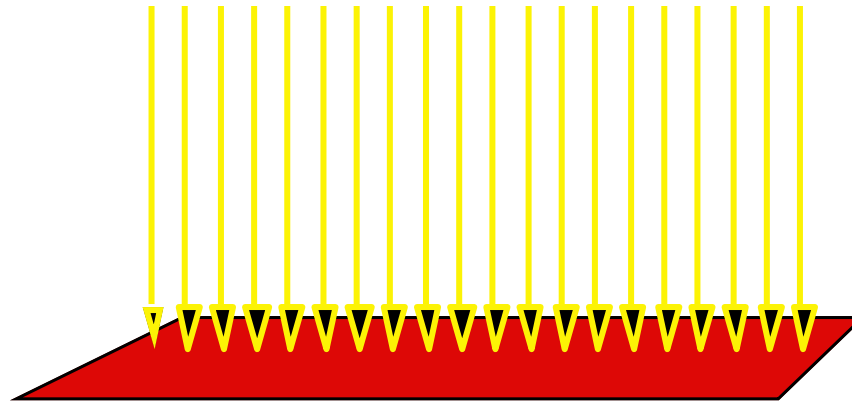


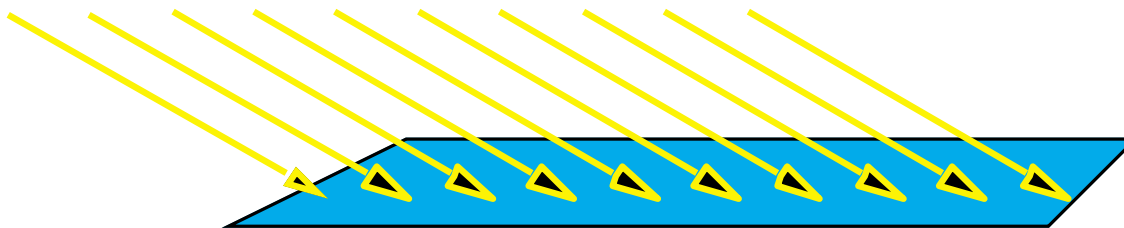


Die Bedeutung der Polargebiete für das Klima der Erde



20 Strahlen pro Fläche:

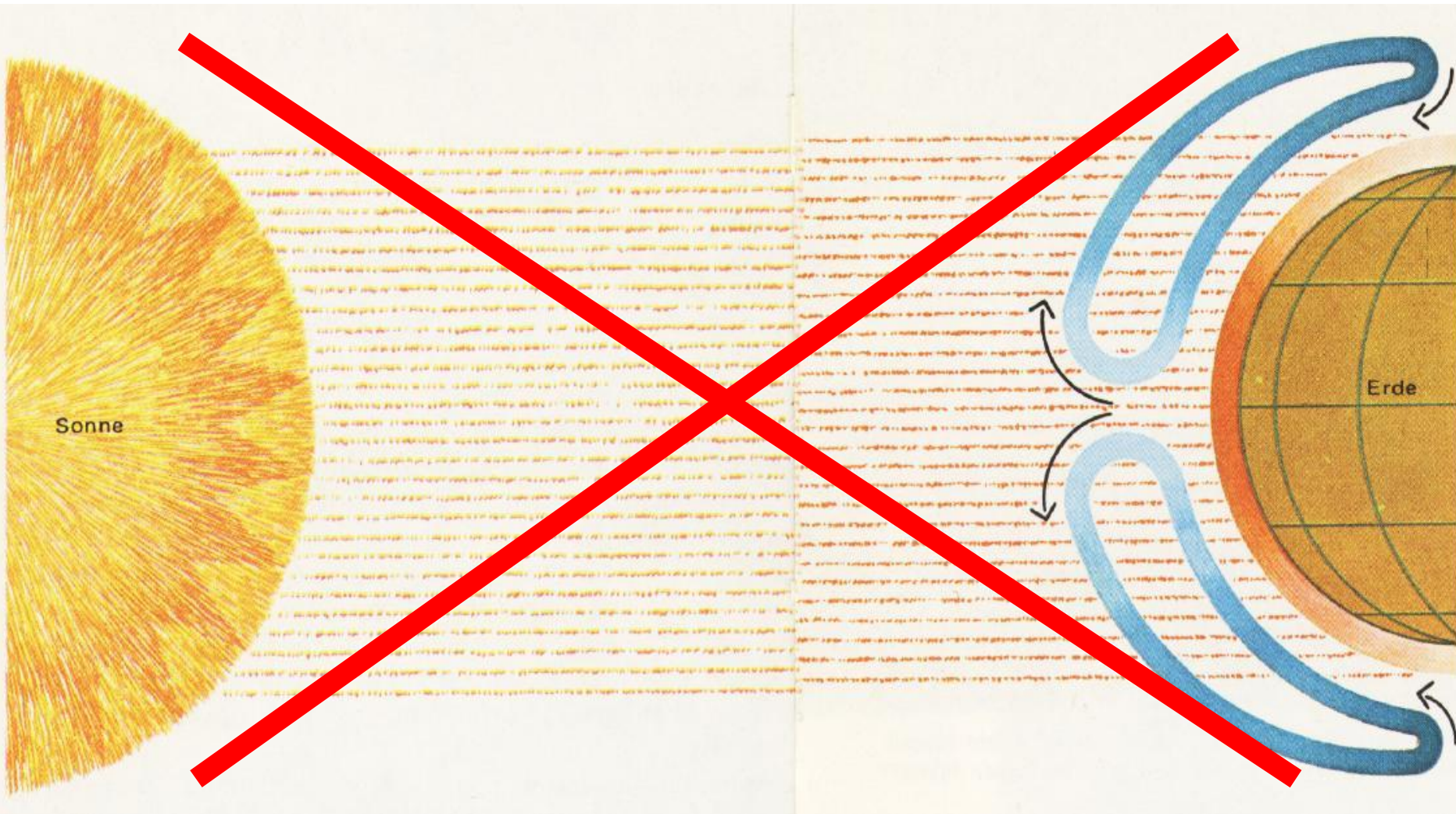
warm



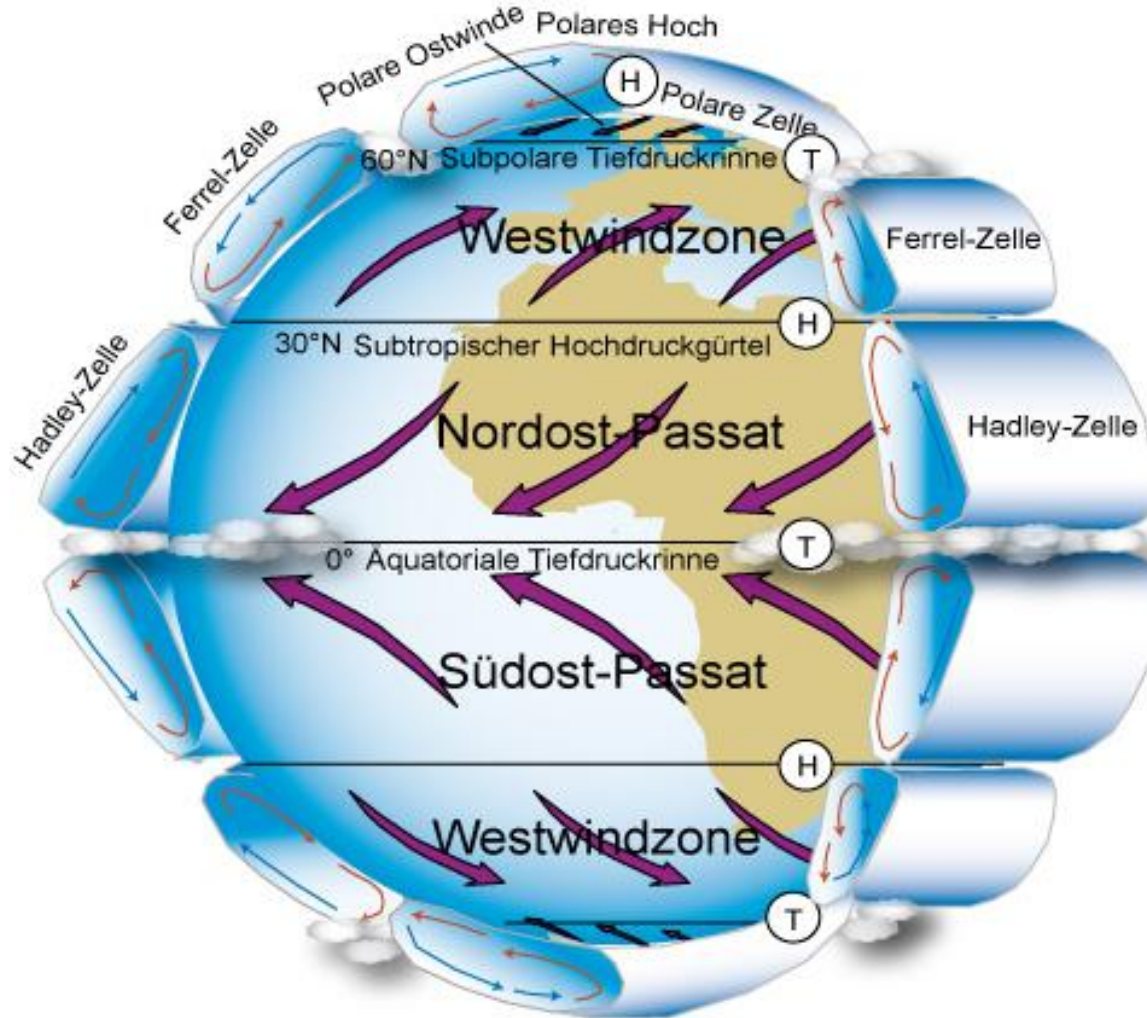
10 Strahlen pro Fläche:

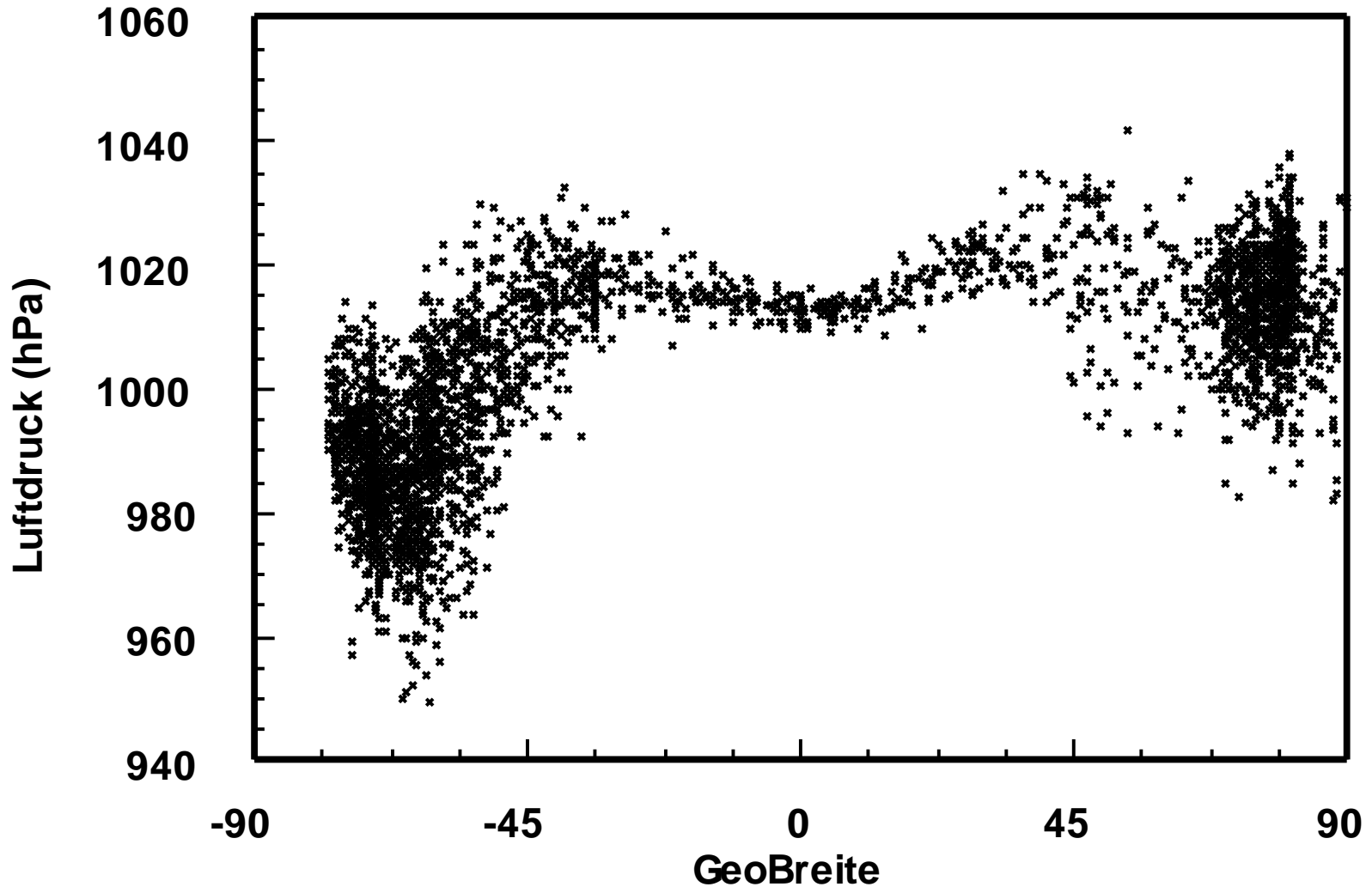
kalt

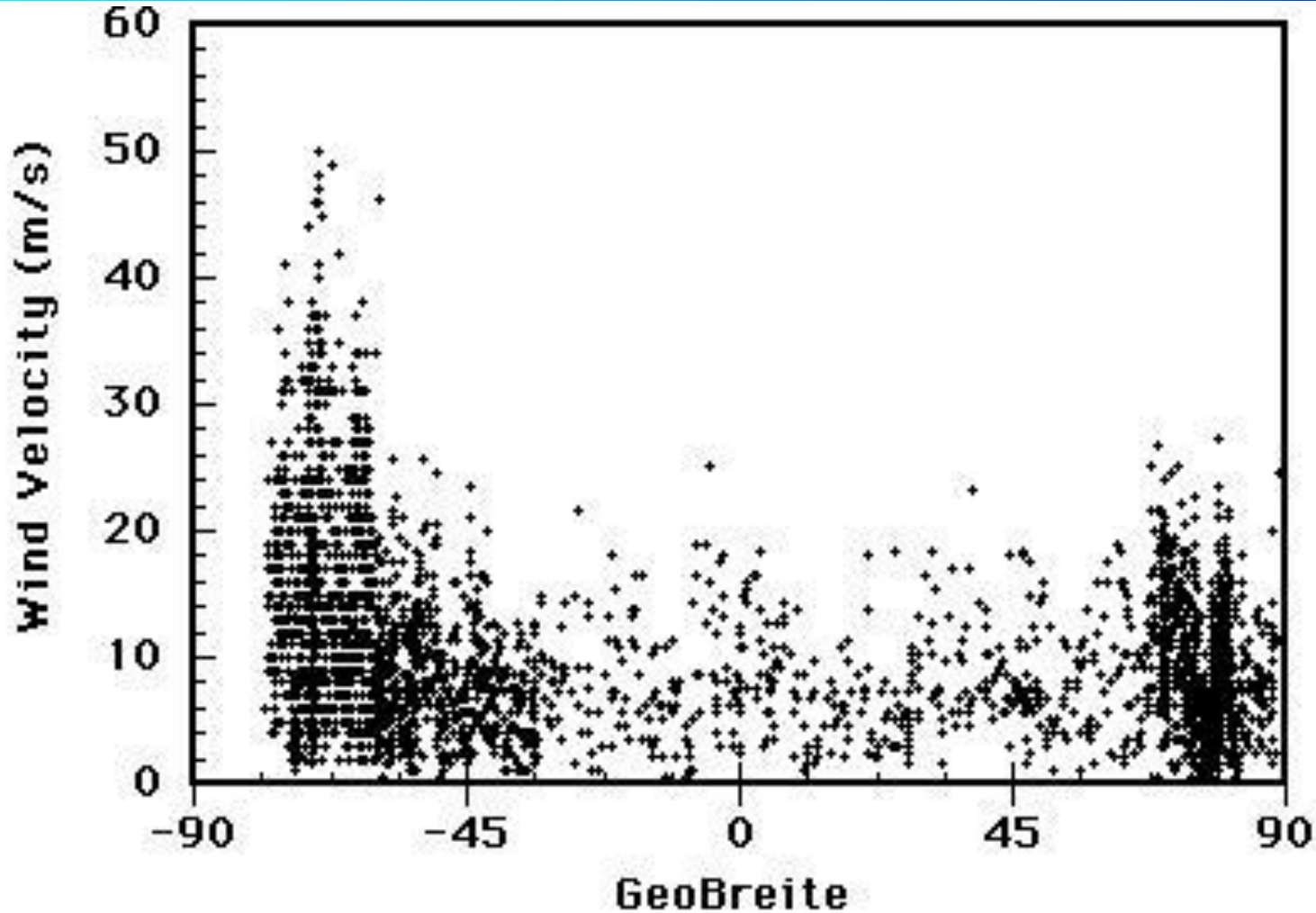
Klima einer nicht rotierende Erde



Klima rotierende Erde





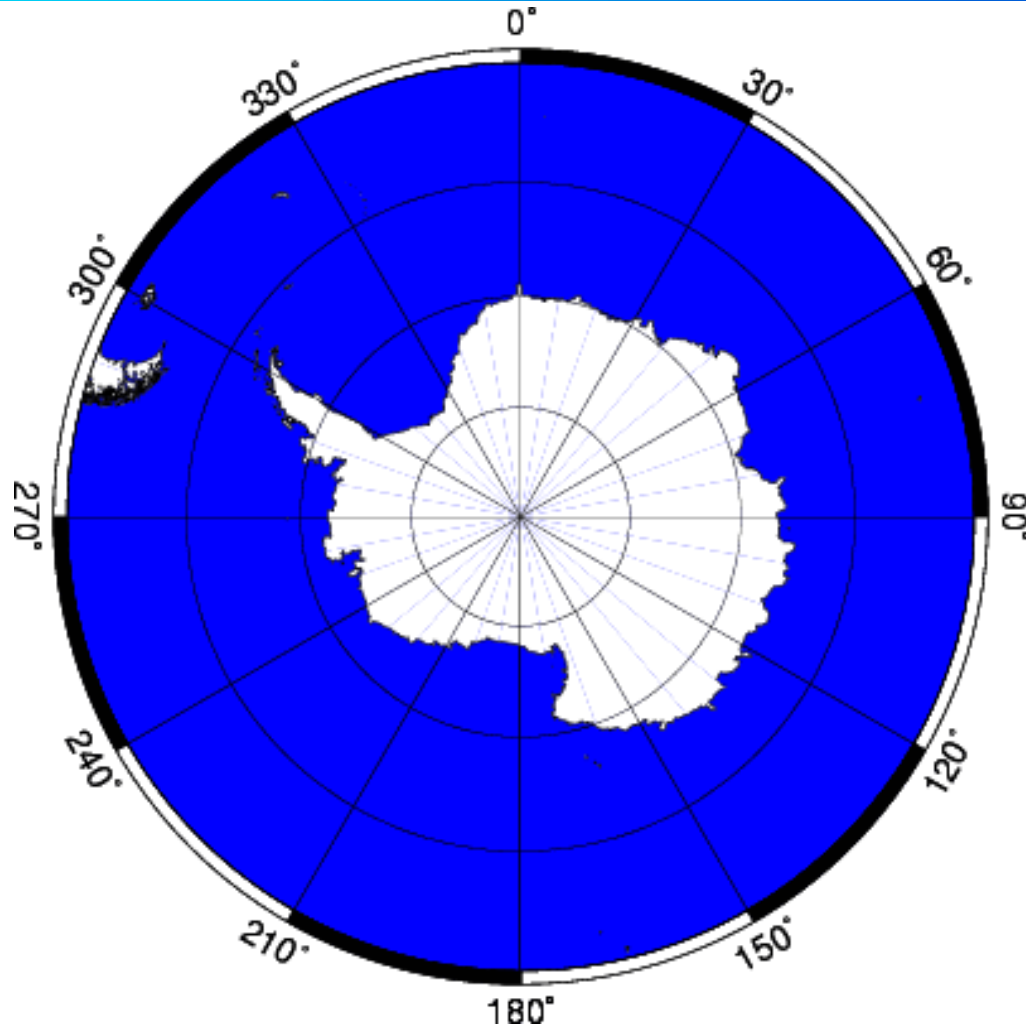


Die Polargebiete sind...

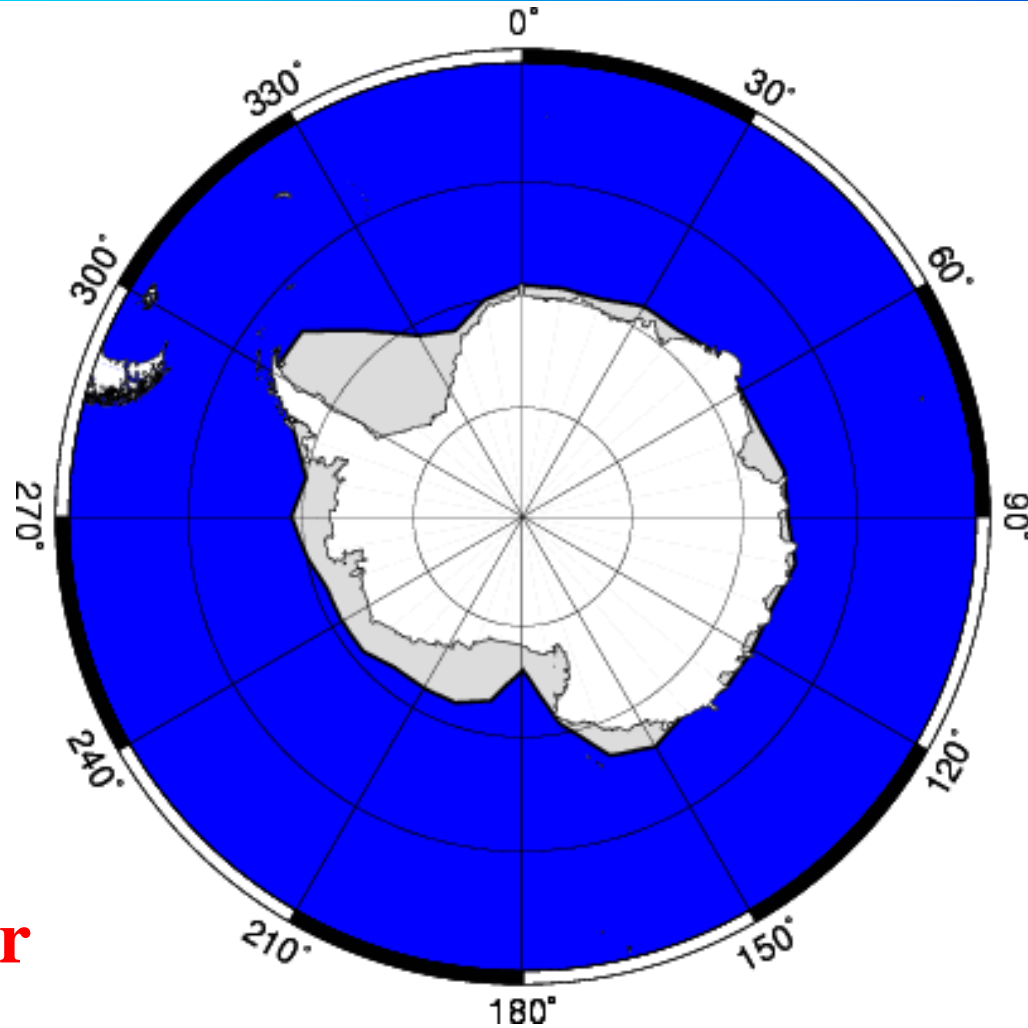
- **Motor der allgemeinen Zirkulation**



Antarktis im Südlichen Ozean

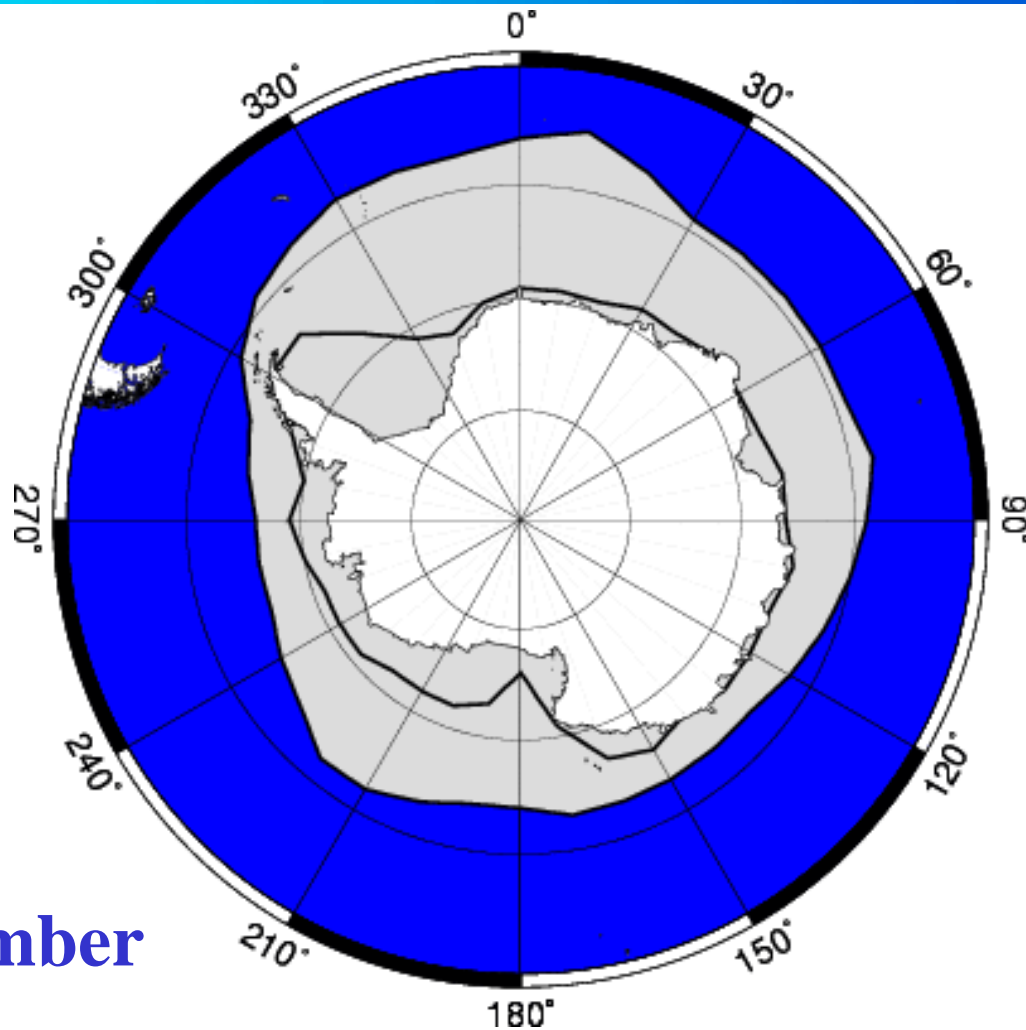


Antarktis im Südlichen Ozean



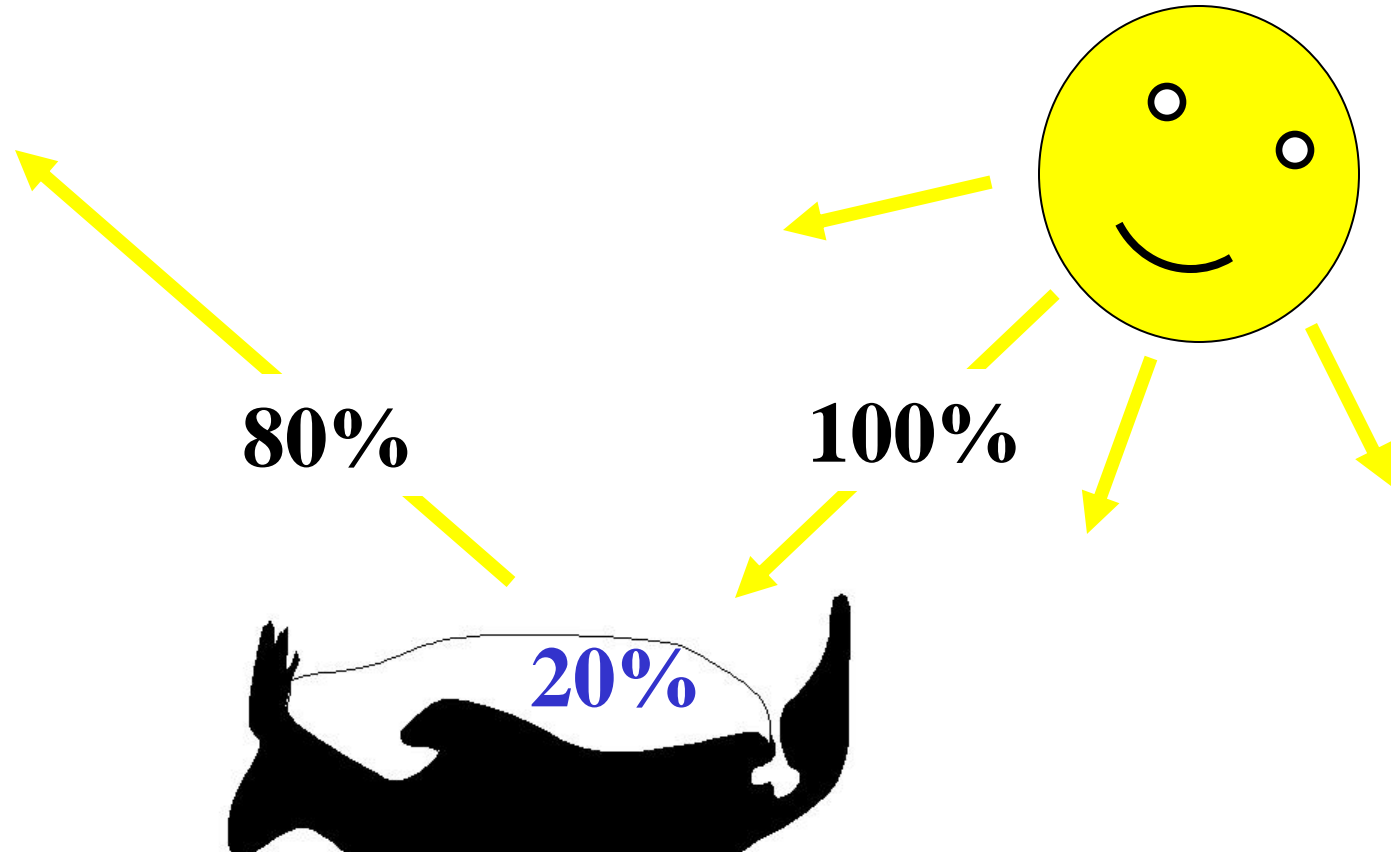
Mittlere
Eiskante
im **Januar**

Antarktis im Südlichen Ozean



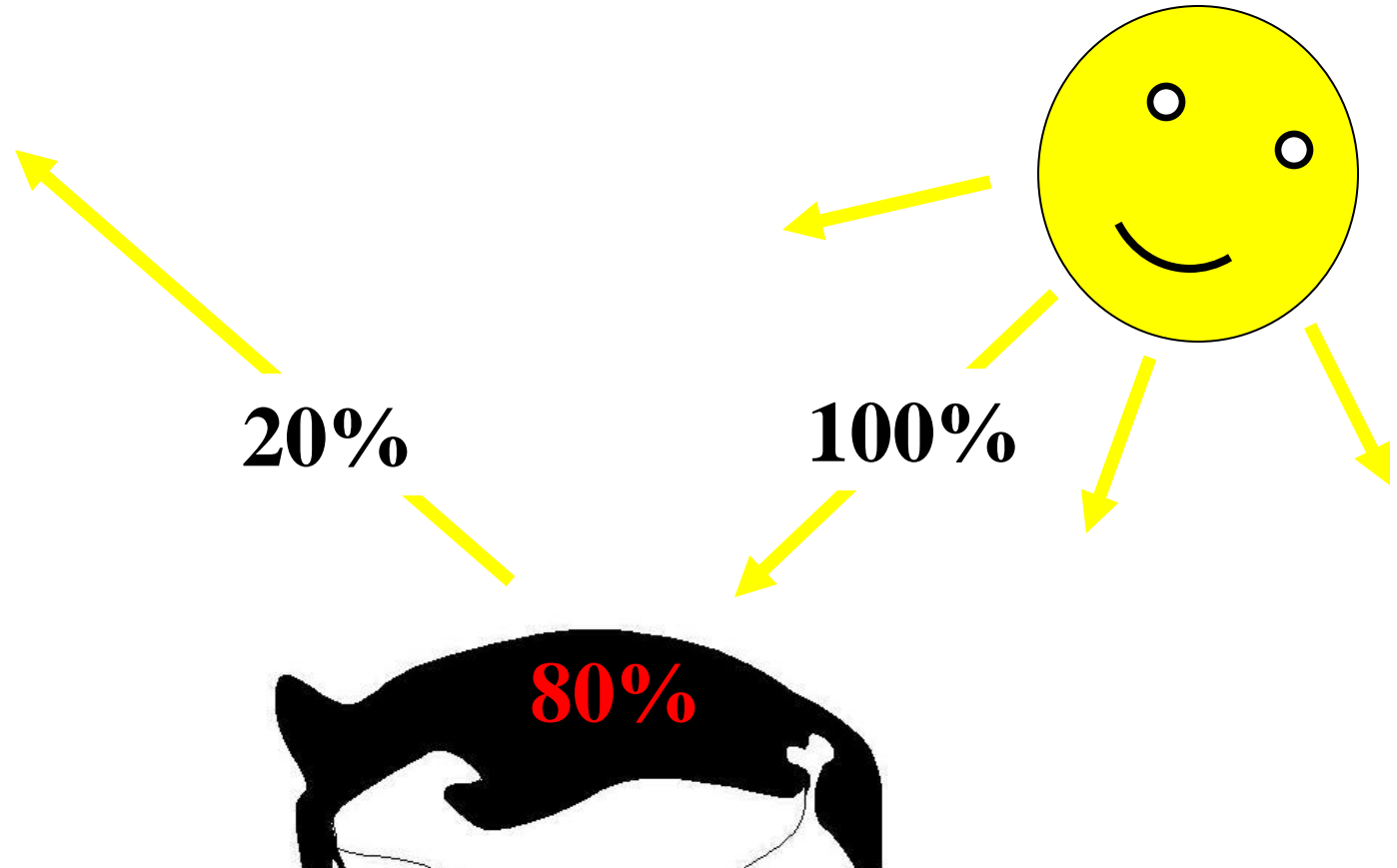
Mittlere
Eiskante
im **September**

Viel Meereis bedeutet...



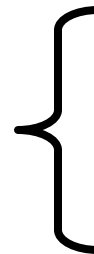
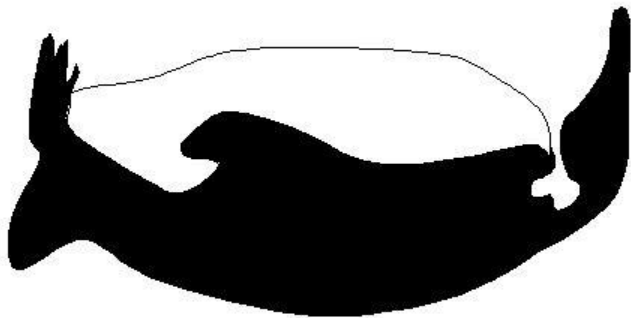
Mehr Eis → mehr Reflektion → Abkühlung → noch mehr Eis....

Wenig Meereis bedeutet...

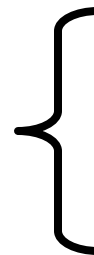
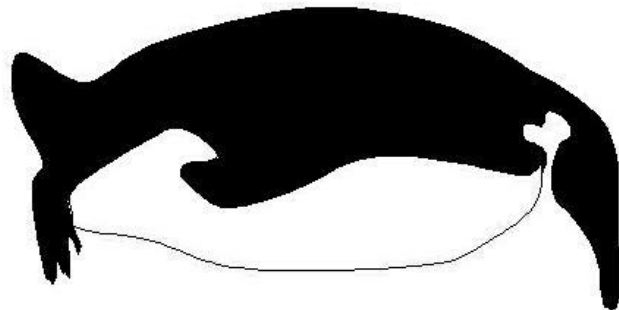


Wenig Eis → weniger Reflektion → Erwärmung → noch weniger Eis...

Eis-Albedo-Rückkopplung



Mehr Eis →
mehr Reflektion →
Abkühlung →
noch mehr Eis....



Wenig Eis →
weniger Reflektion →
Erwärmung →
noch weniger Eis....

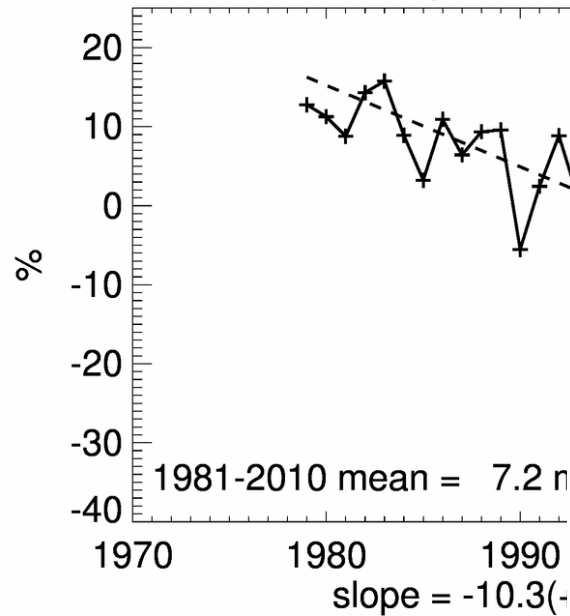


Positive Rückkopplung

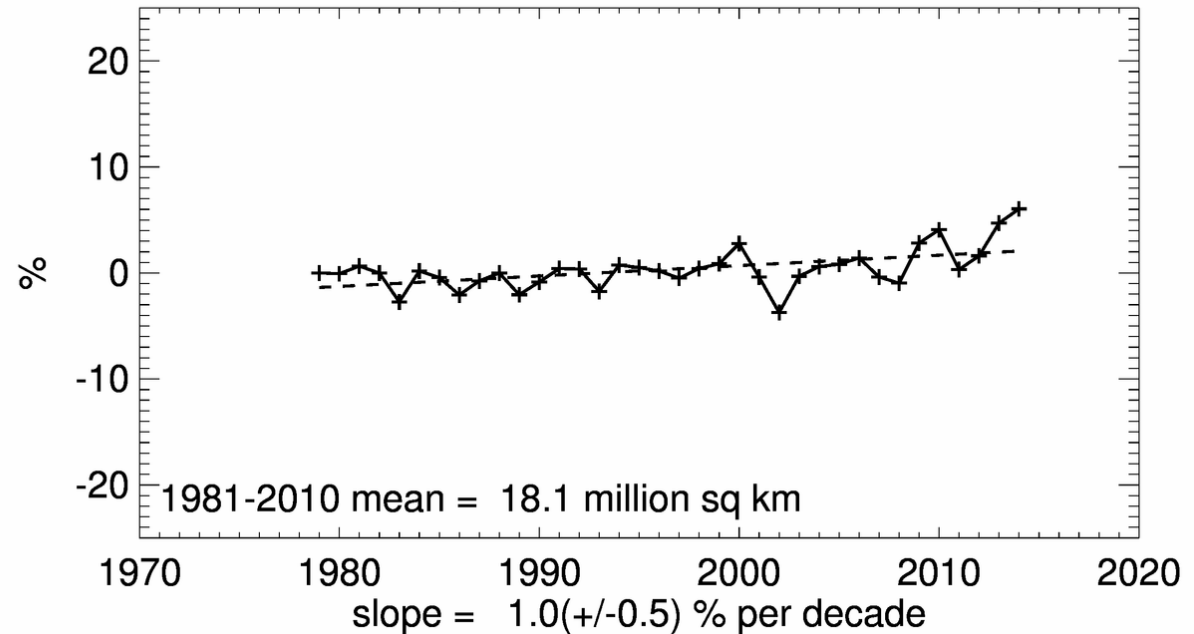


Klima destabilisierend

Northern Hemisphere Extent Anomalies Aug 2014

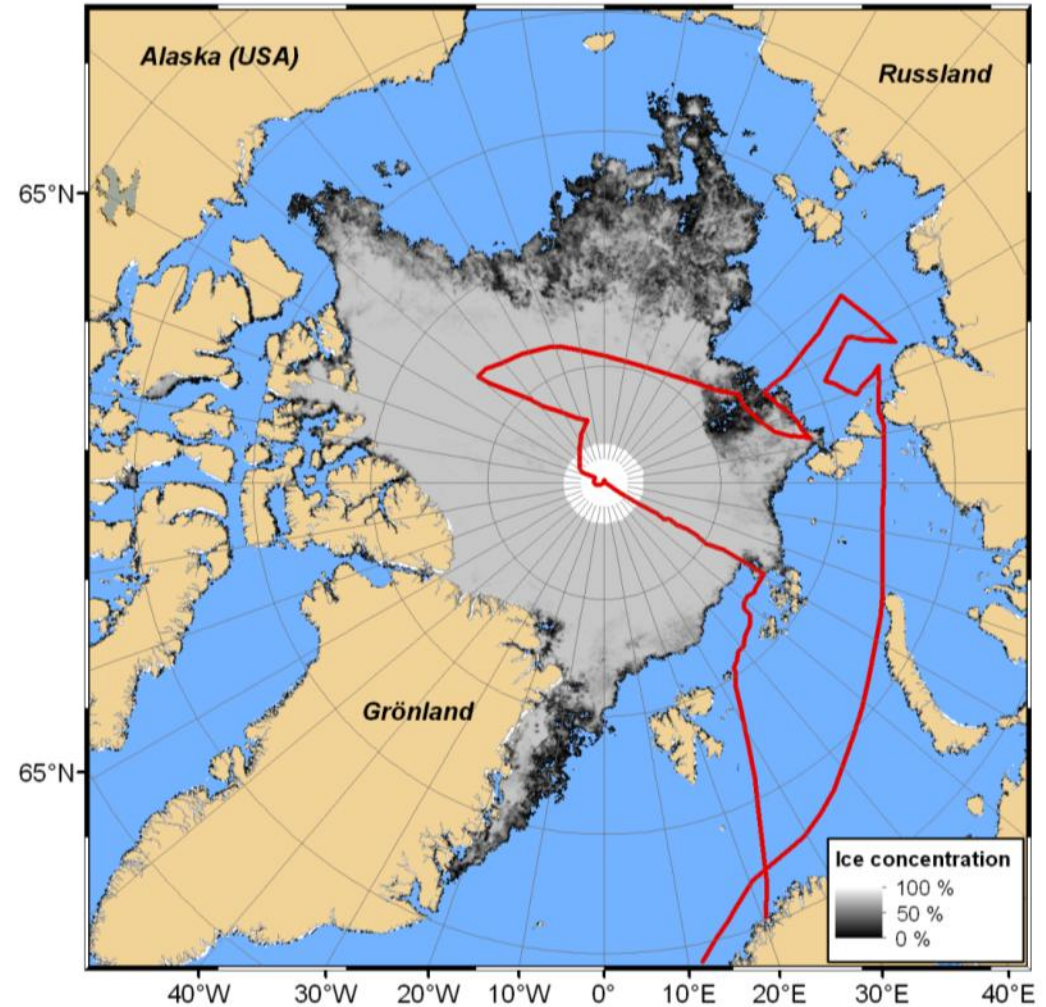


Southern Hemisphere Extent Anomalies Aug 2014

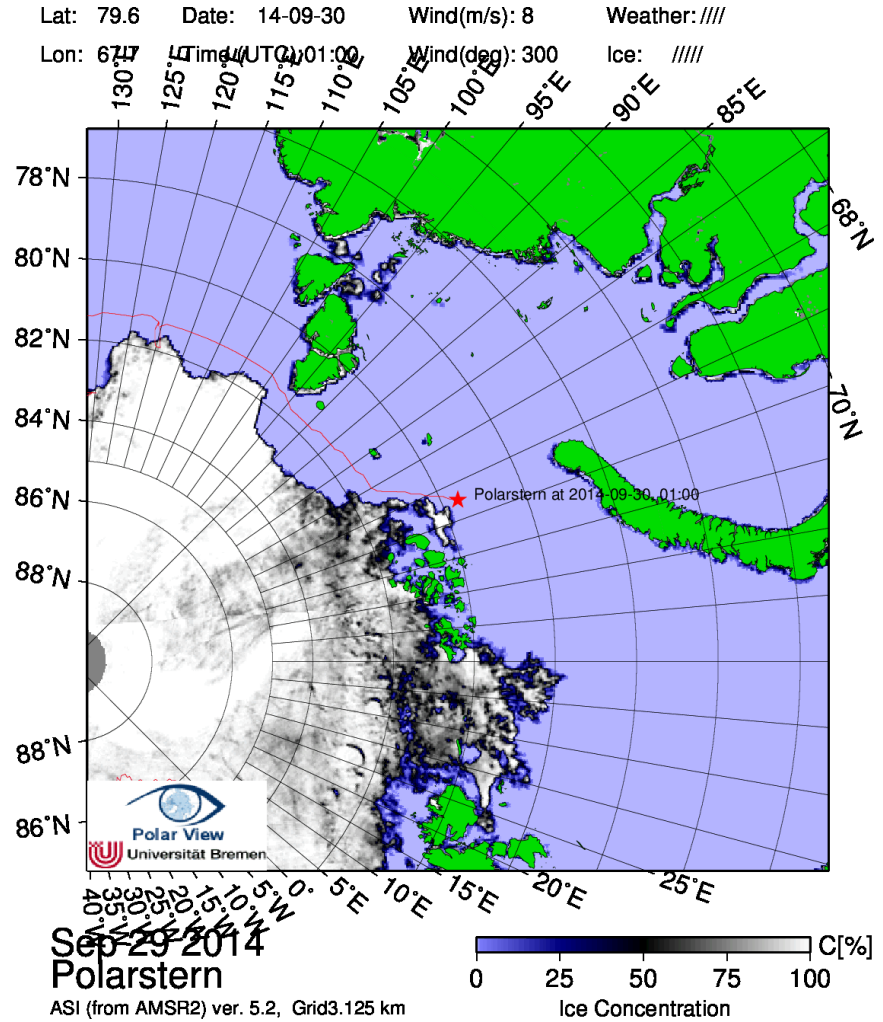


Kursplot Polarstern
2011-08-05 bis 2011-10-06

Eisbedeckung:
September 2011



Kursplot Polarstern Ende September 2014



Die Polargebiete sind....

- **Motor der allgemeinen Zirkulation**
- **Klima-Vagabunden**

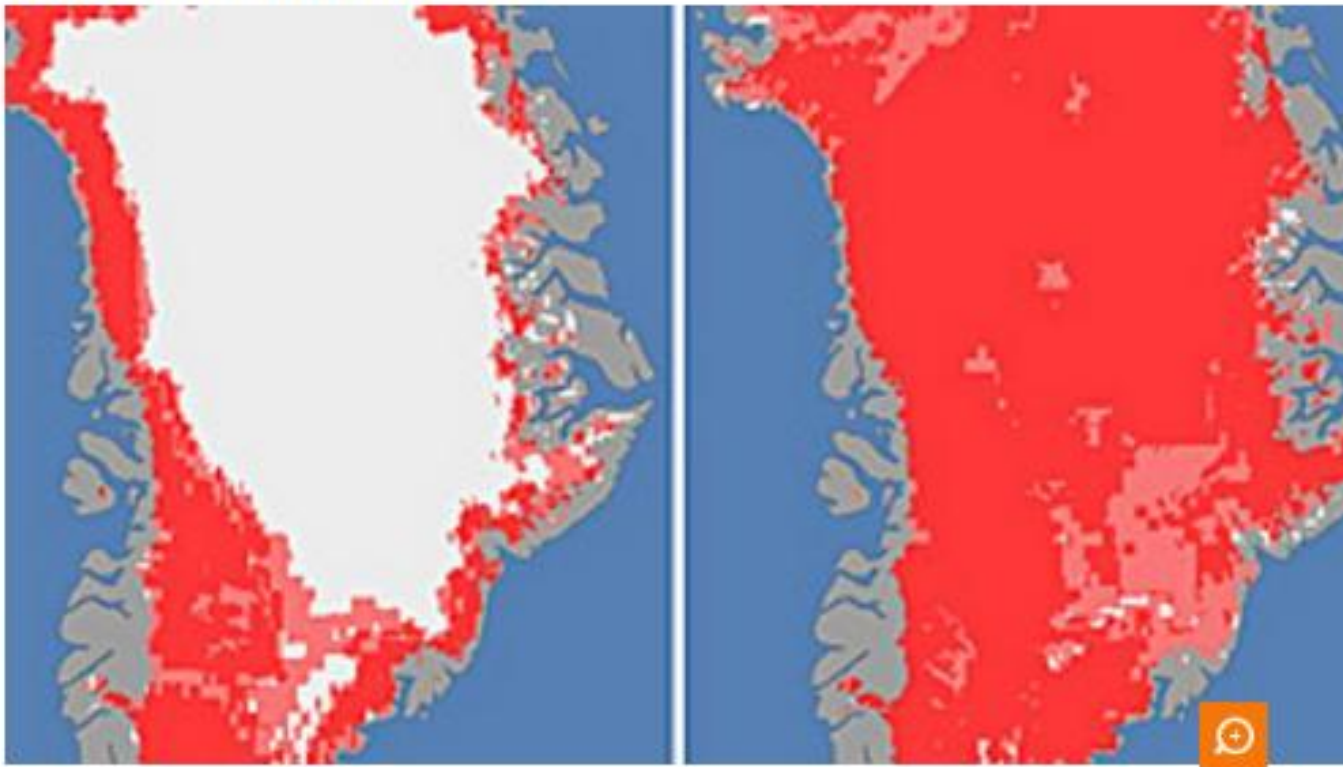


- Über 75 Prozent der Süßwasser-Reserven der Erde sind in den Eismassen gespeichert.
- Von dieser enormen Menge wiederum liegen etwa 99 Prozent in der Antarktis und in den Gletschern Grönlands fest.
- Schmilzt Grönland komplett: 6 m höherer Meeresspiegel
- Schmilzt die Antarktis komplett: 65 m höherer Meeresspiegel
- 1901 bis 2010 betrug der mittlere Meeresspiegelanstieg 19 ± 2 cm!!!

Ursache des Meeresspiegelanstiegs	Geschwindigkeit des Anstiegs (mm pro Jahr)	
	1961-2003	1993-2003
Thermische Ausdehnung	0.42 ± 0.12	1.6 ± 0.5
Gletscher und Eiskappen	0.50 ± 0.18	0.77 ± 0.22
Grönländischer Eisschild	0.05 ± 0.12	0.21 ± 0.07
Antarktischer Eisschild	0.14 ± 0.41	0.21 ± 0.35

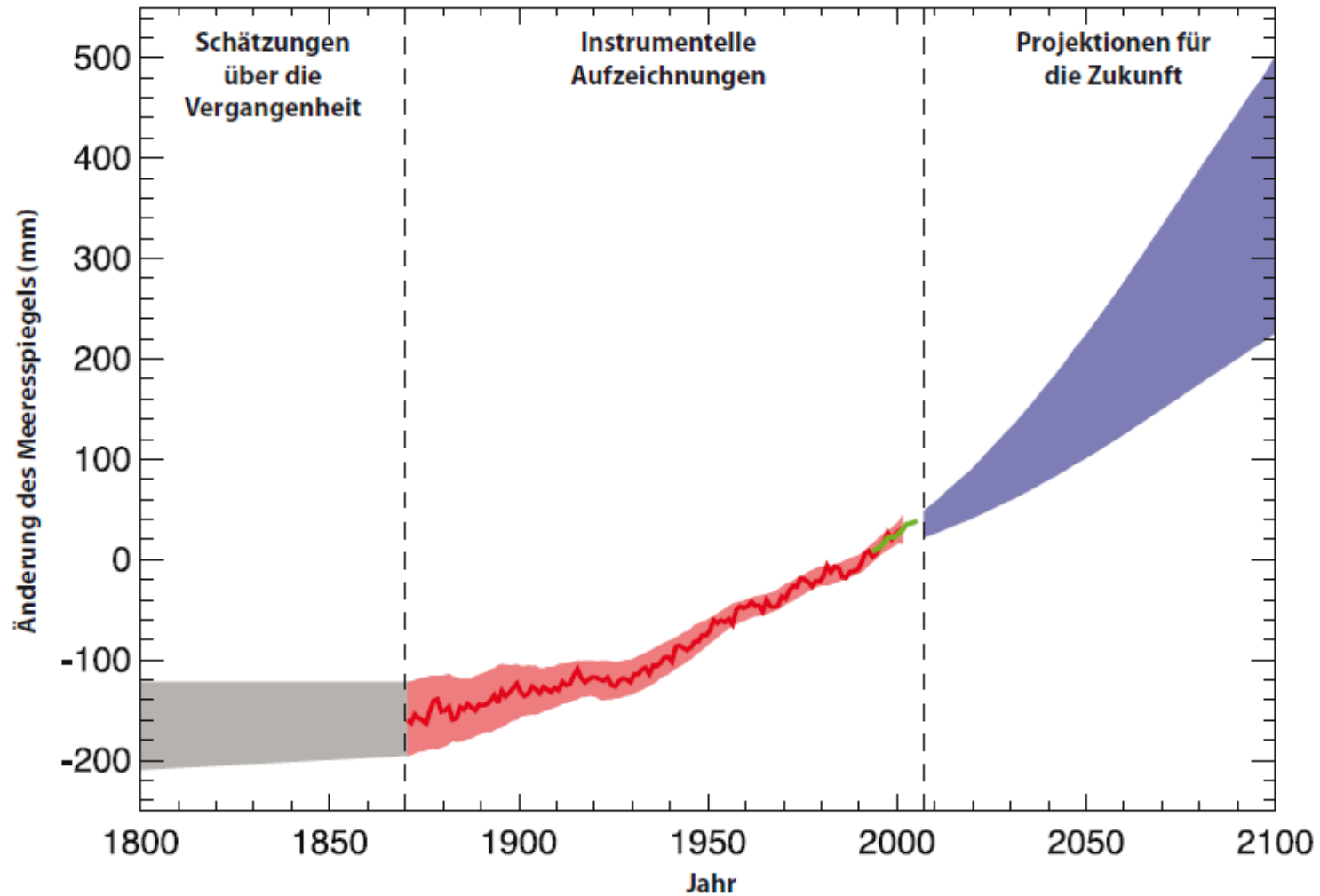
(Quelle: IPCC 2007, Tabelle 5.3, S. 419)

Ganz Grönland taut auf



Grönland schmilzt: 97 Prozent der Eisschicht beginnen derzeit, sich in Wasser zu verwandeln. Das ist doppelt so viel wie in normalen Sommern. Forscher rätseln über die Auswirkungen.

IPCC Prognose (SRES A1B)



Die Polargebiete sind....

- **Motor der allgemeinen Zirkulation**
- **Klima-Vagabunden**
- **Wichtig für den Meeresspiegel**

Met-Mast

Lufttemperatur,
Windrichtung,
Windgeschw.,
Luftfeuchte in 2
und 10 m Höhe.



Radiosondierung

Lufttemperatur,
Luftfeuchte,
Windrichtung,
Windgeschw.,
Ozon bis 35 km.



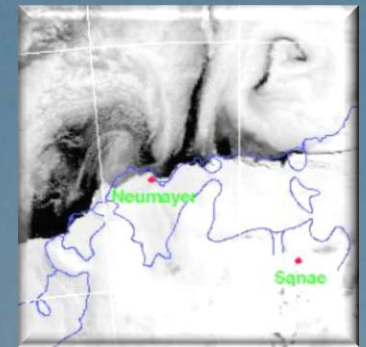
BSRN (Strahlung)

Global, Reflex,
Diffus, Direkt,
OG1, RG8, UV,
Gegen, Aus,
Sonnenscheindauer.



Wetterberatung

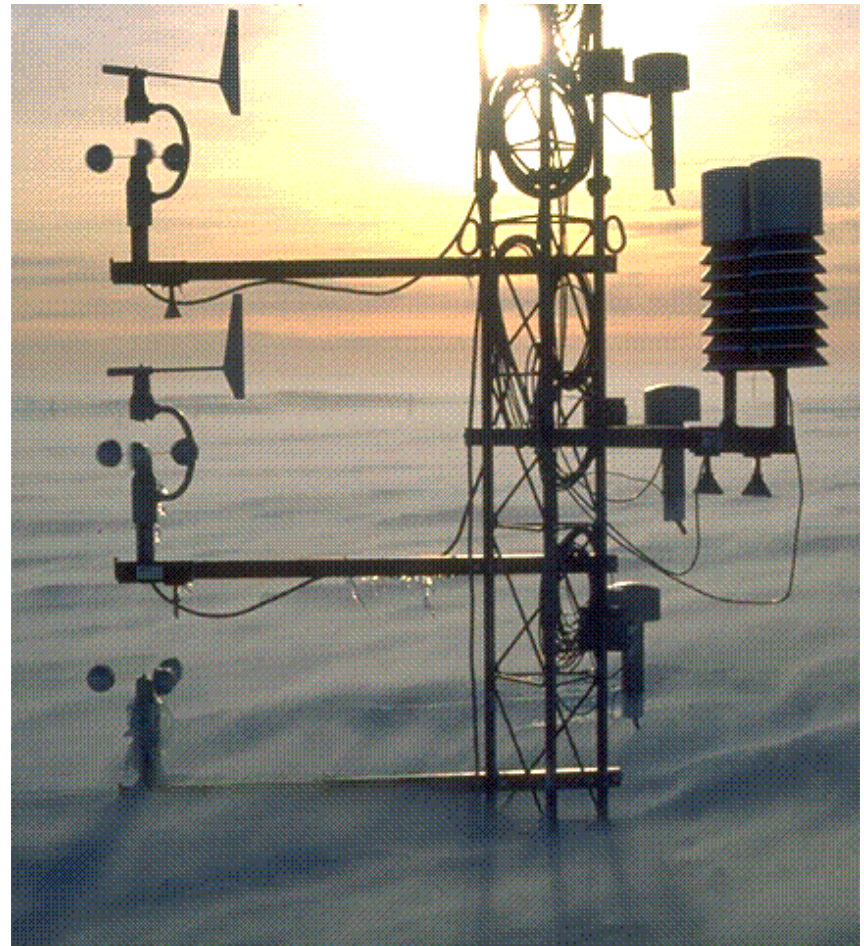
Sat-Bild-Empfang,
Wolkenhöhenlaser,
Sichtweitenmesser,
Online-Daten,
Modell-Produkte.



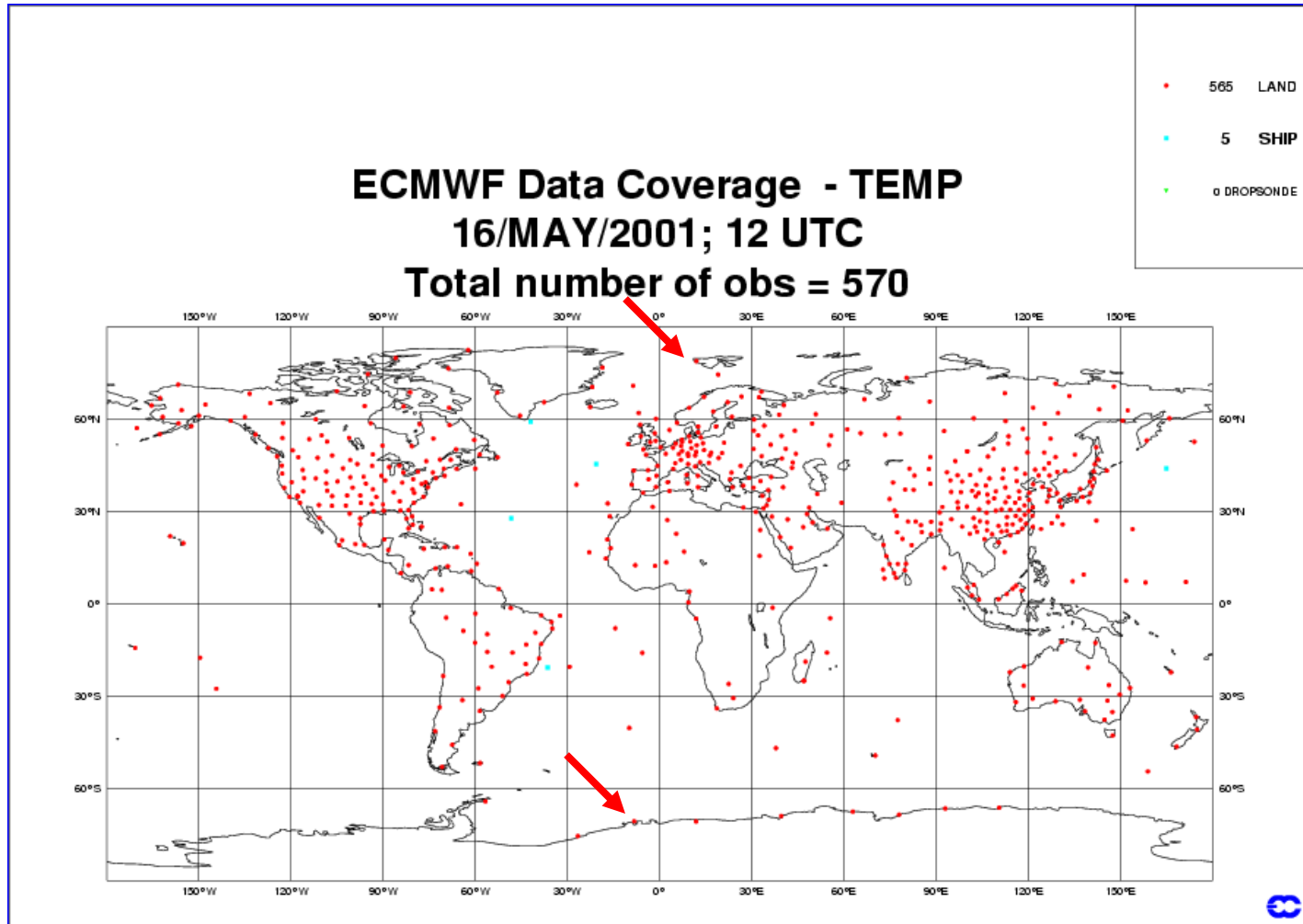
Meteorologie Observatorium Neumayer

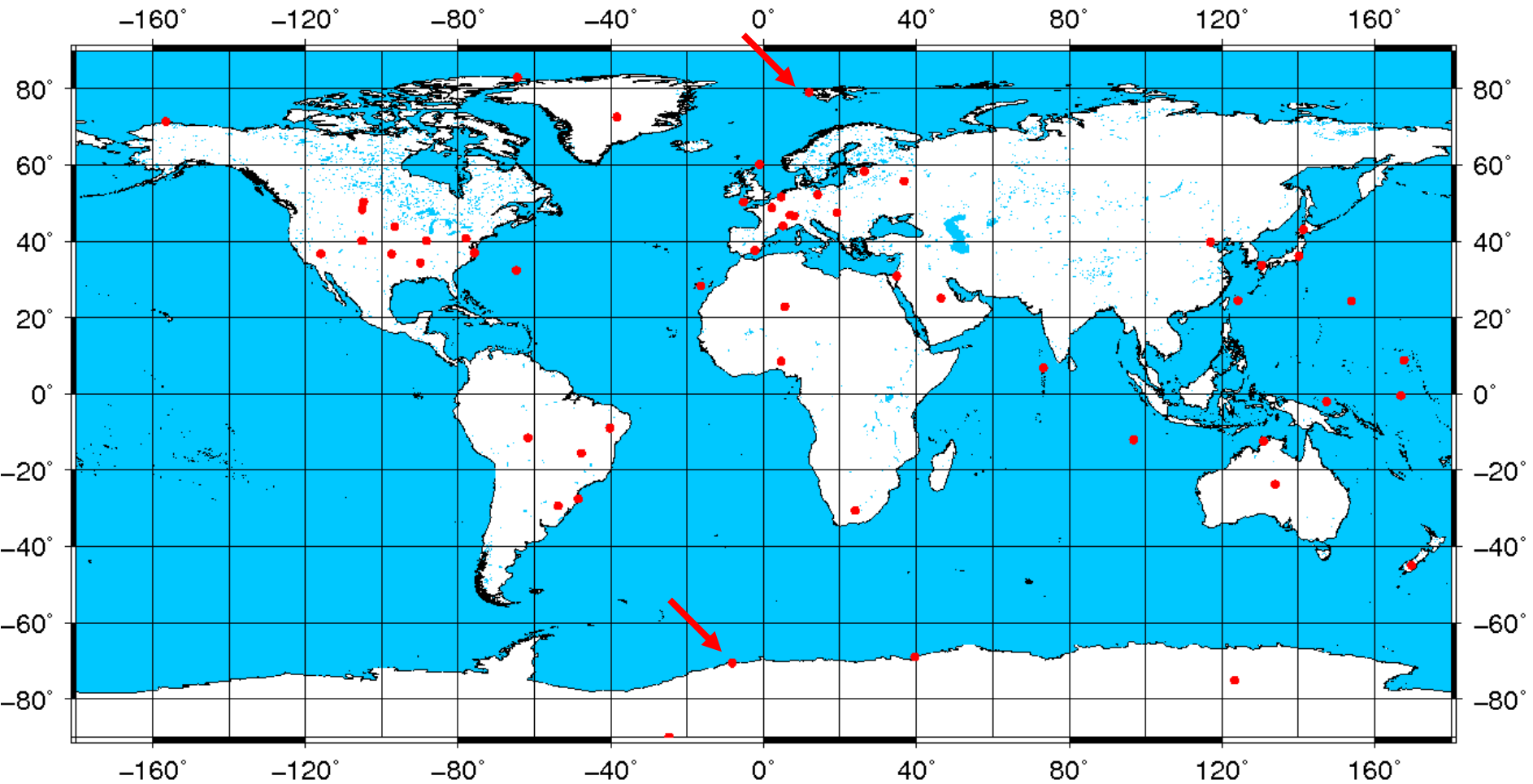
- 1.) 3-stündliche synoptische Beobachtungen
- 2.) Tägliche Radiosondierung incl. Ozon
- 3.) „Baseline Surface Radiation Network“ (BSRN)
- 4.) Wettervorhersagezentrale für „Nord-Antarktis“

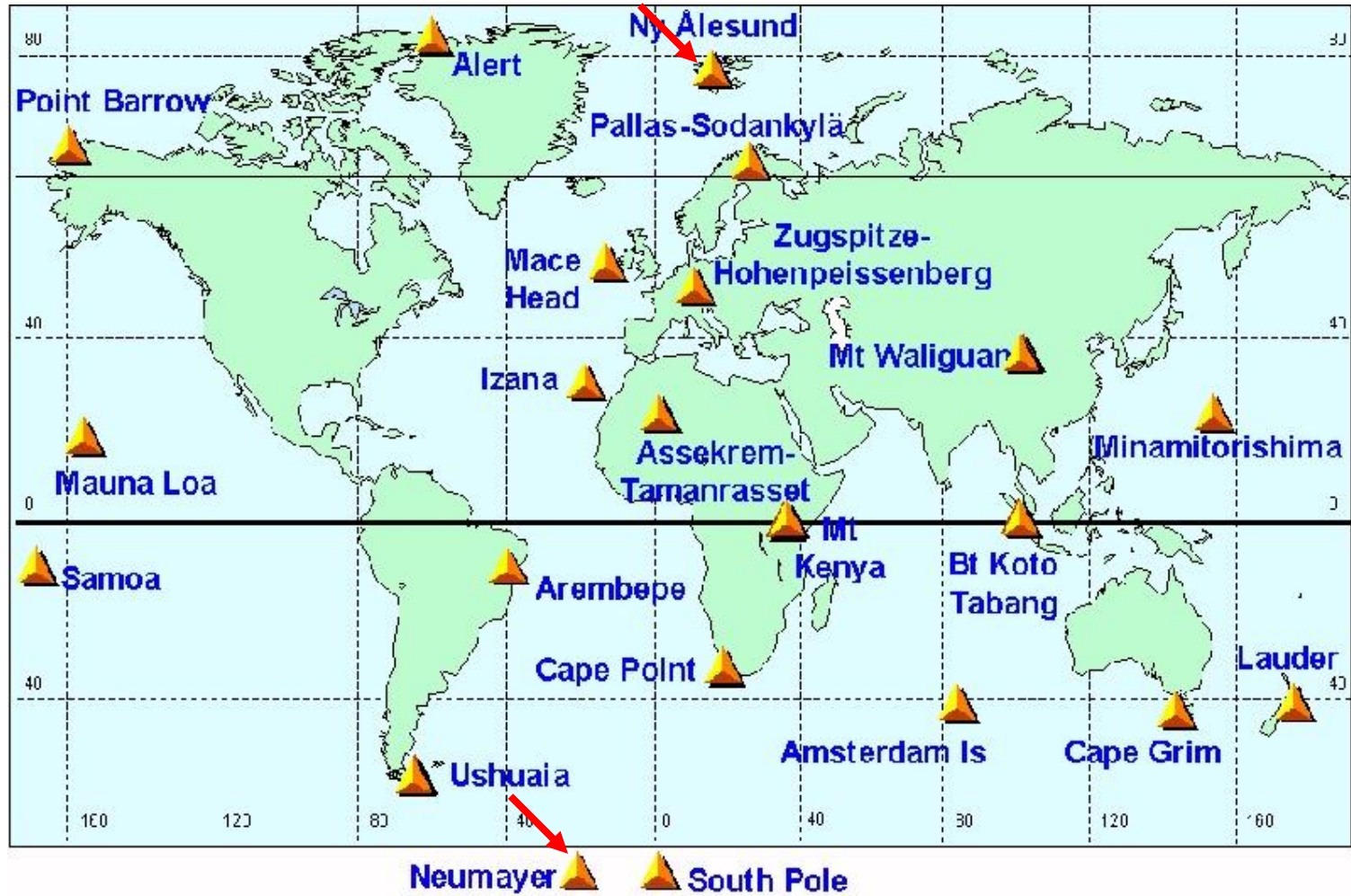
1. **Global Telecommunication System (GTS, GCOS)**
2. **Baseline Surface Radiation Network (BSRN)**
3. **Network for the Detection of Atmospheric Composition Change (NDACC)**
4. **Global Atmospheric Watch (GAW)**



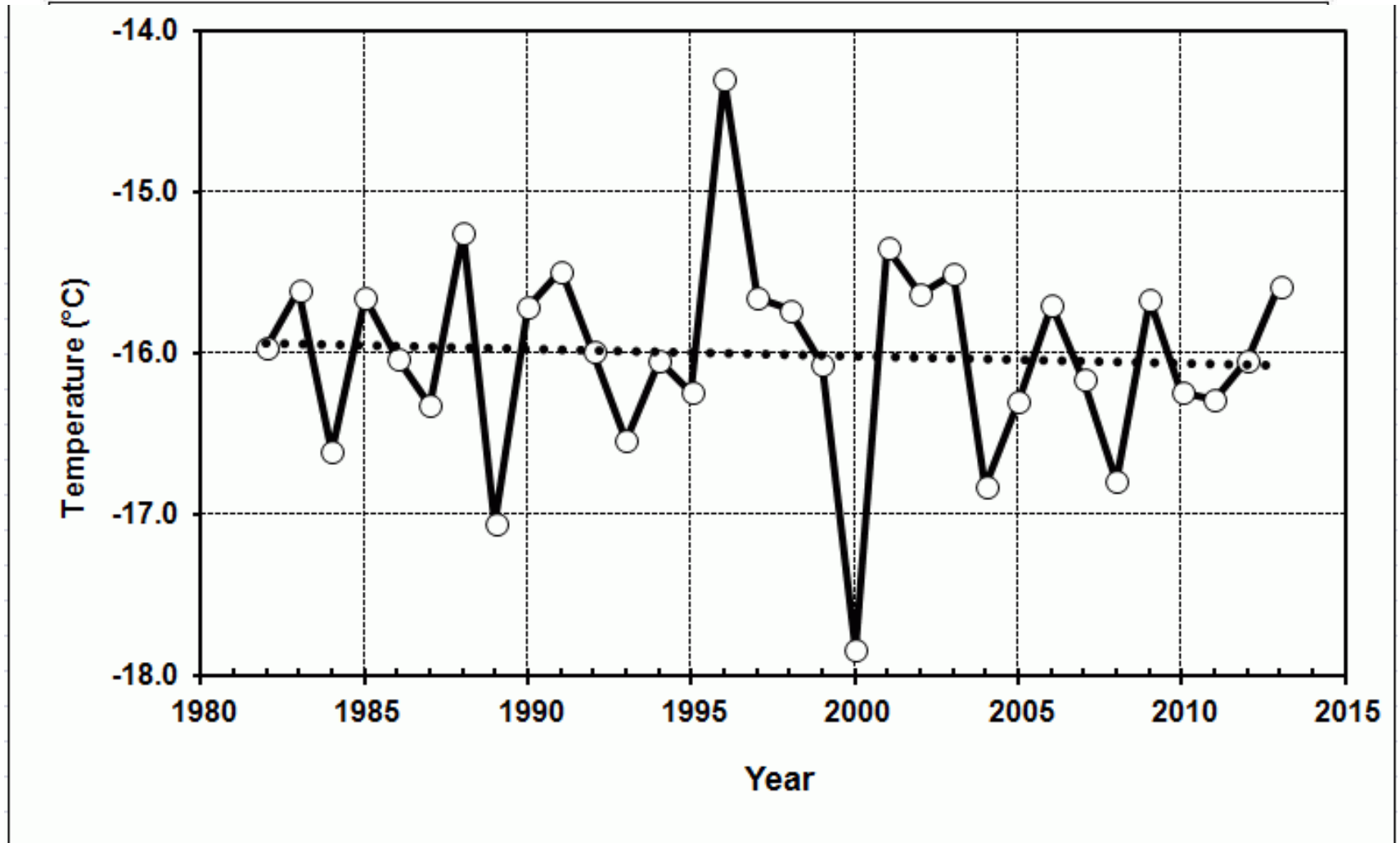
Dateneinspeisung in das GTS



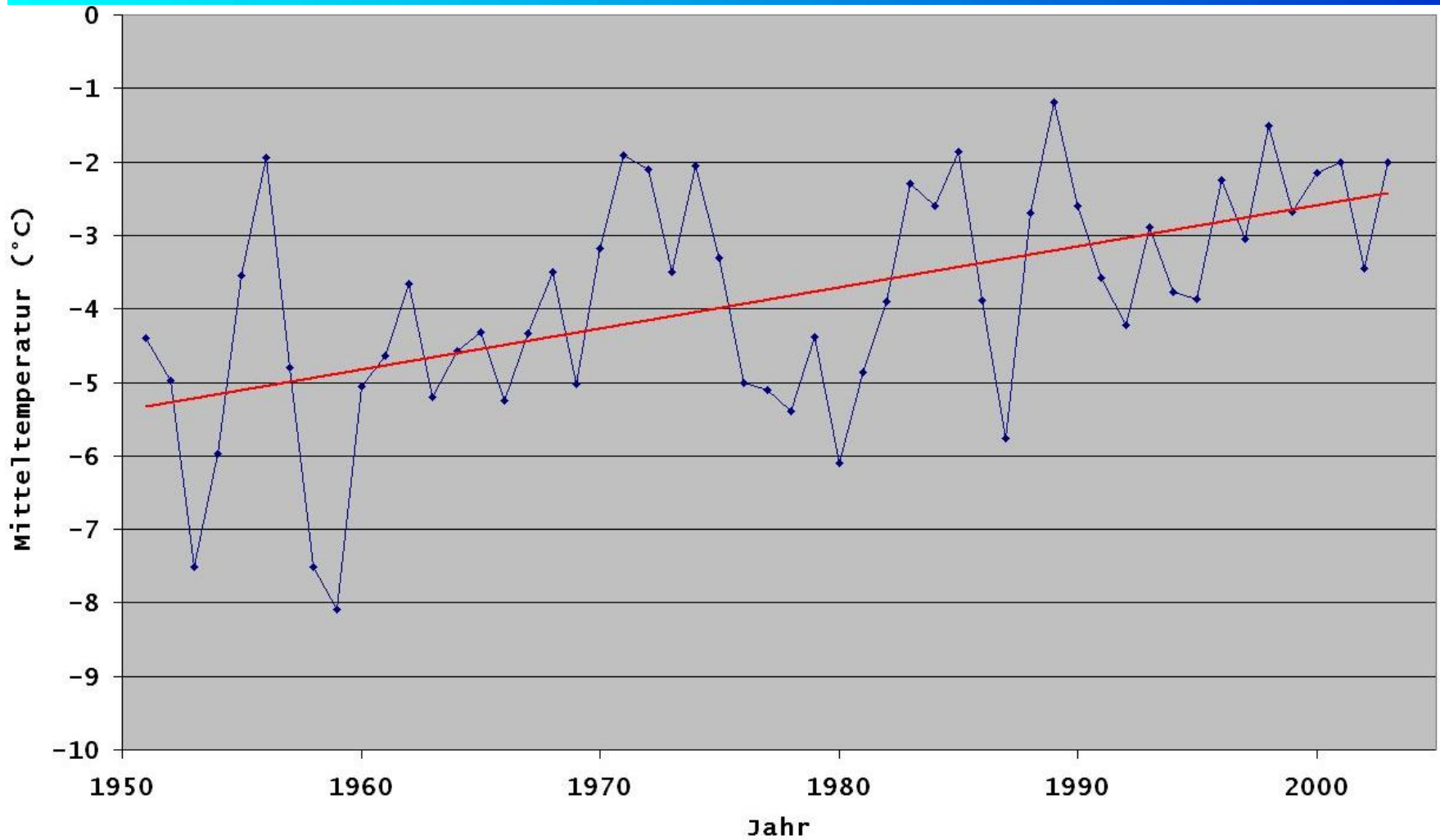


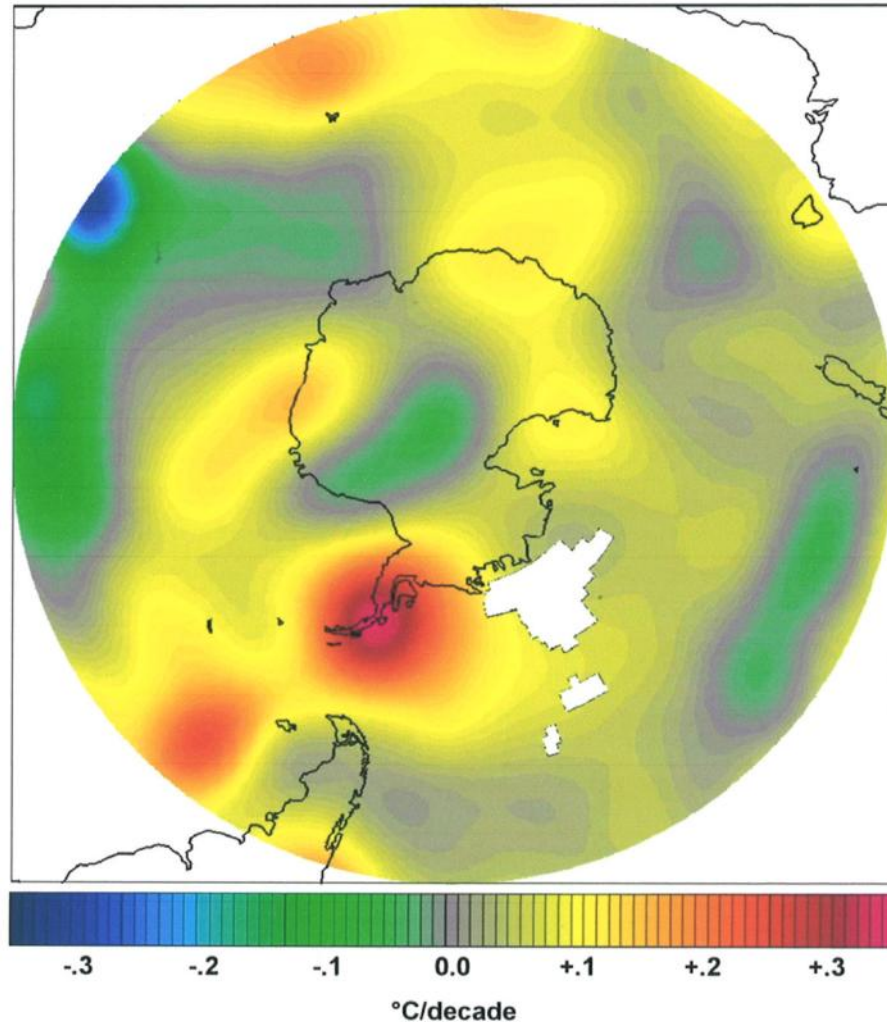


Temperatur von Neumayer



Faraday/Vernadsky

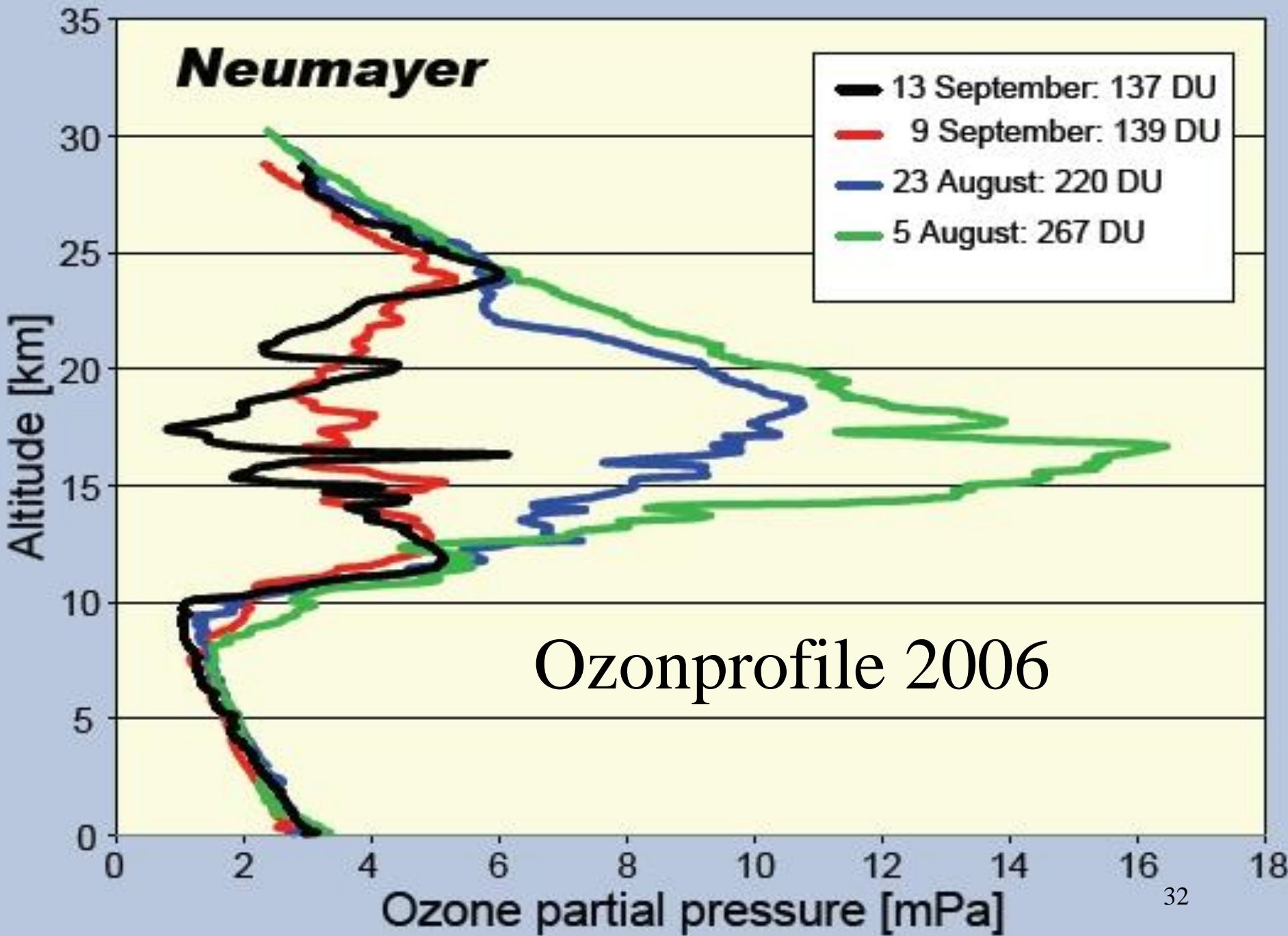




Start vom Dach NM_III

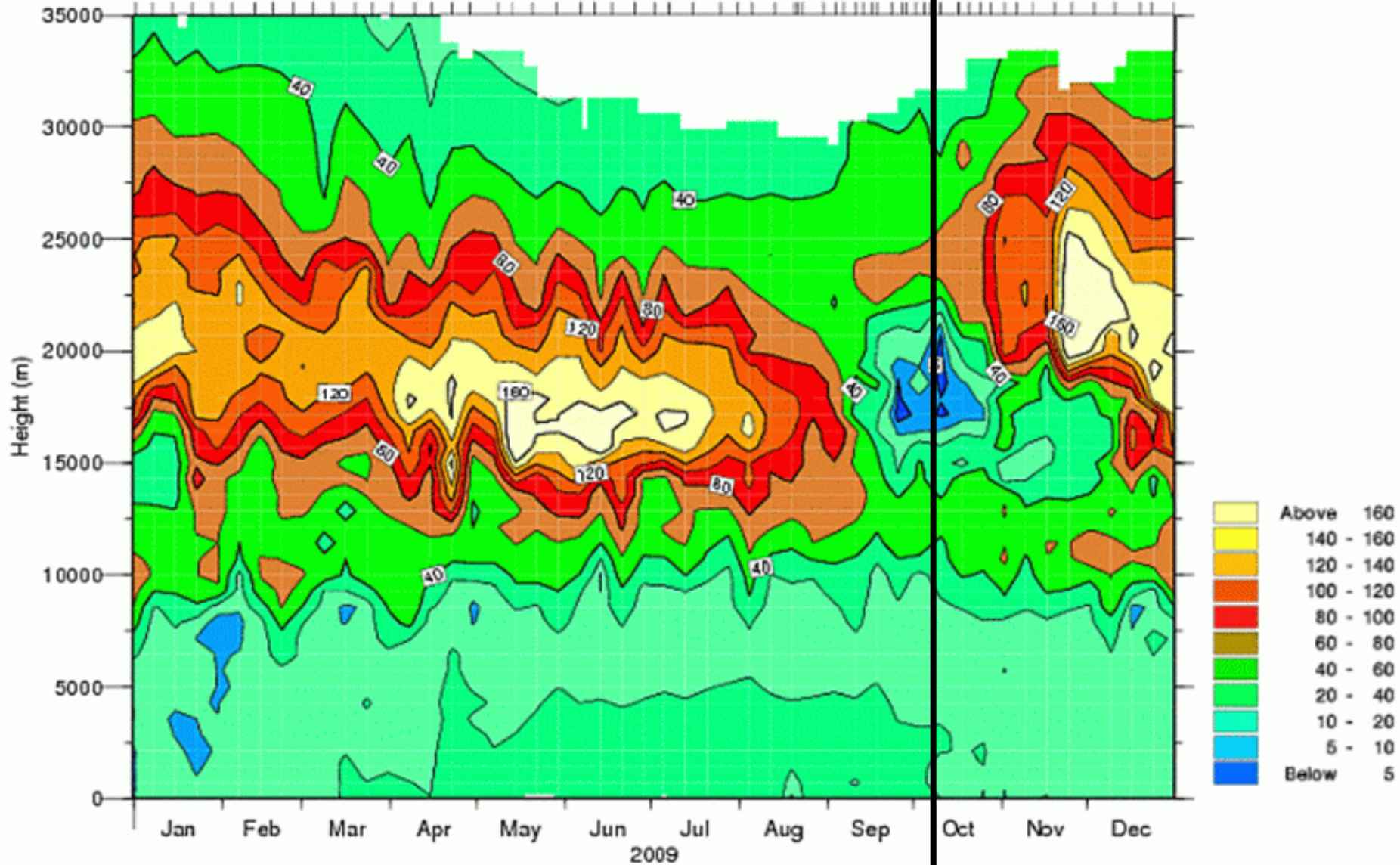


Neumayer

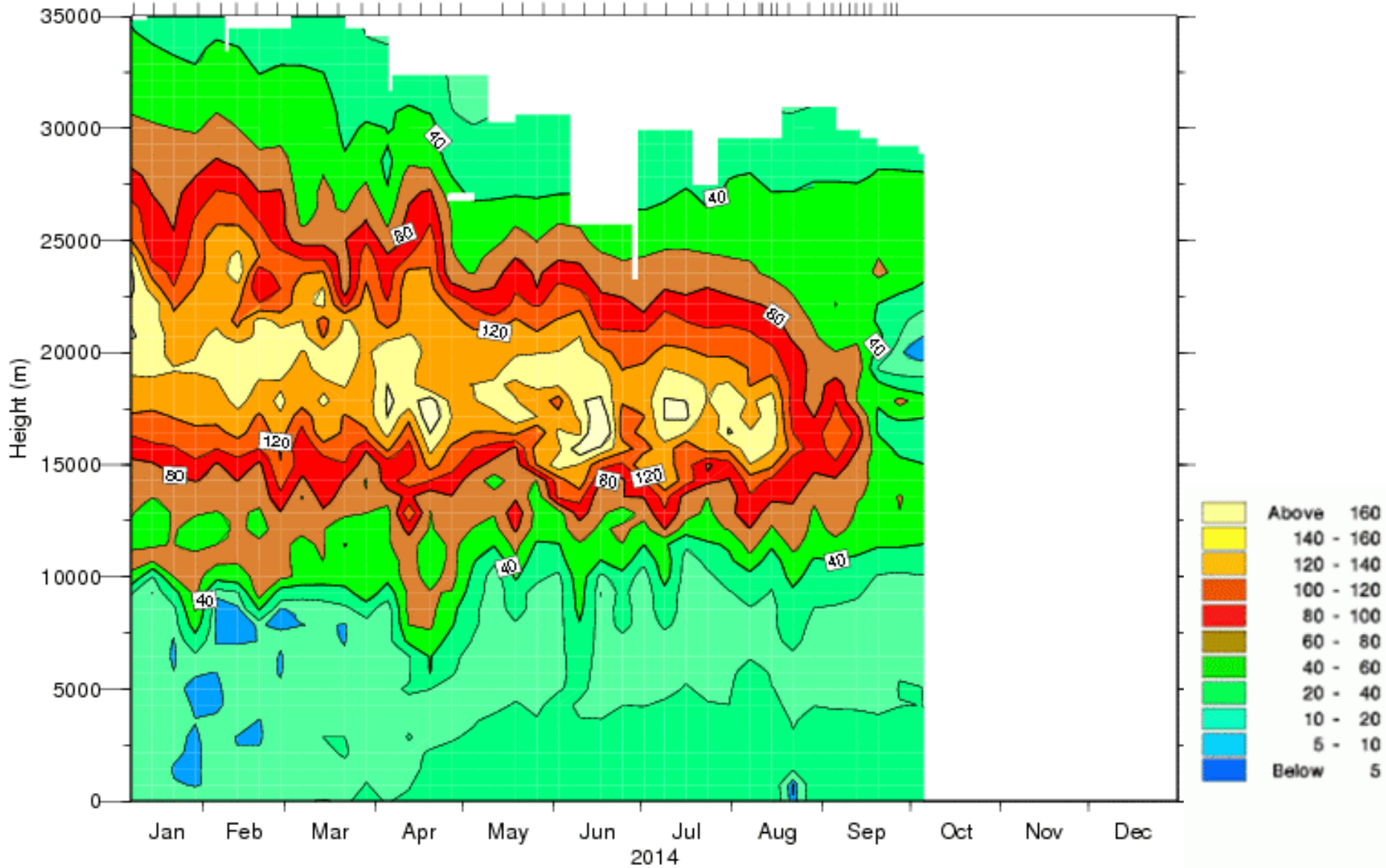


Ozonprofile 2006

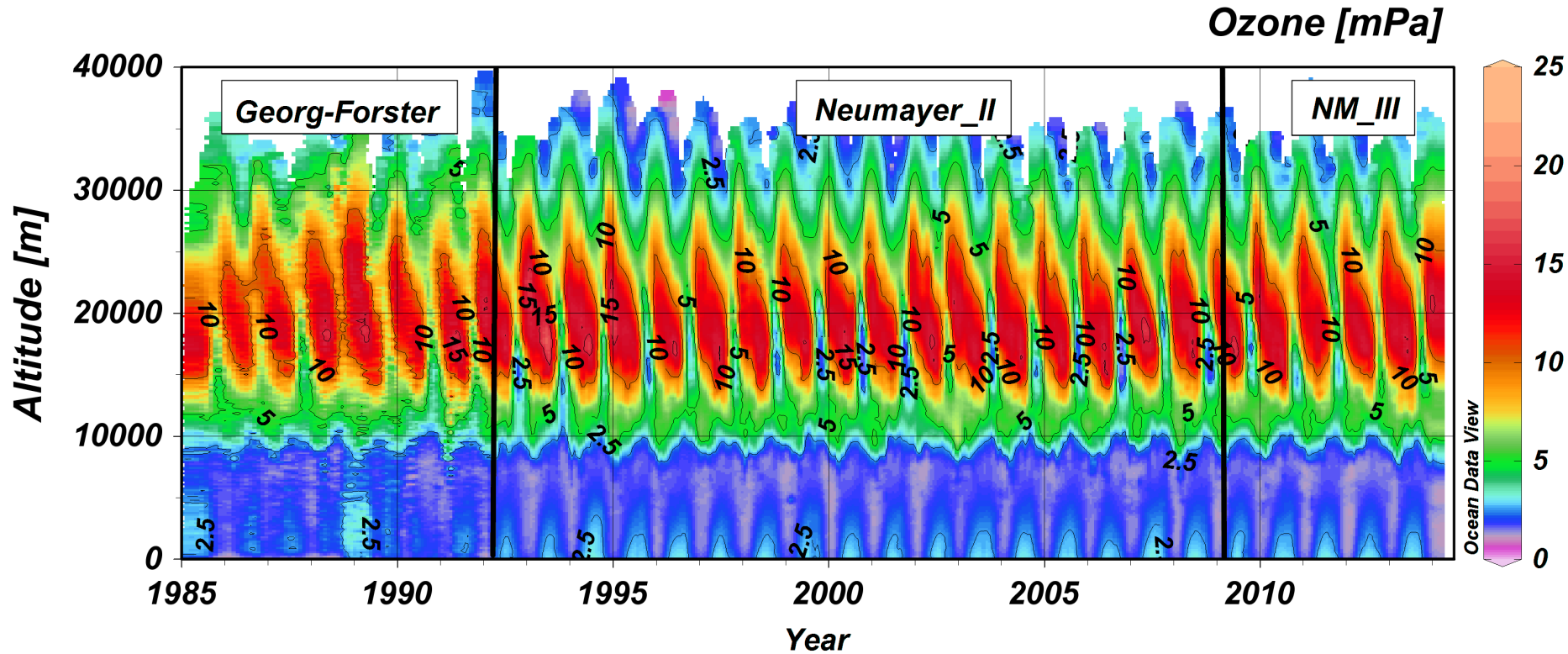
Ozone (nanobar) at Neumayer Radiosonde Station 70 S, 8 W from 2009-01-01 to 2009-12-31



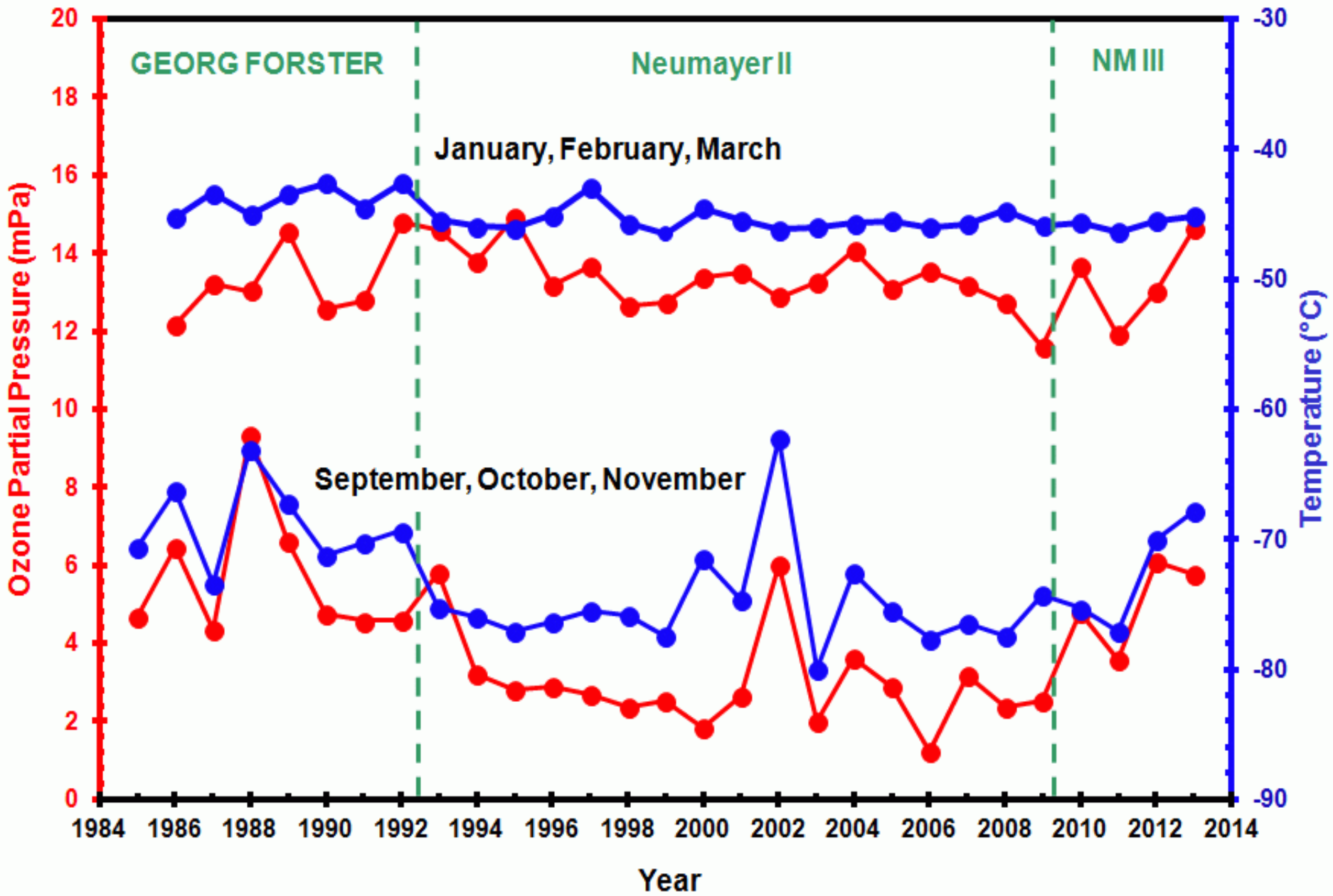
Ozone (nanobar) at Neumayer Radiosonde Station 70 S, 8 W from 2014-01-01 to 2014-09-26



Stratospheric ozone-depletion



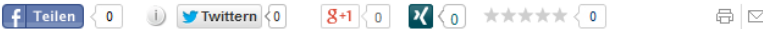
Timeseries of Seasonal Averaged Stratospheric Parameters at 70 hPa



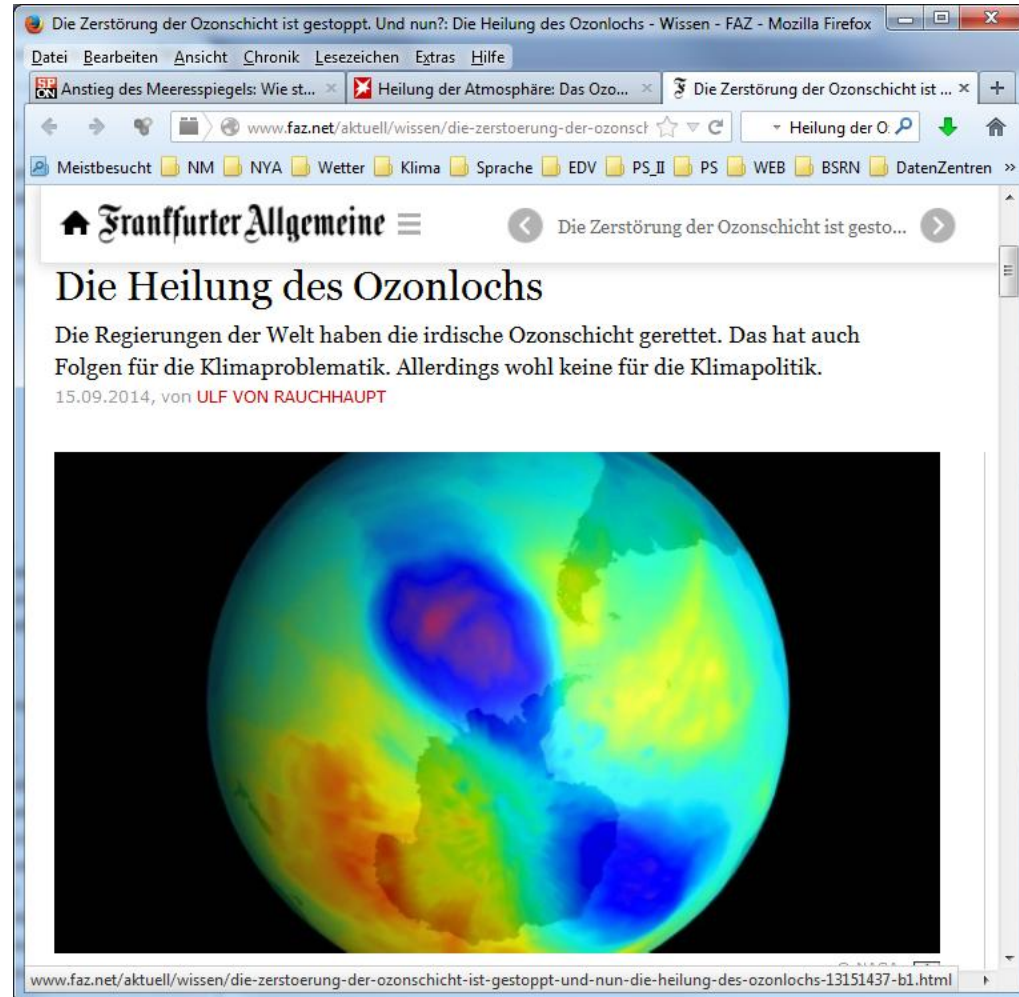
FOCUS Magazin | Nr. 38 (2014)

WISSEN
Die Heilung der Ozonschicht

Montag, 15.09.2014, 00:00 - von FOCUS-Redakteur Michael Odenwald

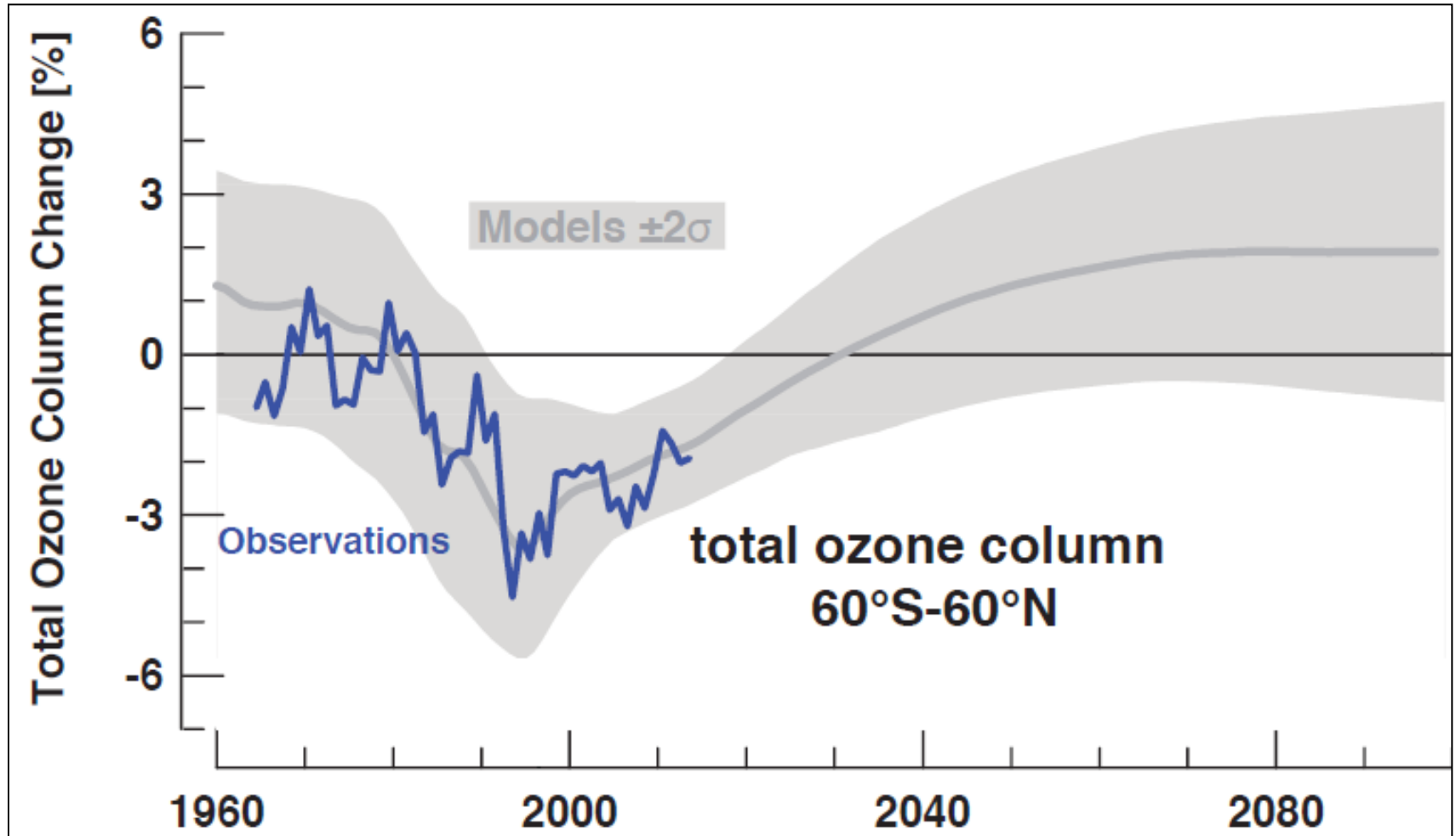


... Erste Anzeichen der Besserung zeigten sich 2012. Messreihen ergaben, dass damals weniger Ozon über der Antarktis zerstört wurde als in der Dekade davor. „Wir können erstmals sagen, dass unsere Daten eine Umkehr im Ozontrend abbilden“, erklärte der Klimatologe Gert König-Langlo vom Bremerhavener Alfred-Wegener-Institut für Polarforschung. „Die Ozonschicht erholt sich.“...





Erholung der Ozonschicht



theguardian

News | Sport | Comment | Culture | Business | Money | Life & style

Environment > Ozone layer

Antarctica may heat up dramatically as ozone hole repairs, warn scientists

As blanket of ozone over southern pole seals up, temperatures on continent could soar by 3C, increasing sea level rise by 1.4m

Die Polargebiete sind....

- **Motor der allgemeinen Zirkulation**
 - **Klima-Vagabunden**
 - **Entscheidend für den Meeresspiegel**
 - **Regionen mit stärkstem Ozonabbau**
- 
- A wide, flat, snow-covered landscape under a bright sky, with a blue horizontal bar above the text.





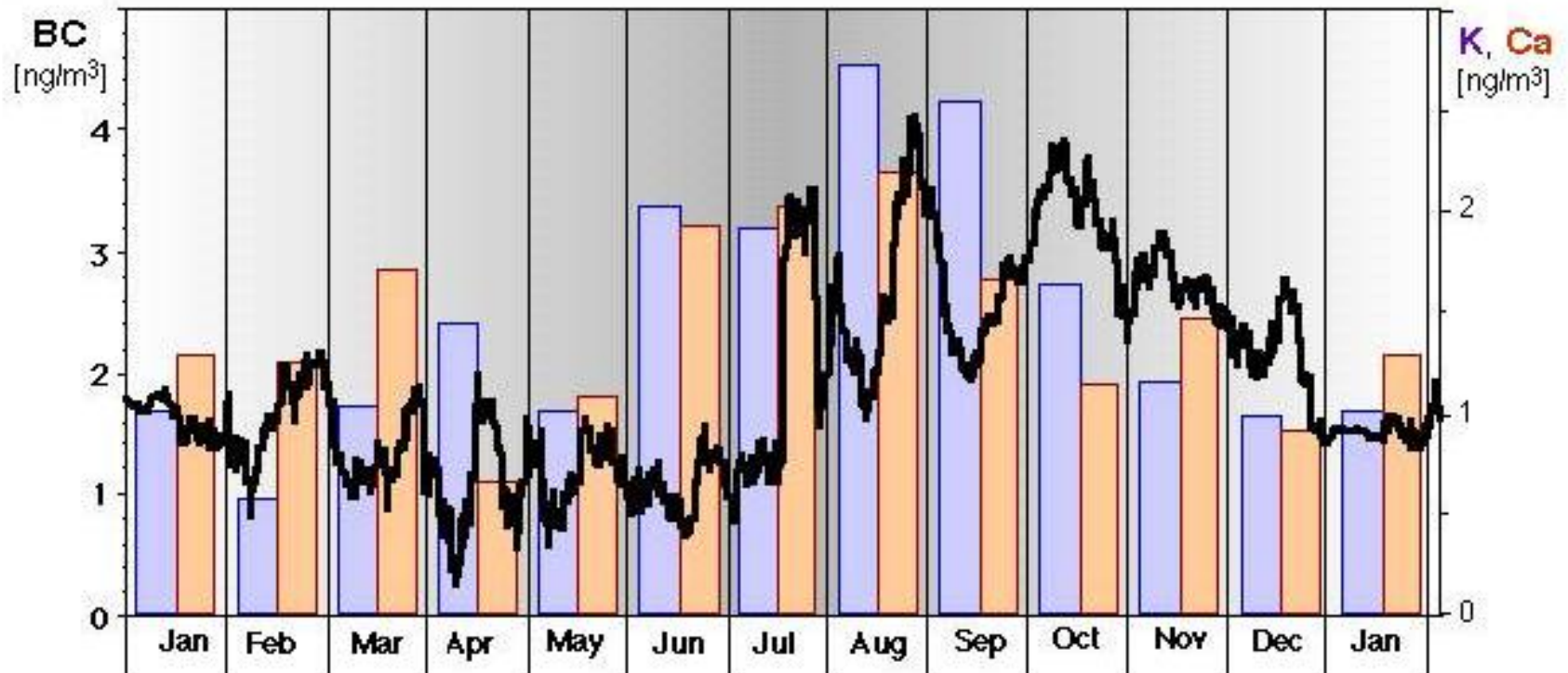


category	sampling method <i>samples per month</i>	compounds	institute
trace gases	compressed air (200 bar) 2-3 (<i>spot</i>)	CH ₄ , ¹³ CH ₄ , ¹⁴ CH ₄ (since 1987) SF ₆ , ⁸⁵ Kr (since 1983)	IUPH, IAR
	compressed air (2 bar, flasks) 4(<i>spot</i>)	CO ₂ , ¹³ CO ₂ , N ₂ O, CH ₄ (since 1994)	IUPH
	chemisorption (NaOH) 4(<i>cont.</i>)	¹⁴ CO ₂ (since 1982)	IUPH
water vapour	molecular sieve 4(<i>cont.</i>)	H ₂ O, ² H, ³ H (since 1989)	IUPH
	cryo-trapping 4(<i>cont.</i>)	H ₂ O, ² H, ³ H, H ₂ ¹⁸ O (since 1995)	IUPH
reactive trace compounds	low volume filter sampling 4(<i>spot</i>)	sulfate, nitrate, nitric acid, methanesulfonate (MSA), Na, K, Ca, Mg, ammonia (since 1988)	IUPH/AWI
chemical composition of aerosols	high volume filter sampling 4(<i>cont.</i>)	sulfate, nitrate, chloride, bromide, nitric acid, methanesulfonate, Na, K, Ca, Mg, ammonia (since 1983)	IUPH/AWI
	high volume filter sampling	[¹⁵ NO ₃ ⁻ , ³⁴ SO ₄ ²⁻]*	ÖFS
	high volume filter sampling 2(<i>cont.</i>)	²¹⁰ Pb, ⁷ Be, (since 1983) ¹⁰ Be**	IUPH
	Berner type impactor 4(<i>cont.</i>)	[sulfate, nitrate, chloride, bromide, nitric acid, methanesulfonate, Na, K, Ca, Mg]**	AWI
snow, snow pits	snow and firn samples	sulfate, nitrate, chloride, bromide, nitric acid, methanesulfonate, Na, K, Ca, Mg, ammonia, ² H, H ₂ ¹⁸ O, (since 1995)	AWI, GSF

category	measured property <i>interval</i>	method	institute
<i>physico-chemical properties of aerosols</i>	particles (>10 nm) <i>1 min</i>	condensation nuclei counter (since 1982)	AWI/UM
	ultra fine particles (>3 nm) <i>1 min</i>	condensation nuclei counter (since 1996)	AWI
	particle size distribution 0.3-20 μm <i>60 min</i>	laser aerosol spectrometer (1996-98)	AWI
	black carbon <i>240 min</i>	aethalometer (since 1995)	AWI
	PAH <i>15 min</i>	photo-ionization (since 1996)	AWI/IUPH
	aerosol scattering <i>10 min</i>	integrating nephelometer (since 1996)	AWI
<i>trace gases</i>	^{222}Rn <i>180 min</i>	$^4\text{He}^{2+}$ spectroscopy of ^{214}Po (since 1983)	IUPH
	NO and NO_y <i>30 min</i>	chemiluminescence (1999)	AWI
	$\text{H}_2\text{O}_2, \text{HCHO}$ <i>15 min</i>	fluorimeter (1997)	AWI
	O_3 <i>3 min</i>	UV-absorption (since 1982)	AWI/DWD
<i>column densities of trace gases</i>	$\text{O}_3, \text{NO}_2, \text{OCIO}, \text{BrO}, \dots$ <i>10 min</i>	UV spectroscopy (DOAS) (since 1994)	IUPH

Ergebnisbeispiele

Black carbon, *nss-K* and *nss-Ca* measurements at Neumayer
 (black carbon: 1995/96/99/00; K and Ca monthly means from 1983-1999)



Die Polargebiete sind....

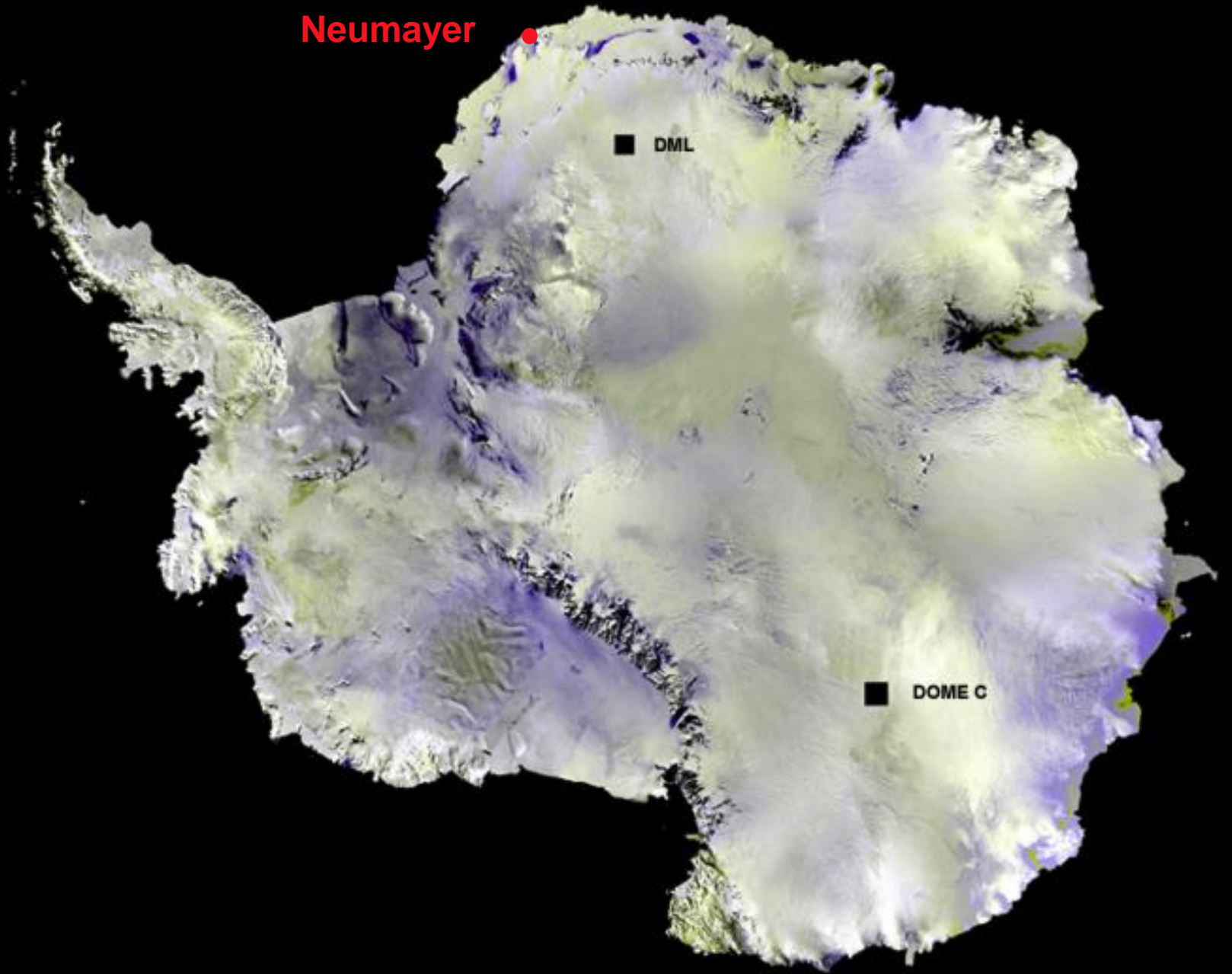
- **Motor der allgemeinen Zirkulation**
- **Klima-Vagabunden**
- **Entscheidend für den Meeresspiegel**
- **Regionen mit stärkstem Ozonabbau**
- **quellenfreie Reinstluftlabore**

Neumayer

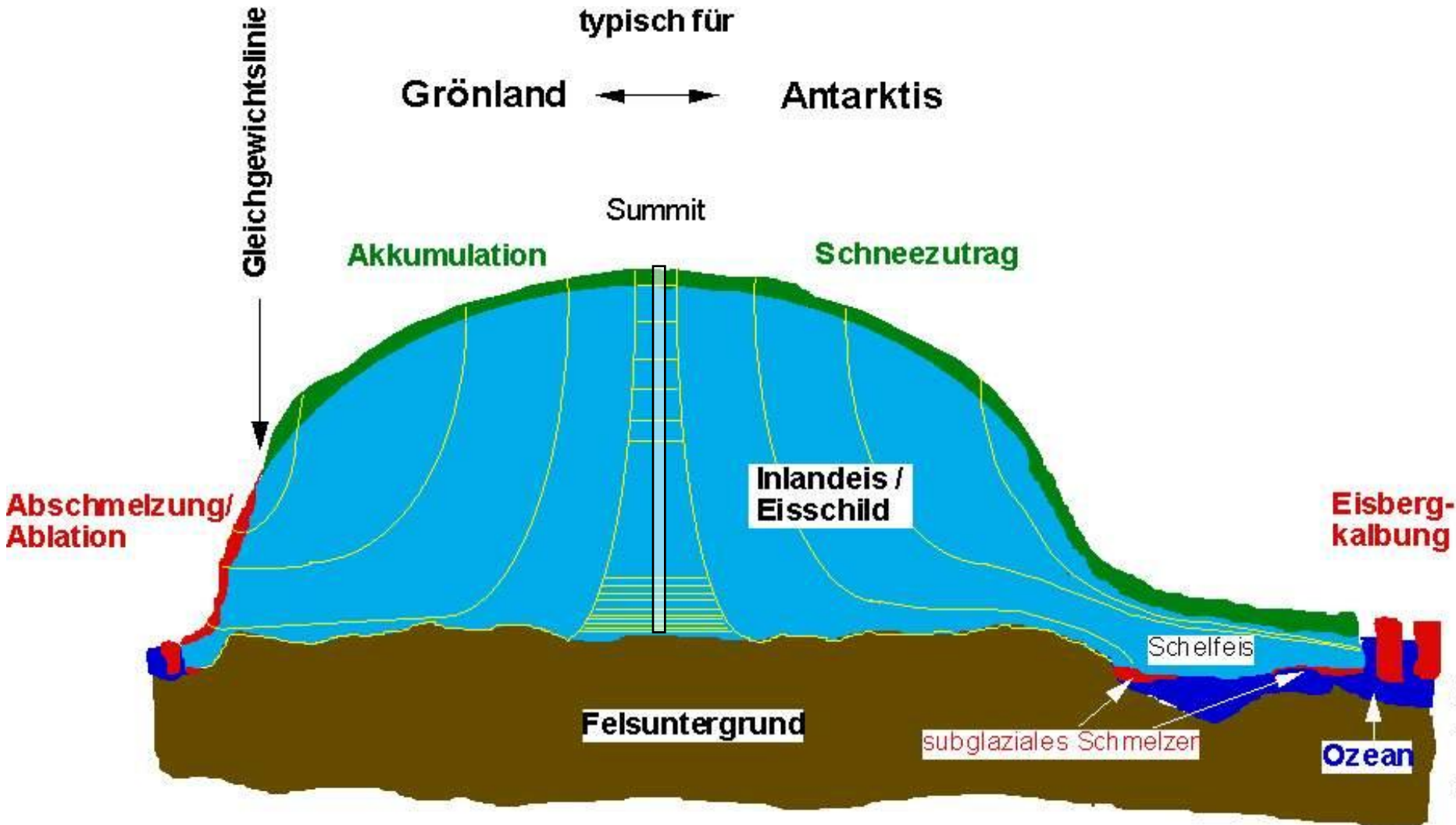


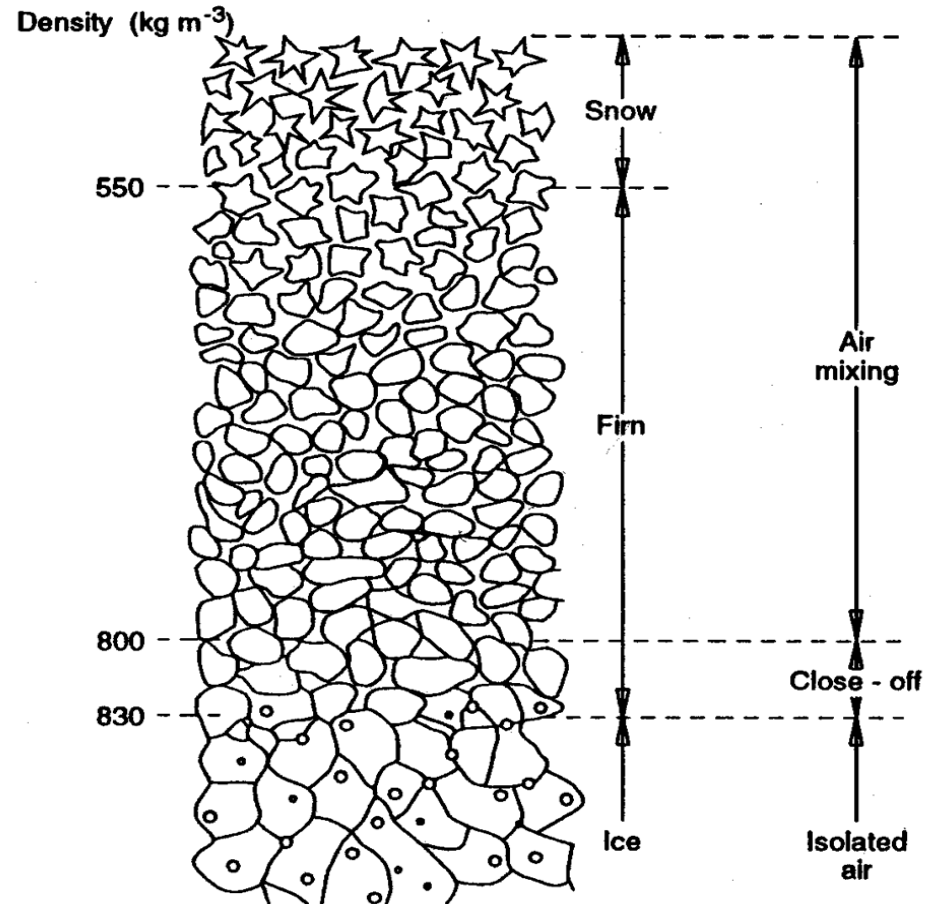
■ DML

■ DOME C

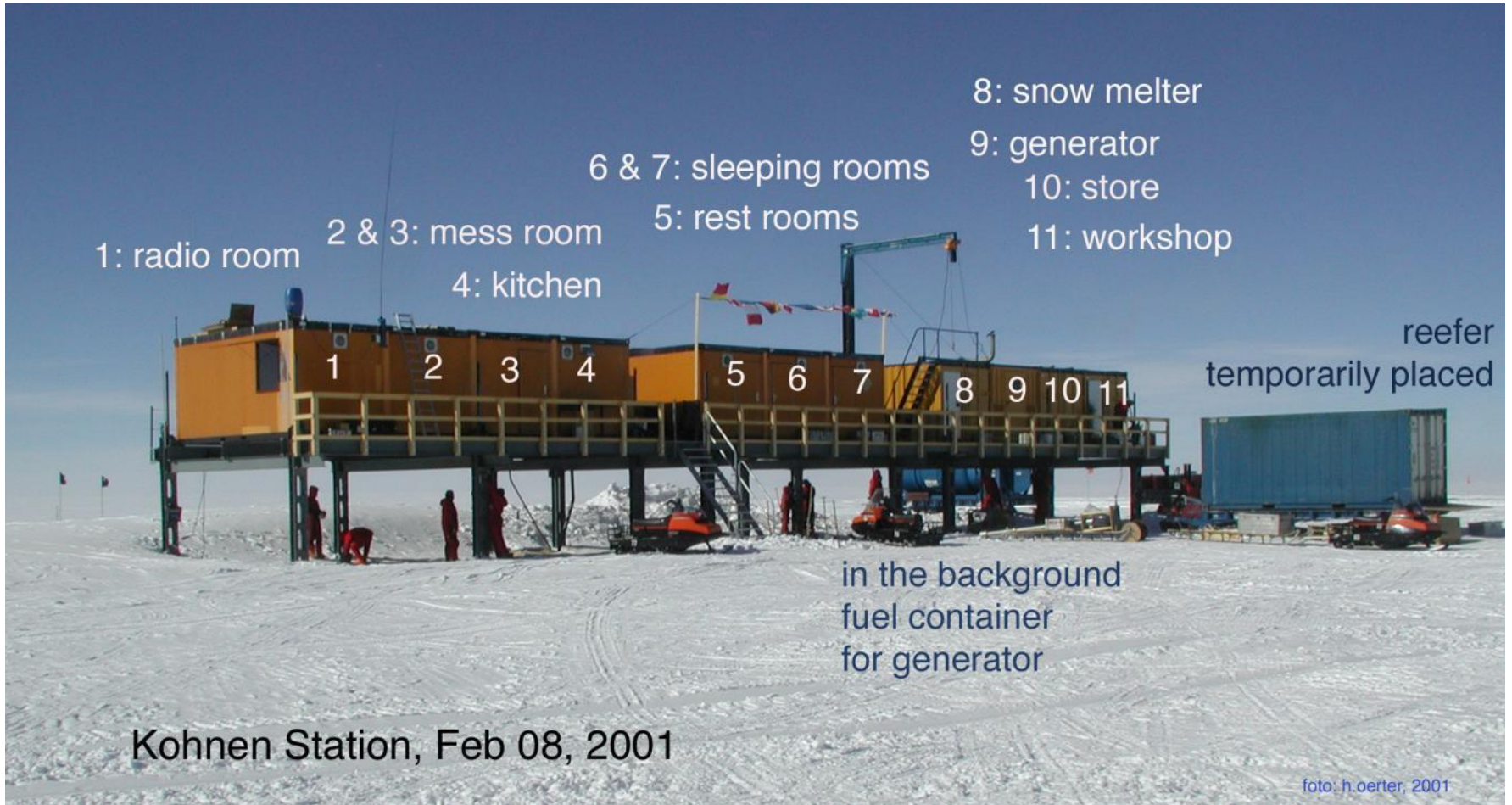


typisch für
Grönland ↔ Antarktis





Kohnenstation



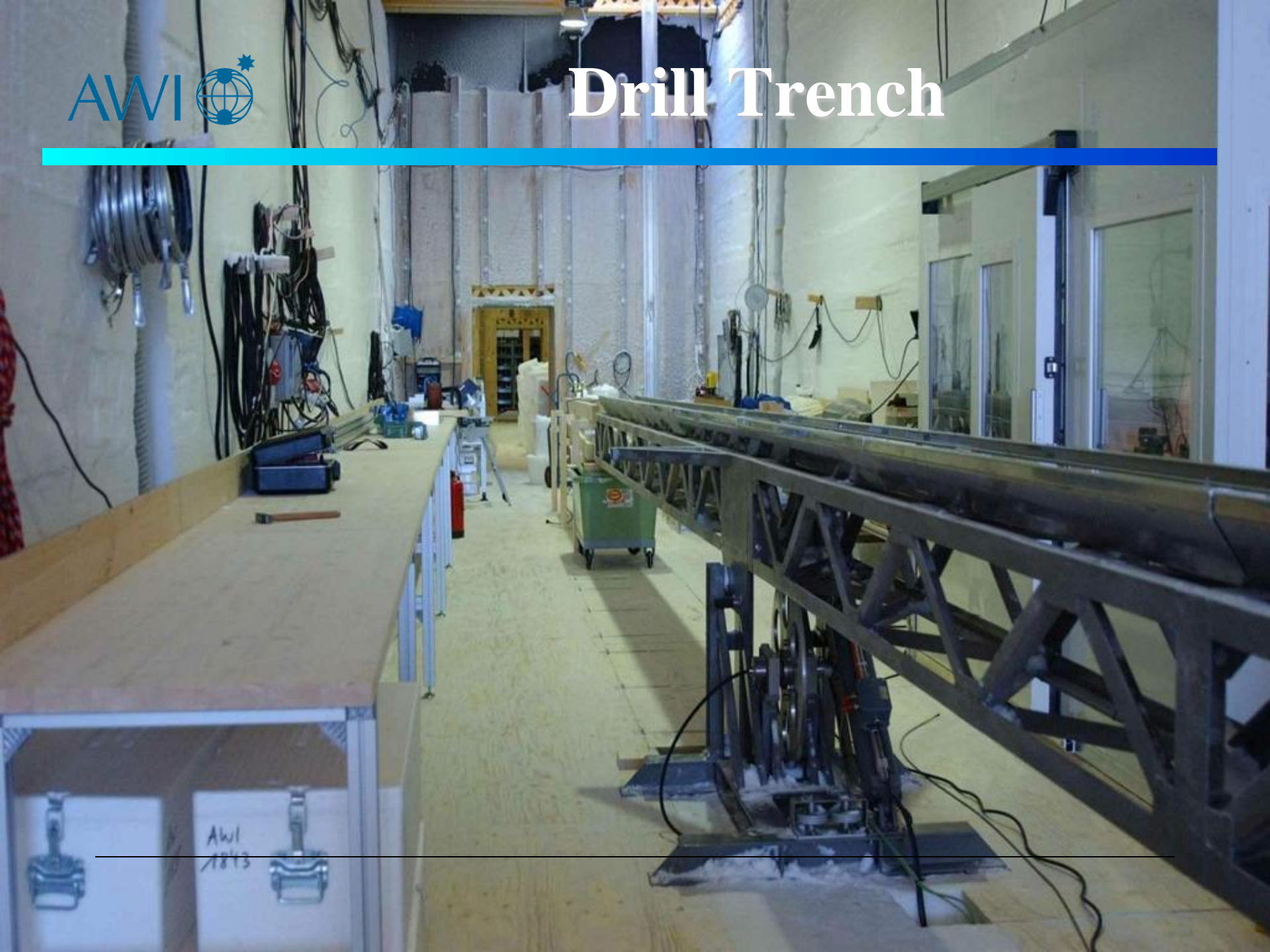
Bau vom Drill Trench



the full bags
were lifted by crane
out of the trench

View into the drill trench while excavating the deep inclined trench

Drill Trench



AWI
1813

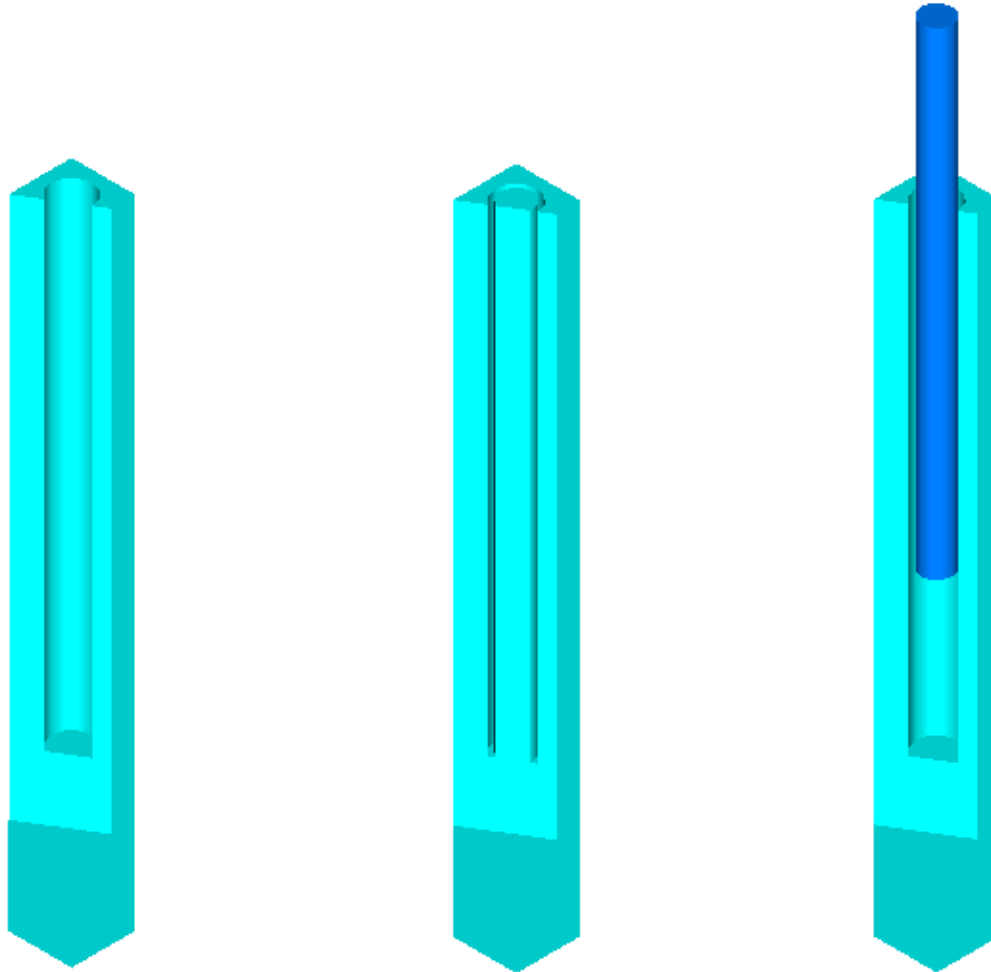
Eingang zur Vergangenheit...



Reamer #4 (255 mm) above the borehole

Feb 03, 2001

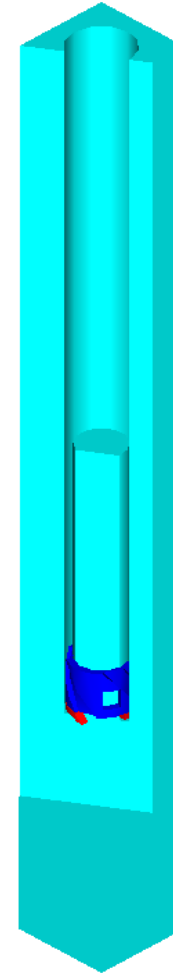
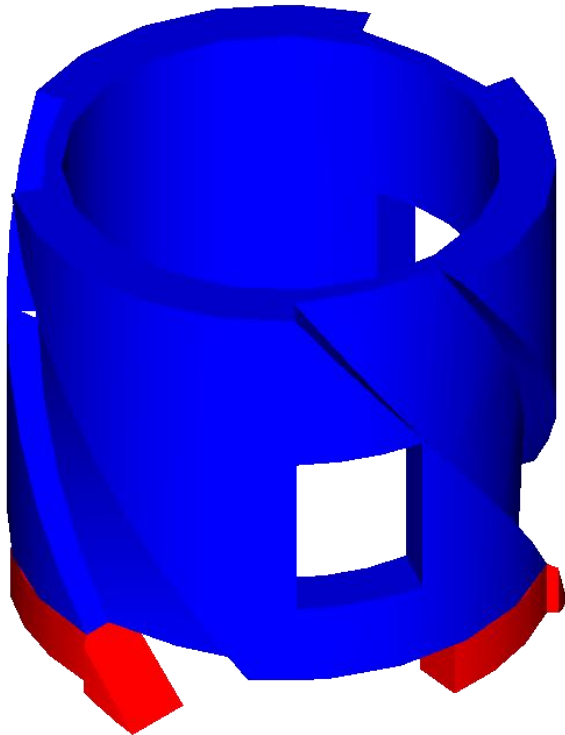
Was ist ein Bohrkern?



Bohrkopf

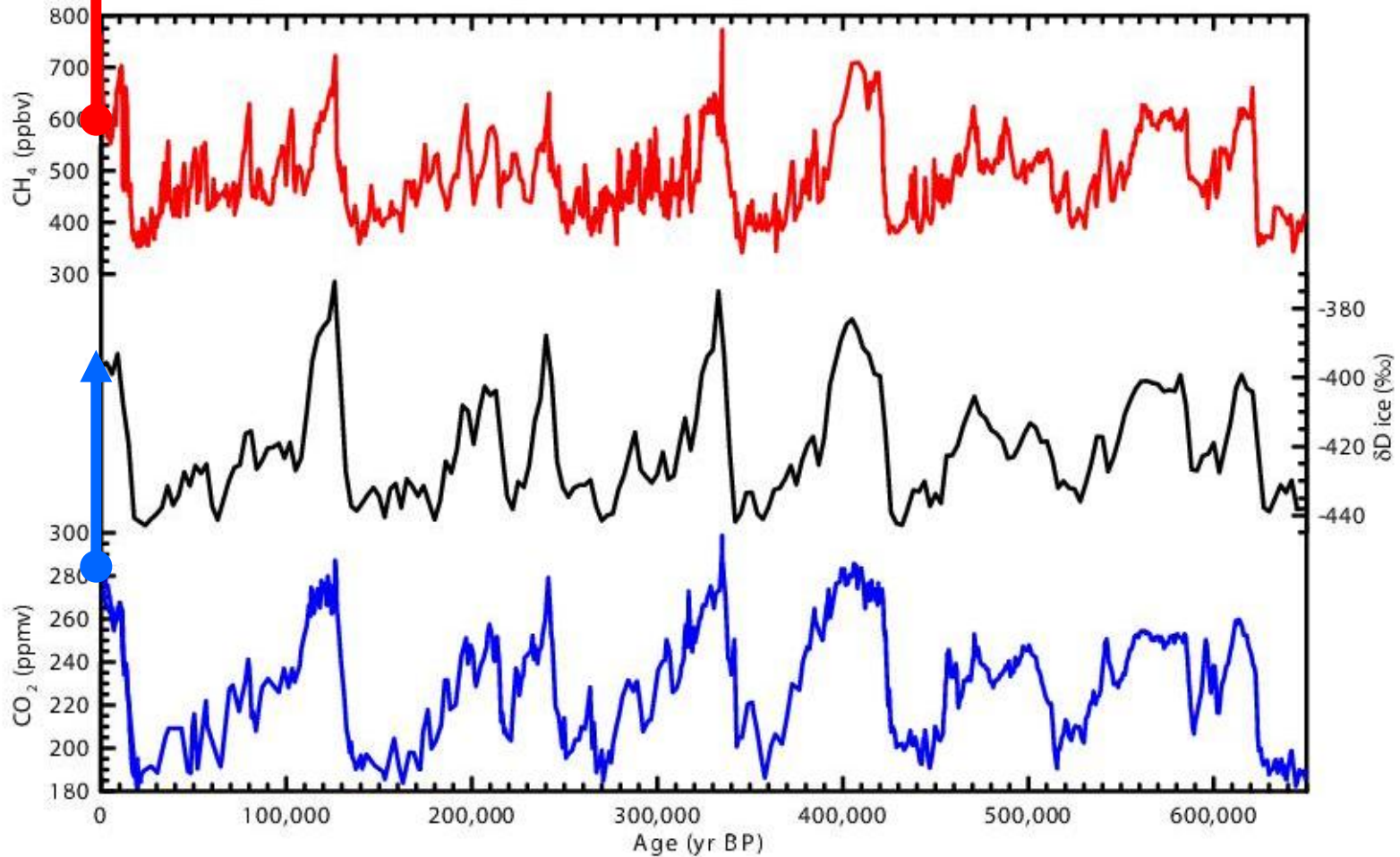


Schneideprinzip



Bohrkern wird zersägt





Die Polargebiete sind....

- **Motor der allgemeinen Zirkulation**
- **Klima-Vagabunden**
- **Entscheidend für den Meeresspiegel**
- **Regionen mit stärkstem Ozonabbau**
- **quellenfreie Reinstluftlabore**
- **bedeutendes Klima-Archiv...**

