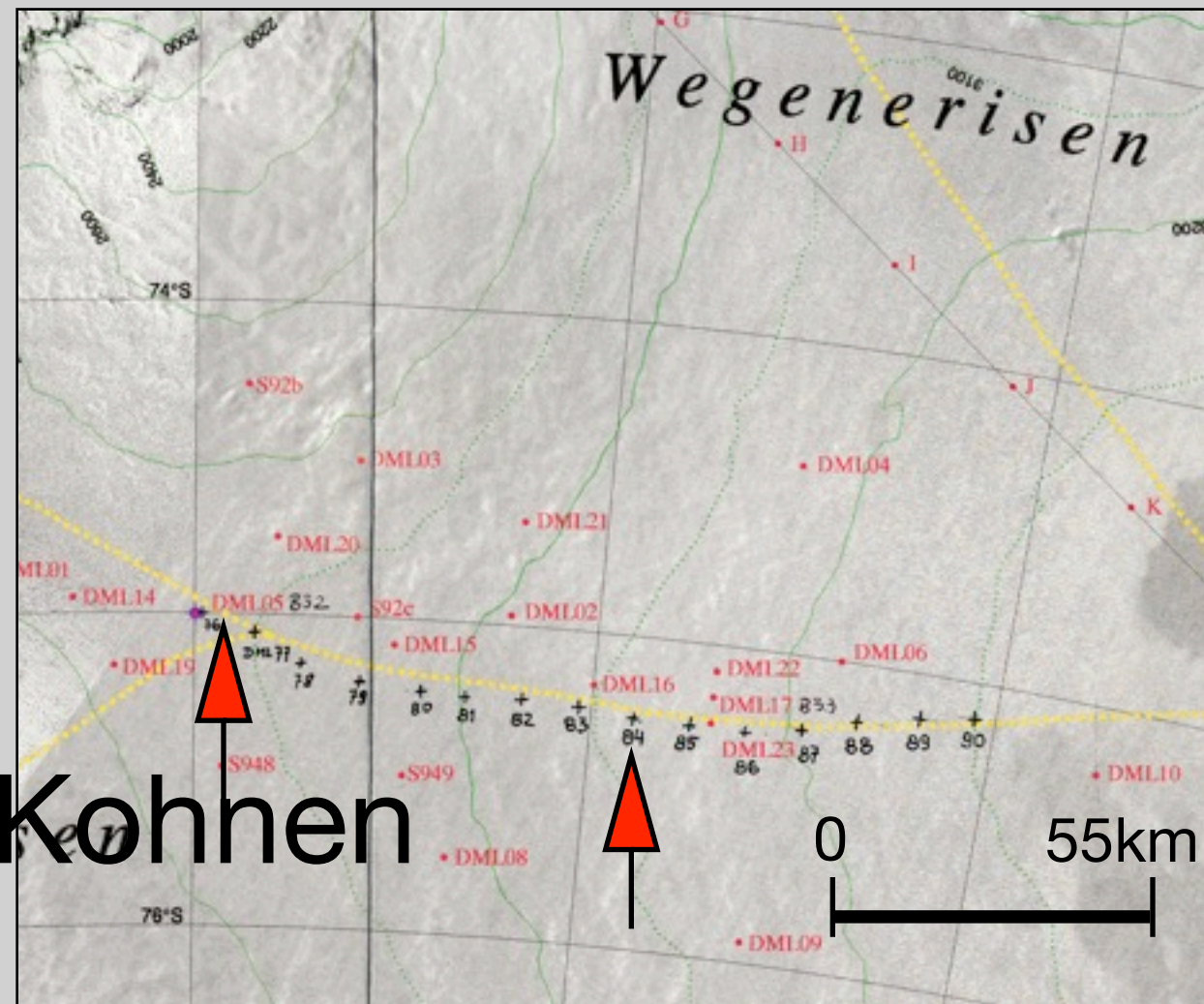
Snow pit DML84,  
05.01.2006



photo: hans oerter, 2006



# horizontal layering in the firn pack



Snow pit DML84,  
05.01.2006

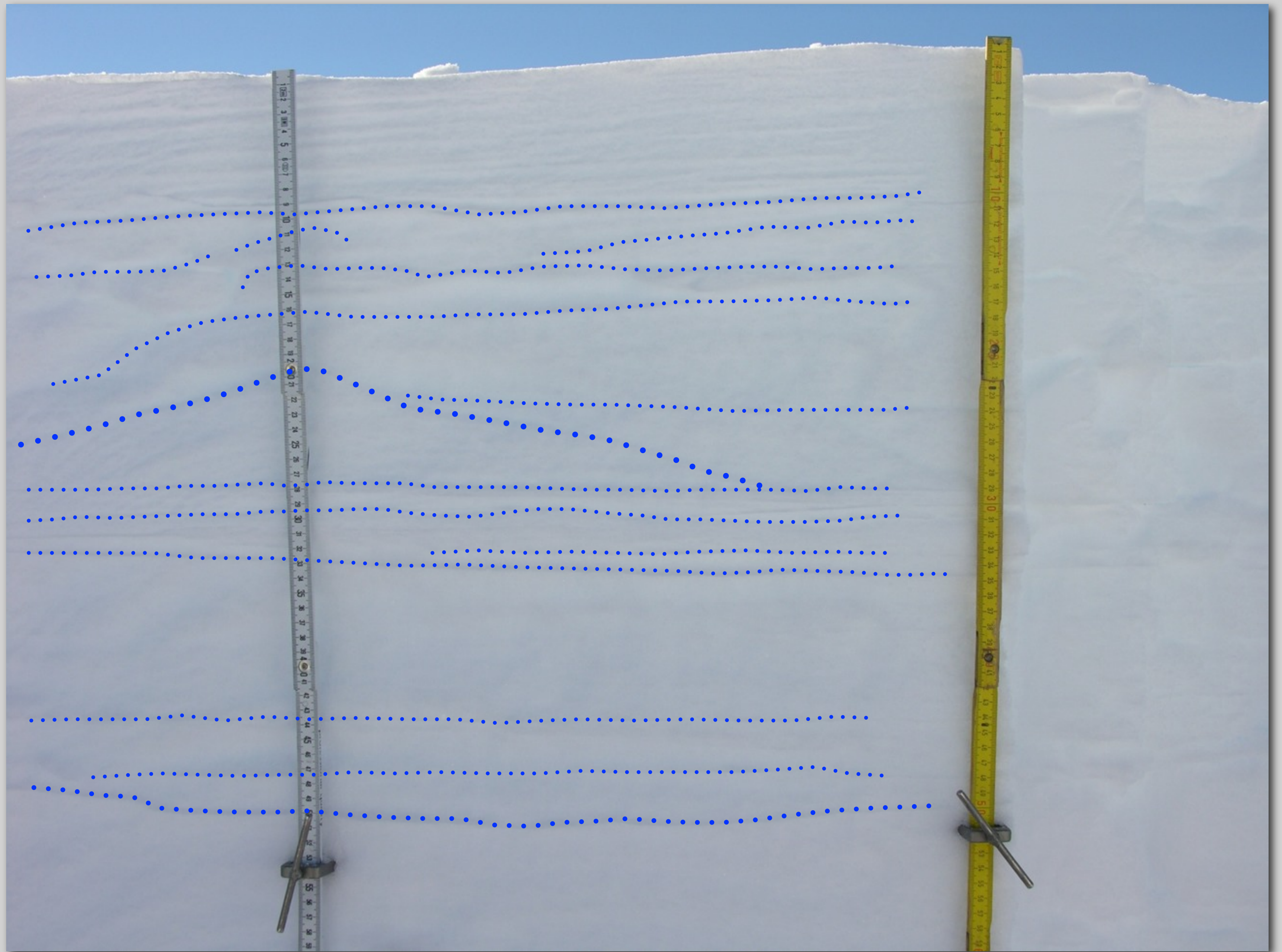
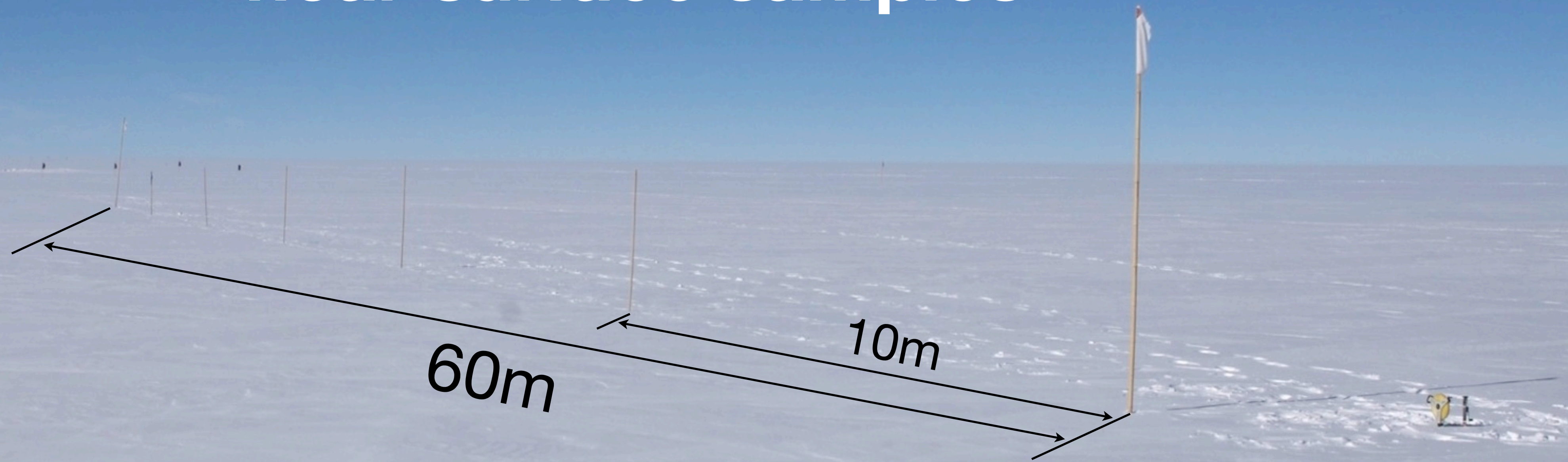


photo: hans oerter, 2006



# near surface samples



Profile of near-surface samples (0-60 m), 26.01.2008  
sampled with a spacing of 1m, 6cm deep

Kohnen



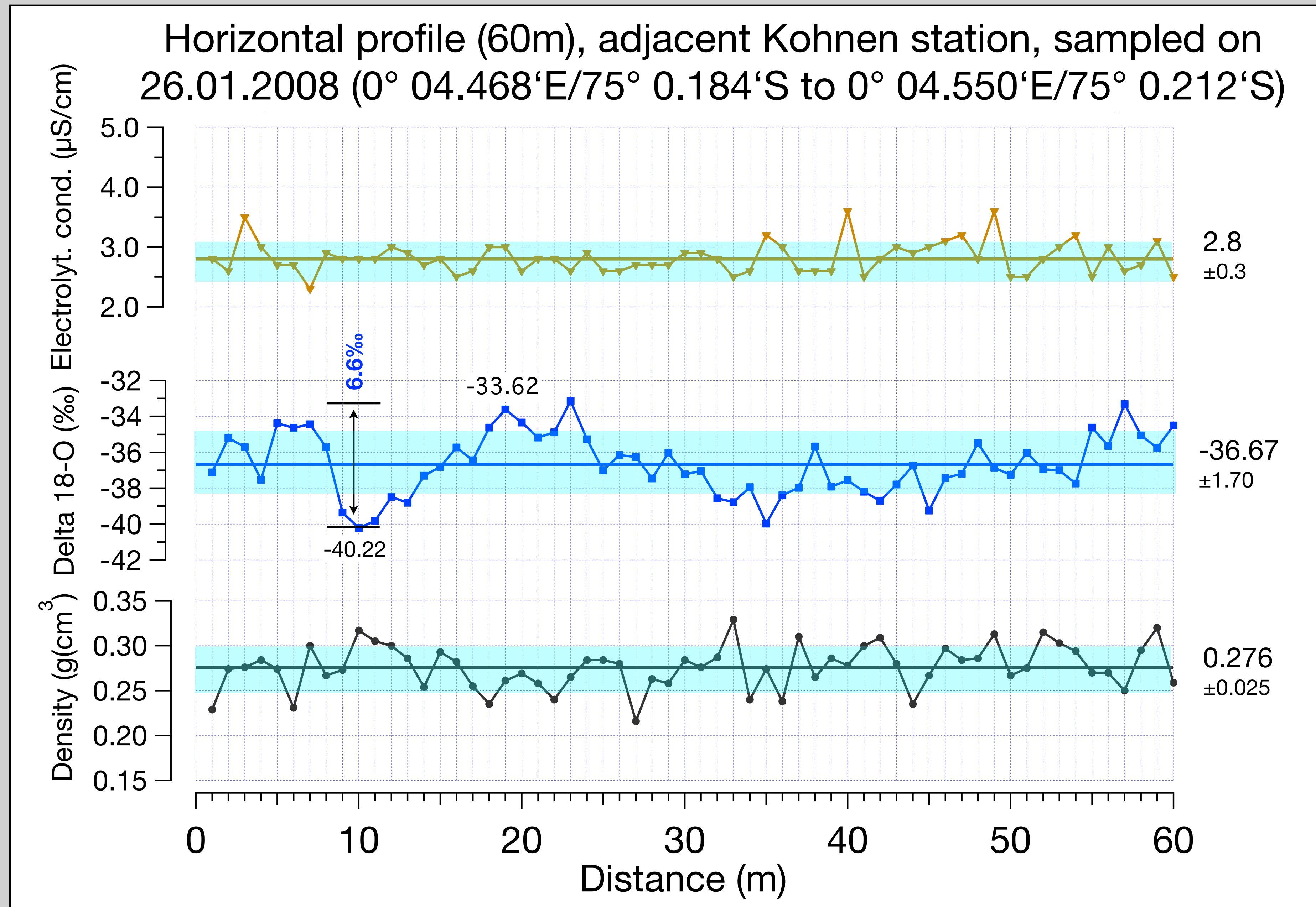
photo: hans oerter, 26.01.2008



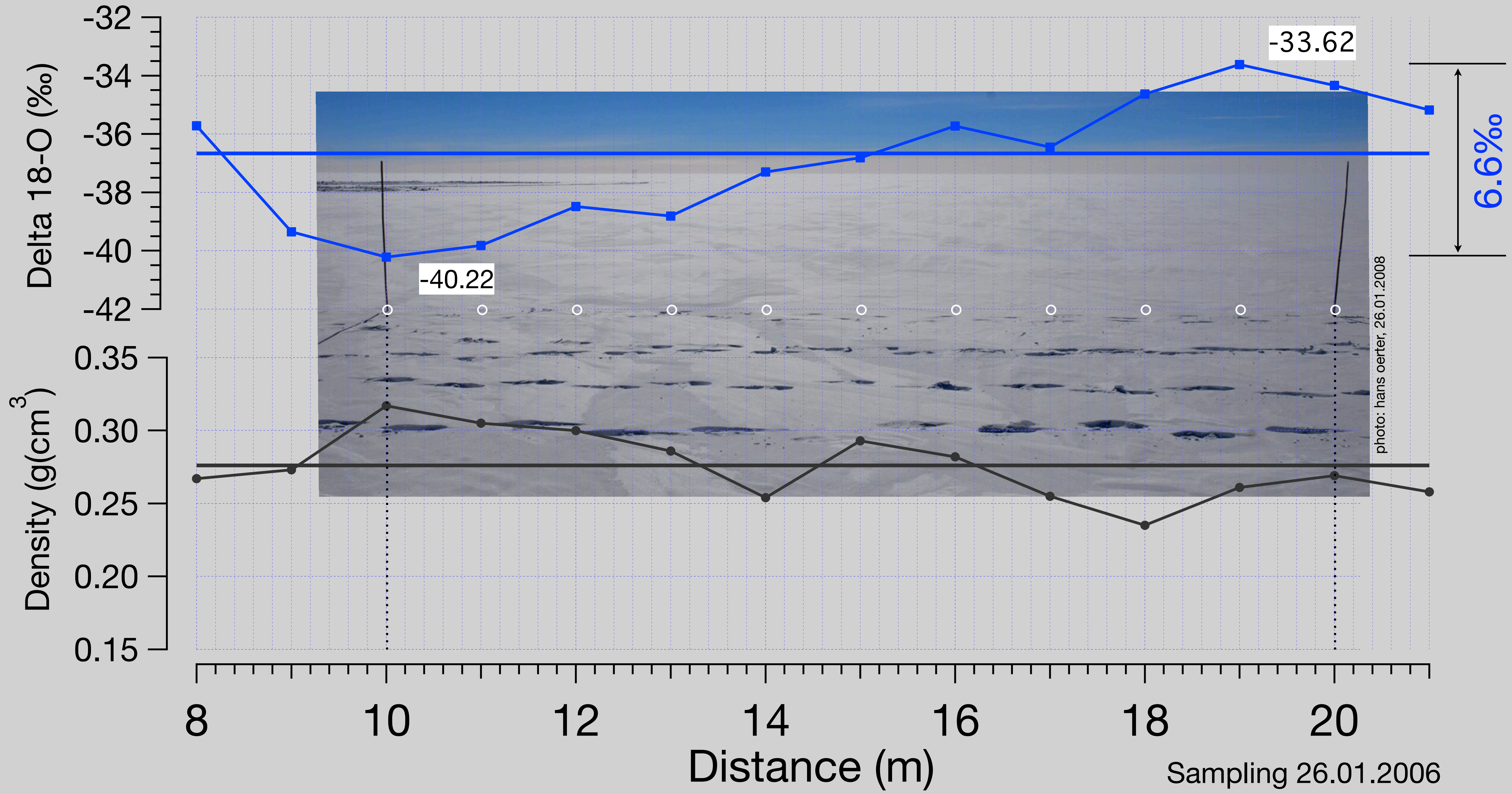
# Sampling with cylindric probe

Inner  $\varnothing$  = 44 mm  
Length = 60 mm

Sampling of the  
upper 6 cm of the  
snow surface

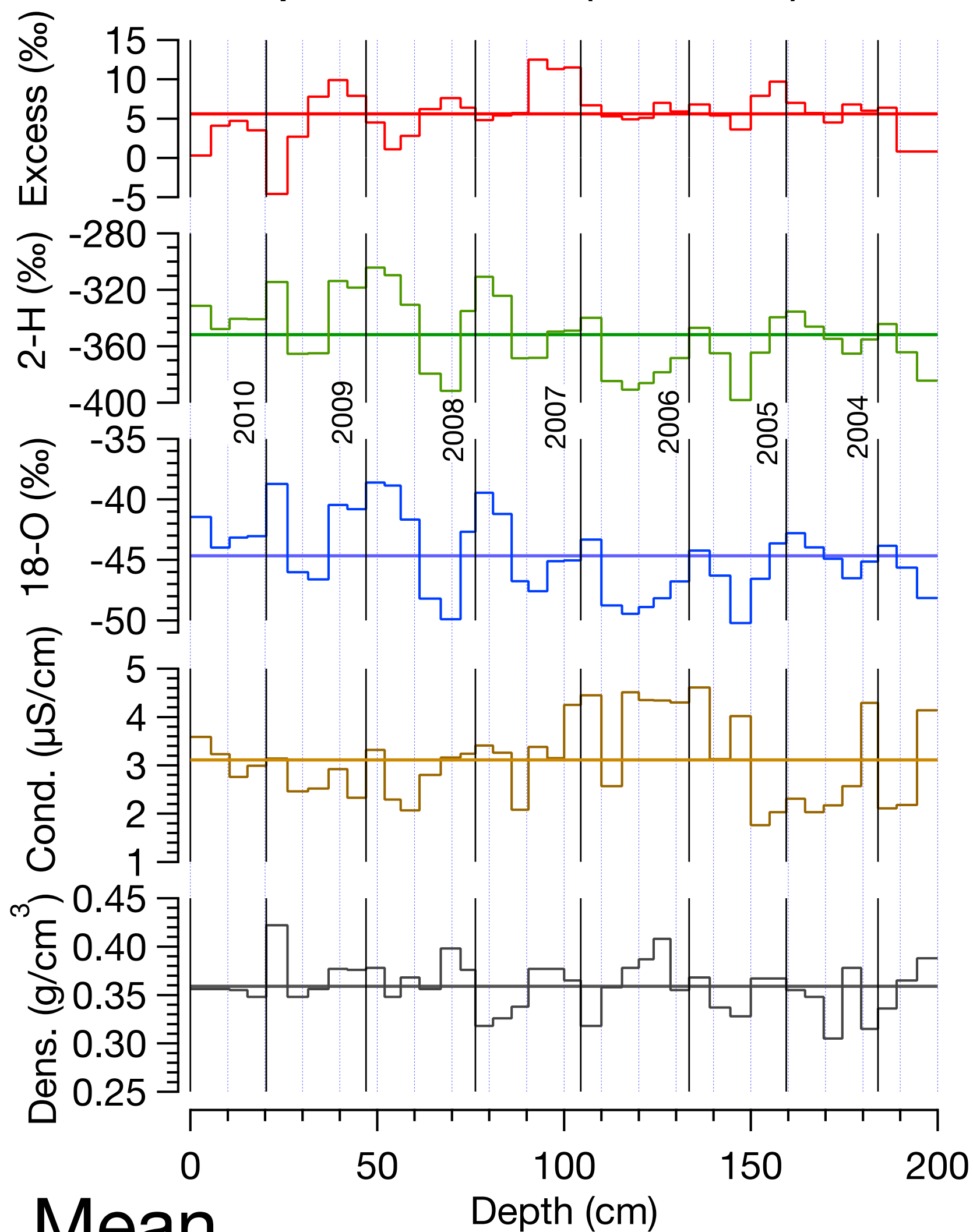








Snow pit SS1106 (Kohnen), 23.12.2010



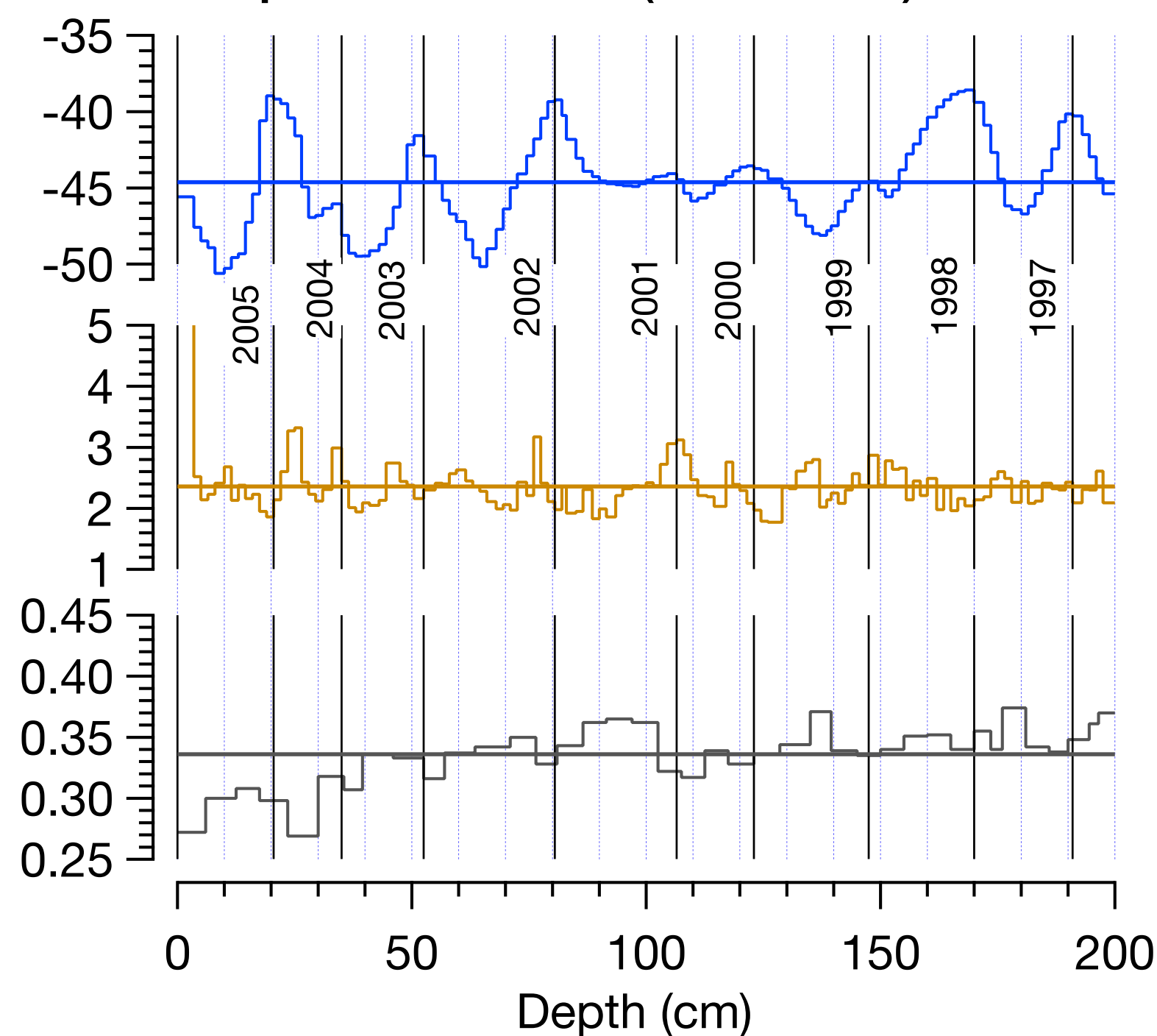
Mean  $\delta^{18}\text{O}$

-44.67      -44.62      -44.59

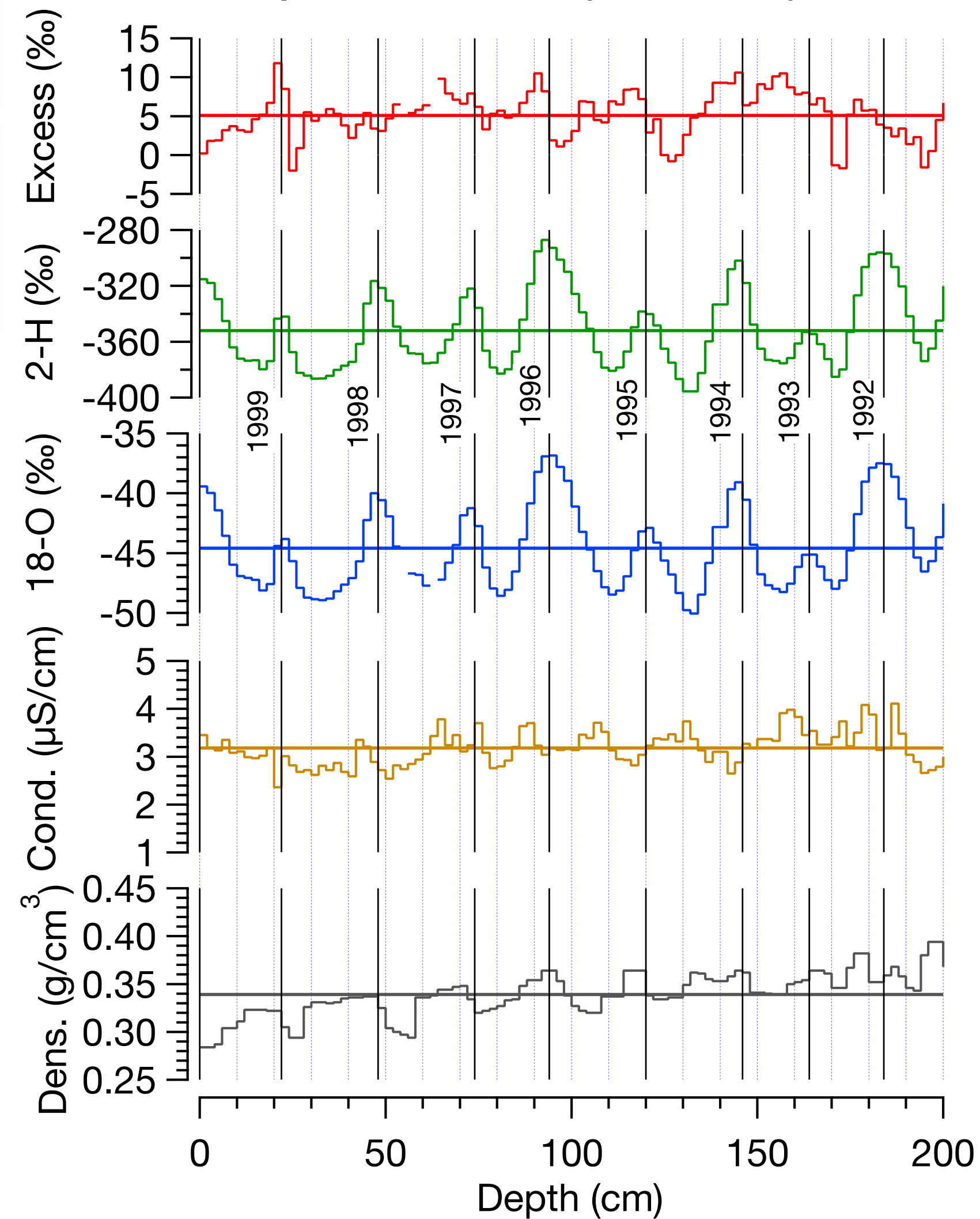
Mean density

0.359      0.336      0.339

Snow pit SS0510 (Kohnen), 03.12.2005



Snow pit SS9908 (Kohnen), 30.01.2000



Mean

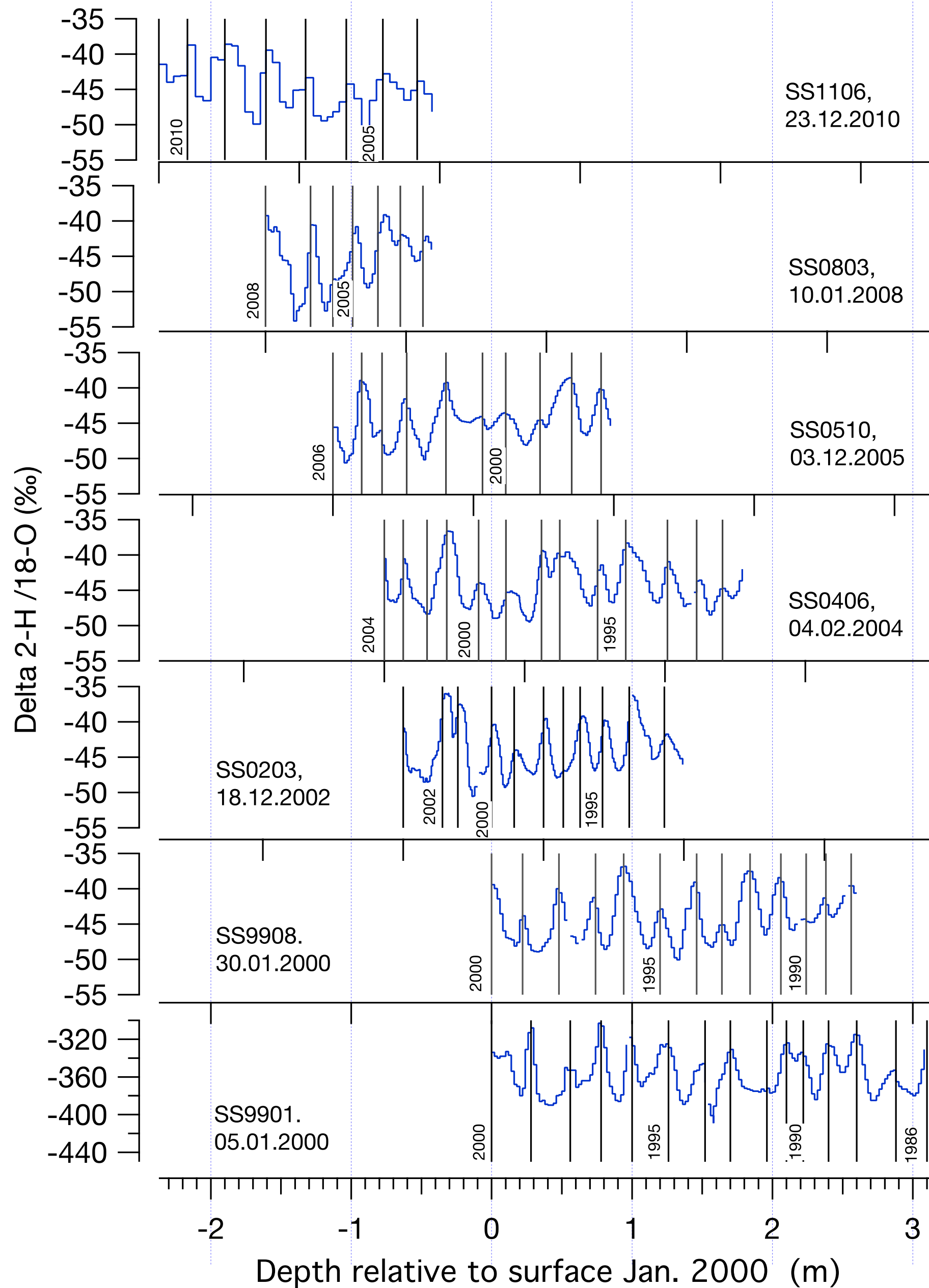
accumulation: 2004-2010: **94.4 ± 13.1**

1997-2005: **70.7 ± 19.1**

1992-1999: **76.5 ± 10.1 kg m<sup>-2</sup> a<sup>-1</sup>**



# Snow pits around Kohlen 2000-2010

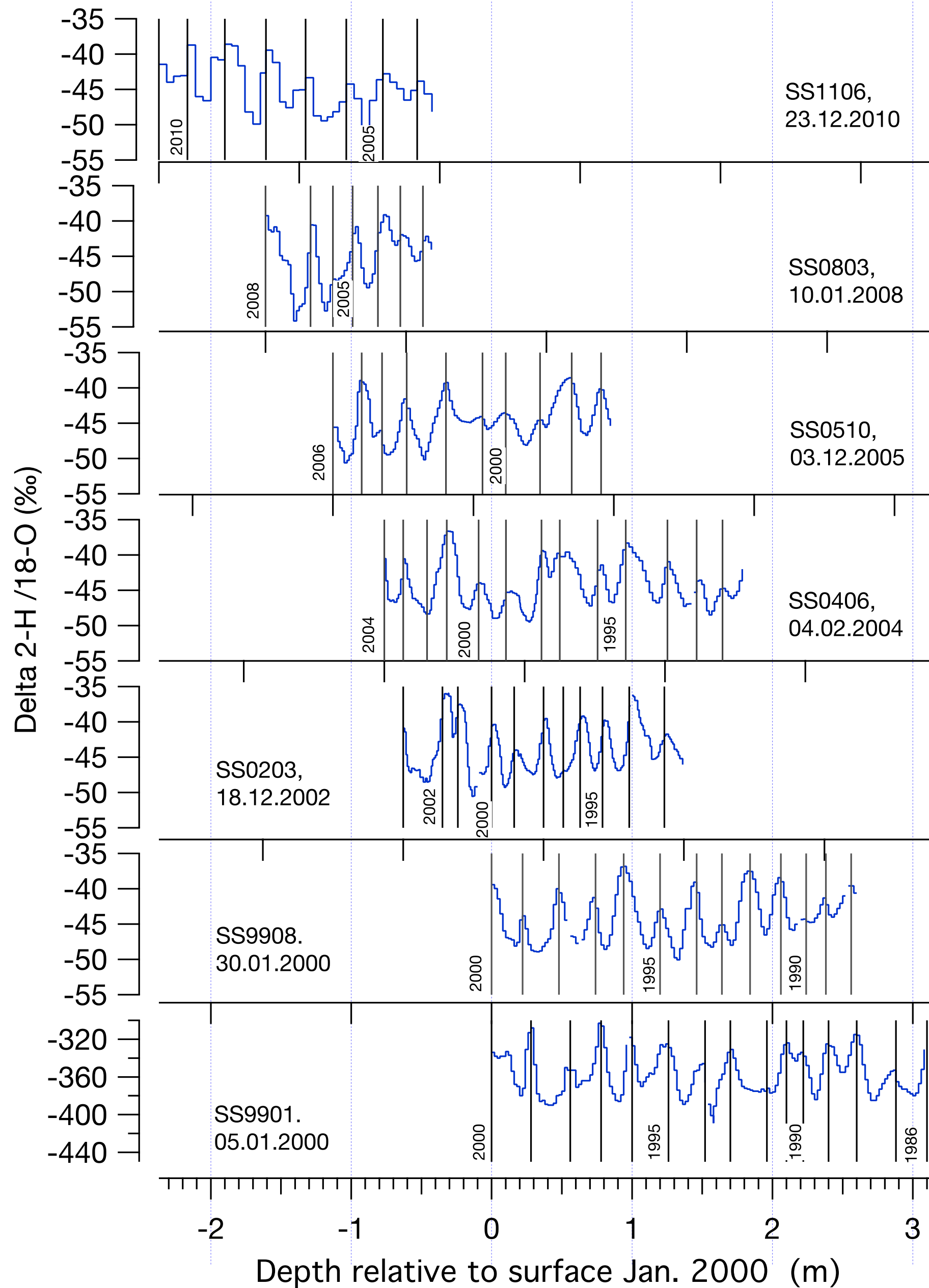


Jahr	ss1106	ss0803	ss0510	ss0406	ss0203	ss9908	Mittel	stabw
2010	-42.91						<b>-42.91</b>	
2009	-42.52						<b>-42.52</b>	
2008	-43.32						<b>-43.32</b>	
2007	-44.19	-46.73					<b>-45.46</b>	1.8
2006	-47.57	-47.39					<b>-47.48</b>	0.1
2005	-46.19	-47.07	-47.00				<b>-46.75</b>	0.5
2004	-44.67	-45.63	-43.53				<b>-44.61</b>	1.1
2003		-41.27	-46.95	-45.03			<b>-44.42</b>	2.9
2002		-43.71	-45.41	-46.08	-45.79		<b>-45.25</b>	1.1
2001			-43.63	-41.69	-38.12		<b>-41.15</b>	2.8
2000			-44.69	-43.79	-44.44		<b>-44.31</b>	0.5
1999			-46.04	-46.88	-45.11	-44.70	<b>-45.68</b>	1.0
1998			-41.84	-46.43	-45.55	-46.43	<b>-45.06</b>	2.2
1997			-43.49	-40.95	-45.13	-44.42	<b>-43.50</b>	1.8
1996				-43.30	-44.88	-43.99	<b>-44.06</b>	0.8
1995				-43.10	-42.99	-43.73	<b>-43.27</b>	0.4
1994				-42.85	-43.66	-45.29	<b>-43.93</b>	1.2
1993				-45.05	-41.36	-46.04	<b>-44.15</b>	2.5
1992				-46.03		-43.47	<b>-44.75</b>	1.8
1991						-41.76	<b>-41.76</b>	
1990						-43.70	<b>-43.70</b>	
1989						-43.64	<b>-43.64</b>	
1988						-42.37	<b>-42.37</b>	
<b>Mittel:</b>	<b>-44.48</b>	<b>-45.30</b>	<b>-44.73</b>	<b>-44.27</b>	<b>-43.70</b>	<b>-44.13</b>	<b>-44.44</b>	<b>0.5</b>
stabw:	1.83	2.38	1.76	1.94	2.38	1.36	1.49	
MIN:	-47.57	-47.39	-47.00	-46.88	-45.79	-46.43		
MAX:	-42.52	-41.27	-41.84	-40.95	-38.12	-41.76		
n:	7	6	9	12	10	12		

Annual mean  $\delta^{18}\text{O}$  (‰-SMOW)



# Snow pits around Kohlen 2000-2010



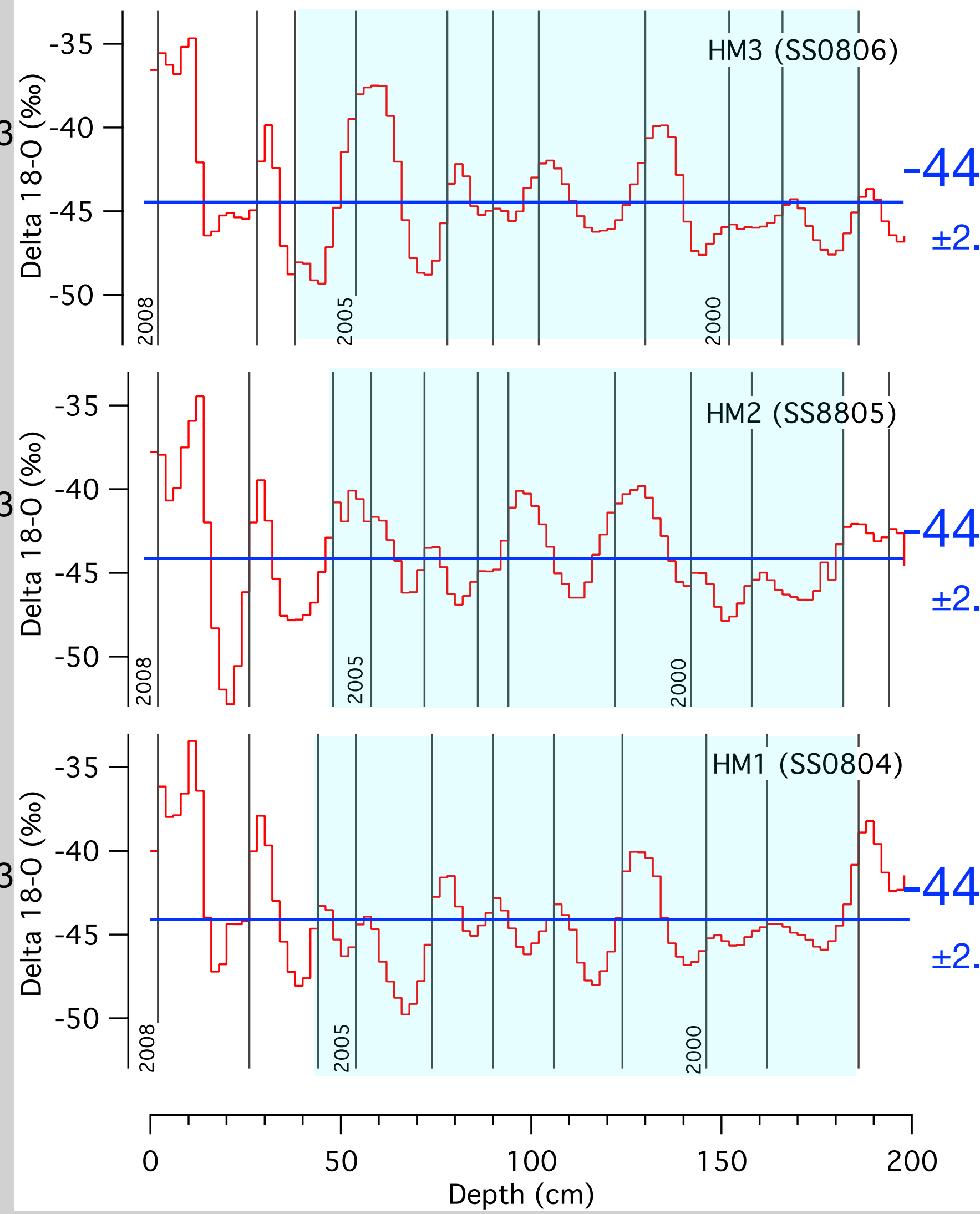
Jahr	ss1106	ss0803	ss0510	ss0406	ss0203	ss9908	ss9901	Mittel	stabw
2010	71.7							<b>71.7</b>	
2009	100.6							<b>100.6</b>	
2008	108.4							<b>108.4</b>	
2007	98.8	98.4						<b>98.6</b>	0.3
2006	105.8	50.9						<b>78.3</b>	38.8
2005	91.6	45.4	65.0					<b>67.4</b>	23.2
2004	83.5	63.7	39.0					<b>62.1</b>	22.3
2003		55.5	56.0	48.8				<b>53.4</b>	4.0
2002		48.9	86.0	59.5				<b>64.8</b>	19.1
2001			100.0	42.9				<b>71.5</b>	40.4
2000			53.0	80.7				<b>66.9</b>	19.6
1999			77.0	68.6		67.7	89.7	<b>75.8</b>	10.2
1998			85.0	97.4		84.5	95.2	<b>90.5</b>	6.8
1997			75.0	48.1		84.9	77.7	<b>71.4</b>	16.1
1996				99.3		67.6	72.8	<b>79.9</b>	17.0
1995				70.8		88.9	86.4	<b>82.0</b>	9.9
1994				107.4		83.6	90.2	<b>93.7</b>	12.3
1993				74.2		62.4	68.0	<b>68.2</b>	5.9
1992				72.8		72.3	99.3	<b>81.5</b>	15.4
1991						80.5	54.1	<b>67.3</b>	18.7
1990						66.2	40.2	<b>53.2</b>	18.4
1989						49.3	66.2	<b>57.8</b>	12.0
1988						63.6	71.5	<b>67.6</b>	5.6
<b>Mittel:</b>	<b>94.4</b>	<b>60.5</b>	<b>70.7</b>	<b>72.5</b>		<b>72.6</b>	<b>75.9</b>	<b>74.4</b>	<b>11.1</b>
stabw:	13.1	19.6	19.1	21.0		11.9	17.5	1.49	
MIN:	71.7	45.4	39.0	42.9		49.3	40.2		
MAX:	108.4	98.4	100.0	107.4		88.9	99.3		
n:	7	6	9	12		12	12		

Annual accumulation rate ( $\text{kg m}^{-2} \text{a}^{-1}$ )

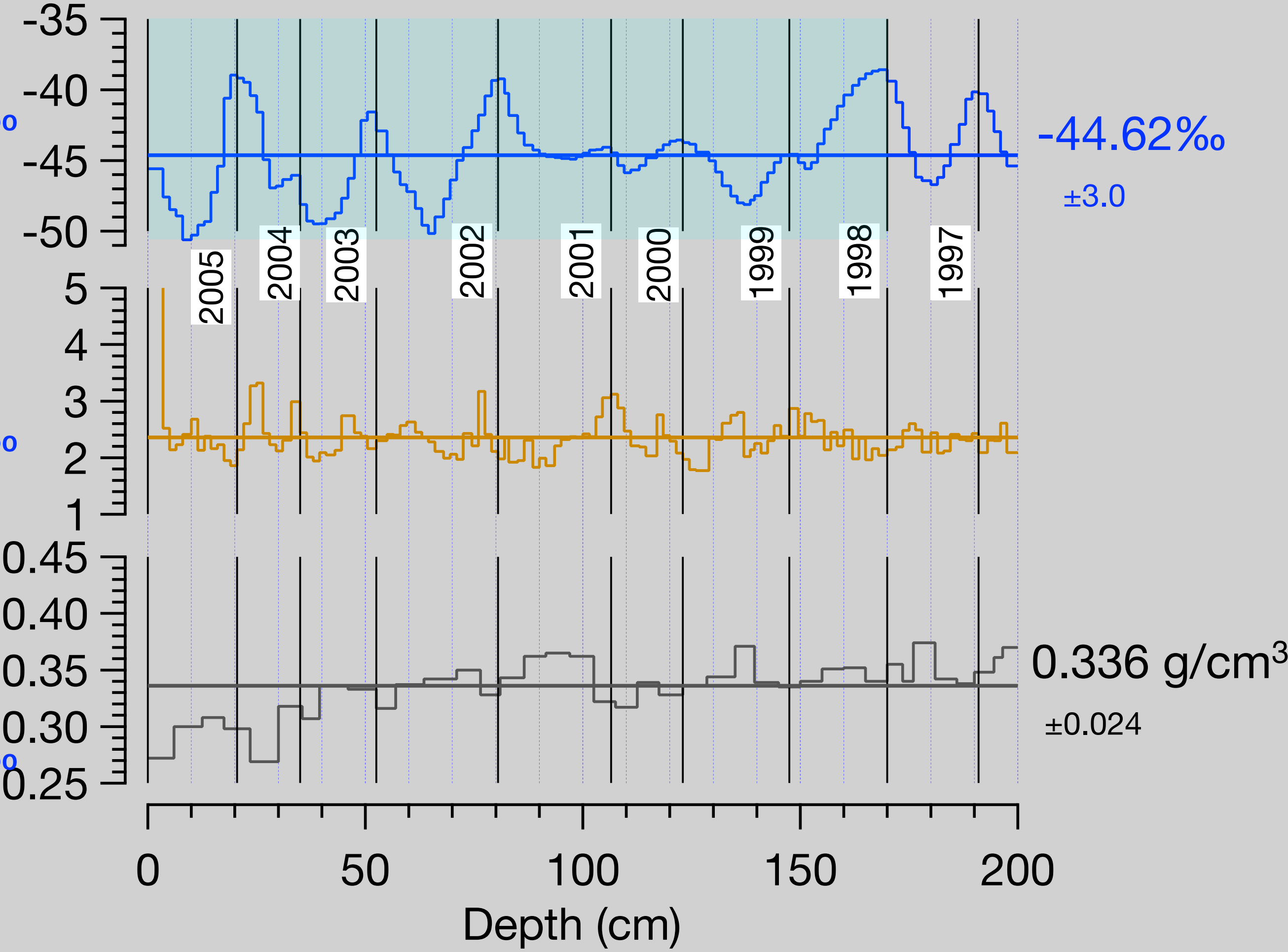


# Mean density

Delta 18-O depth profiles at the snow height sensors HM1, HM2, and HM3



# Snow pit SS0510 (Kohnen), 03.12.2005



# Mean values over 0-200cm depth

h.o/30.09.08

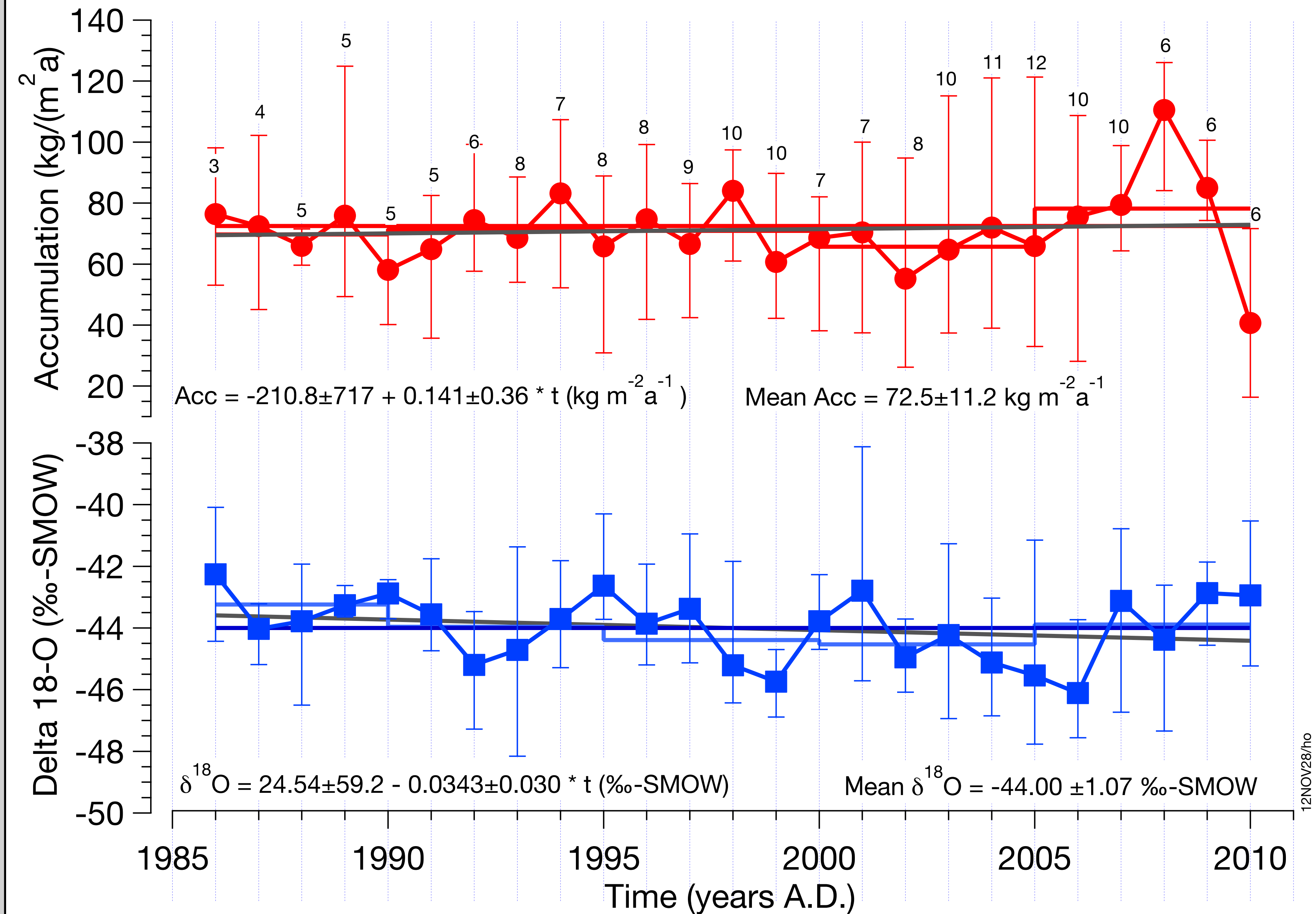


## Annual means of accumulation for 1998-2007 as derived from the 2008 snow pits

	HM1	HM2	HM3	Mean HM1-3	stdev
Jahr	SS0804	SS0805	SS0806		
(1997)		(42.4)			
1998	92.3	85.0	69.6	82.28	11.61
1999	48.6	54.5	46.0	49.71	4.38
2000	76.3	74.4	75.6	75.45	0.99
2001	57.3	93.8	97.6	82.90	22.23
2002	57.6	26.2	38.9	40.89	15.79
2003	51.0	44.3	37.4	44.24	6.79
2004	68.4	43.3	81.1	64.25	19.26
2005	33.3	33.0	53.1	39.81	11.49
2006	55.7	66.2	28.1	50.00	19.68
2007	66.8	74.7	79.5	73.69	6.41
Means	<b>60.74</b>	<b>59.53</b>	<b>60.69</b>	<b>60.32</b>	
stdev	16.24	22.74	23.06	<b>17.29</b>	
	26.7%	38.2%	38.0%	28.7%	



# Composite of all snow pits for the years 1985 - 2010





# Composite of all snow pits for the years 1985 - 2010

compared with long term average from cores (1259-1815 AD)

