



# The World Radiation Monitoring Center and other GCOS-related Projects

at the  
Alfred-Wegener-Institut





## Main WRMC Objectives:

**Archiving** uniform and consistent **measurements** throughout the **Baseline Surface Radiation Network** (BSRN) to:

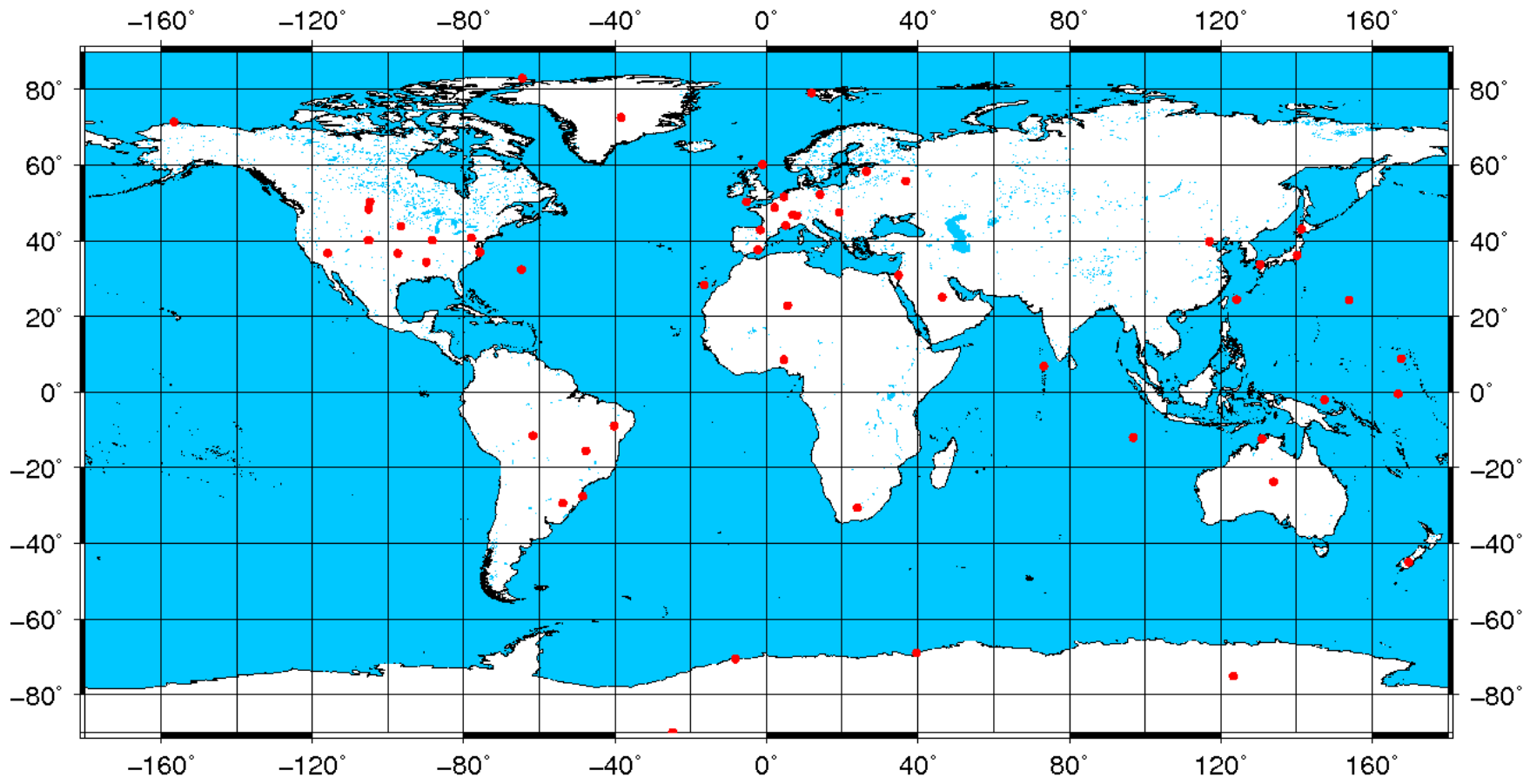
1. **monitor** the surface short-wave and long-wave radiative components and their **changes** with the best methods currently available,
2. provide data for the **validation of satellite**-based estimates of the surface radiative fluxes and
3. produce high quality observational data for **comparison to climate models**.

## **Brief WRMC-BSRN History:**

1. 1988: The WMO proposed the establishment of the BSRN.
2. 1992: The BSRN started with 5 sites and the WRMC at ETH Zurich under the direction of Prof. Atsumu Ohmura.
3. 2004: BSRN officially became a contributor to the Global Climate Observing System (GCOS).
4. 2008 July: After 15 years of nearly continuous operation at ETH Zurich, the archive moved to Alfred-Wegener-Institut (AWI) in Bremerhaven, Germany under the direction of Dr. Gert König-Langlo.



# Present State of the WRMC: 51 stations providing data



## Present State of the WRMC:      Datasets: 6000 station-months

The typical average interval for radiation data is 1 minute:

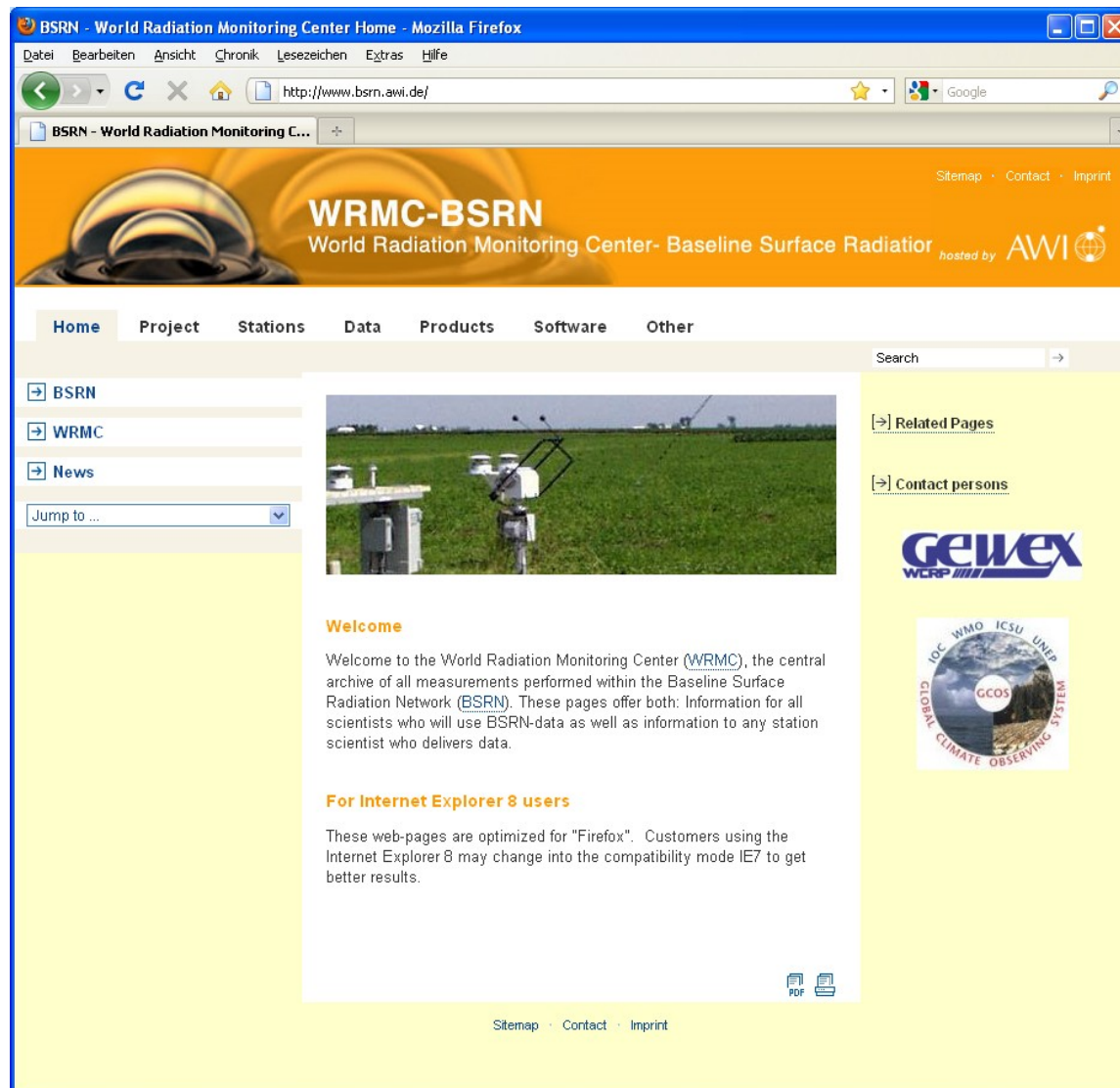
1. LR 0100: (Global, Diffuse, Direct, Long-wave down)	51 stations
2. LR 0200: (Long-wave spectral down)	0 stations
3. LR 0300: (Reflex, Long-wave up)	9 stations
4. LR 0500: (UV)	12 stations
5. LR 1000: (Synops)	8 stations
6. LR 1100: (Upper air soundings)	25 stations
7. LR 1200: (Total ozone)	8 stations
8. LR 1300: (Aerosol optical depths) (under construction)	(14) stations
9. LR 1300: (Ceilometer data)	3 stations
10. LR 30x0: (Radiation measurements from tower)	11 stations

The web-address is:

<http://www.bsrn.awi.de>.

File Access is:

<ftp://ftp.bsrn.awi.de/>



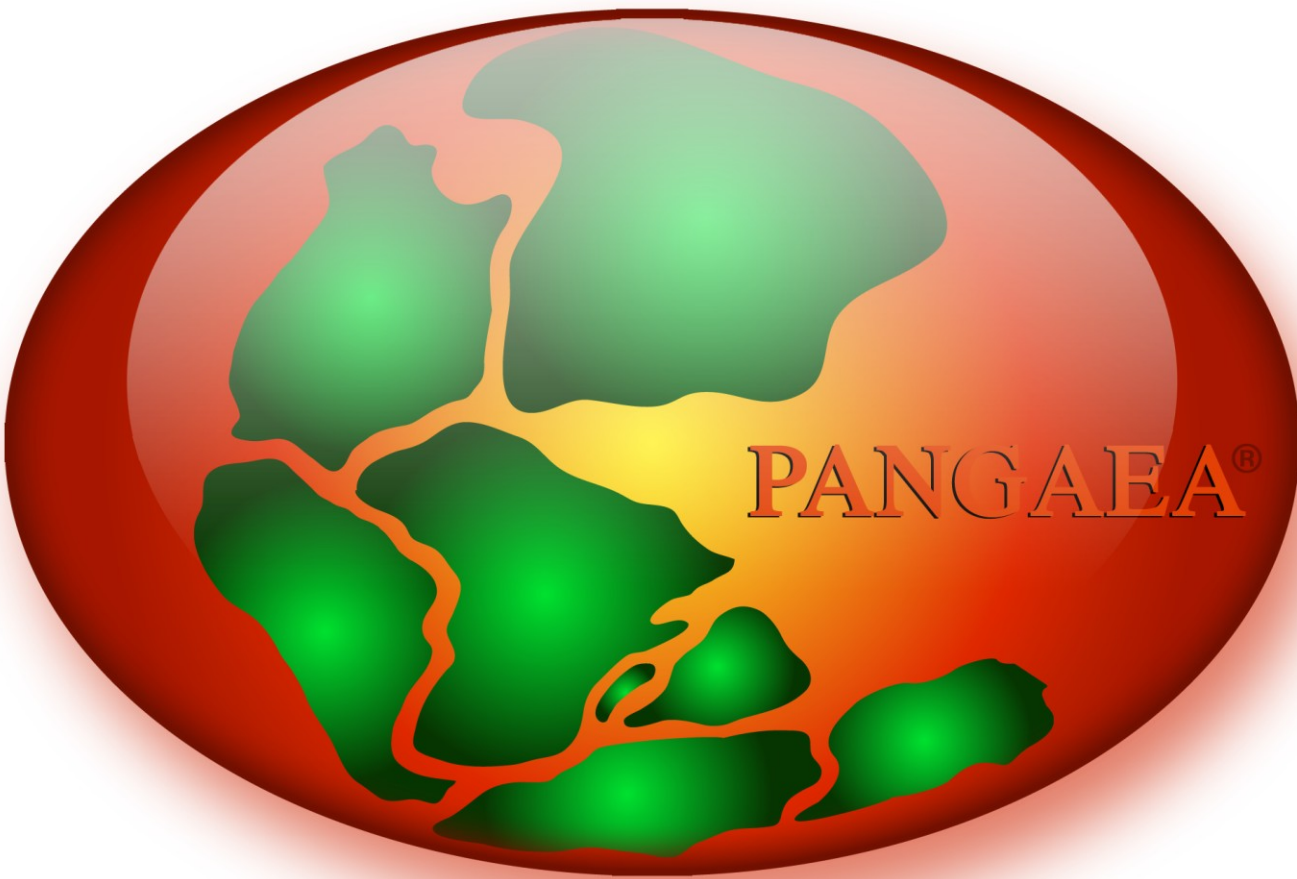
The screenshot shows a Mozilla Firefox browser window displaying the WRMC-BSRN website. The browser's address bar shows the URL <http://www.bsrn.awi.de/>. The website header features the WRMC-BSRN logo and the text "World Radiation Monitoring Center- Baseline Surface Radiation Network" with "hosted by AWI" and a globe icon. A navigation menu includes links for Home, Project, Stations, Data, Products, Software, and Other. A search bar is located in the top right. On the left side, there are links for BSRN, WRMC, and News, along with a "Jump to ..." dropdown menu. The main content area features a photograph of a radiation monitoring station in a field. Below the photo is a "Welcome" section with the text: "Welcome to the World Radiation Monitoring Center (WRMC), the central archive of all measurements performed within the Baseline Surface Radiation Network (BSRN). These pages offer both: Information for all scientists who will use BSRN-data as well as information to any station scientist who delivers data." Below this is a section titled "For Internet Explorer 8 users" with the text: "These web-pages are optimized for 'Firefox'. Customers using the Internet Explorer 8 may change into the compatibility mode IE7 to get better results." At the bottom right of the main content area, there are icons for PDF and print. The footer of the website includes links for Sitemap, Contact, and Imprint. On the right side of the page, there are sections for "Related Pages" and "Contact persons", along with logos for GEWEX WCRP and the GCOS logo (Global Climate Observing System).





# What is PANGAEA?

- 1. PA  
Da
- 2. PA  
cor
- 3. PA  
Pro  
pra
- 4. The  
[Re](#)  
[anc](#)
- 5. Ea  
Dig
- 6. PA  
Sci



al

ific

[and](#)  
[les](#)

g a

rtal



## Present State of the WRMC: 6000 station-months available

Station	Short name	Station manager currently in charge	pre BSRN	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	All
Alice Springs	ASP	Bruce Forgan (B.Forgan@bom.gov.au)					12	12	12	12	12	12	11	12	12	12	12	12	12				X
Barrow	BAR	Ellsworth Dutton (Ellsworth.G.Dutton@noaa.gov)		12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	6		X
Bermuda	BER	Ellsworth Dutton (Ellsworth.G.Dutton@noaa.gov)		12	12	12	12	12	12	12	12	12	12	12	10	12	12	12	12	12	6		X
Billings	BIL	Charles Long (chuck.long@pnl.gov)			4	12	12	12	12	12	12	12	11	12	12	12	12	12	12	12	6		X
Bondville	BON	John Augustine (John.A.Augustine@noaa.gov)					12	12	12	12	12	12	12	12	12	12	12	12	12	12	6		X
Boulder, SURFRAD	BOS	John Augustine (John.A.Augustine@noaa.gov)					5	12	12	12	12	12	12	12	12	12	12	12	12	12	6		X
Boulder	BOU	Ellsworth Dutton (Ellsworth.G.Dutton@noaa.gov)		12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	6		X
Brasilia	BRB	Enio Bueno Pereira																8	10				X

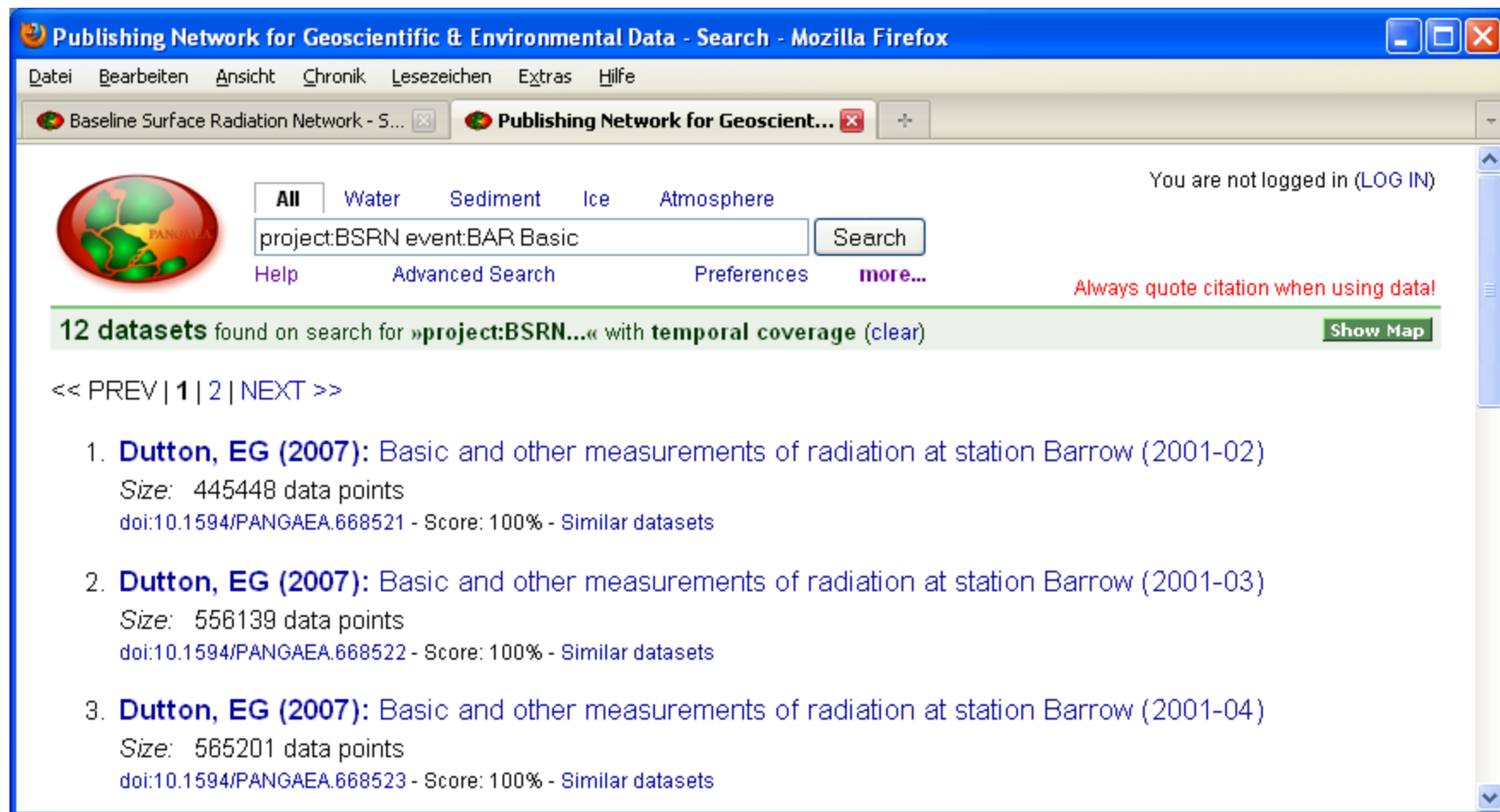
.....

Tamanrasset	TAM	Mohamed Mimouni (m_mimouni_dz@yahoo.fr)										10	12	12	12	12	12	12	12	12	12		X
Tateno	TAT	Nozomu Ohkawara (ohkawara@met.kishou.go.jp)						11	12	12	12	12	12	11	11	12	12	12	12	12	12		X
Toravere	TOR	Ain Kallis (kallis@aai.ee)									12	12	12	12	12	12	12	12	12	12	12	1	X
Xianghe	XIA	Xiangao Xia (xiangaoxia2000@yahoo.com)															12	12	12	8			X
Historical station	Eismitte		1																				X
	<b>All</b>			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			<b>pre BSRN</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>All</b>





# What offers PANGAEA?



The screenshot shows a Mozilla Firefox browser window displaying the PANGAEA search results page. The browser title is "Publishing Network for Geoscientific & Environmental Data - Search - Mozilla Firefox". The address bar shows the URL "Baseline Surface Radiation Network - 5...". The search results are for the query "project:BSRN event:BAR Basic".

Navigation: << PREV | 1 | 2 | NEXT >>

1. **Dutton, EG (2007):** Basic and other measurements of radiation at station Barrow (2001-02)  
Size: 445448 data points  
doi:10.1594/PANGAEA.668521 - Score: 100% - Similar datasets
2. **Dutton, EG (2007):** Basic and other measurements of radiation at station Barrow (2001-03)  
Size: 556139 data points  
doi:10.1594/PANGAEA.668522 - Score: 100% - Similar datasets
3. **Dutton, EG (2007):** Basic and other measurements of radiation at station Barrow (2001-04)  
Size: 585201 data points  
doi:10.1594/PANGAEA.668523 - Score: 100% - Similar datasets

# What offers PANGAEA?

PANGAEA presents well defined metadata for any dataset (no login)

**Dutton, Ellsworth (2007): Basic and other measurements of radiation at station Barrow (2001-12) - Mozilla Firefox**

Datei Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe

http://doi.pangaea.de/10.1594/PANGAEA.668531

*Citation:* **Dutton, Ellsworth (2007):** Basic and other measurements of radiation at station Barrow (2001-12), *Climate Monitoring & Diagnostics Laboratory, Boulder*, doi:10.1594/PANGAEA.668531

*Project(s):* **Baseline Surface Radiation Network (BSRN)**

*Coverage:* *West:* -156.6070 \* *East:* -156.6070 \* *South:* 71.3230 \* *North:* 71.3230  
*Minimum HEIGHT above ground:* 2.0 m \* *Maximum HEIGHT above ground:* 2.0 m  
*Date/Time Start:* 2001-12-01T00:00:00 \* *Date/Time End:* 2001-12-31T23:59:00

*Event(s):* **BAR** (Barrow) \* *Latitude:* 71.3230 \* *Longitude:* -156.6070 \* *Elevation:* 8.0 m \* *Date/Time:* 1992-01-01T00:00:00 \* *Location:* Alaska, United States of America \* *Campaign:* WCRP/GEWEX \* *Device:* Monitoring station \* *Comment:* BSRN station no: 22; Surface type: tundra; Topography type: flat, rural

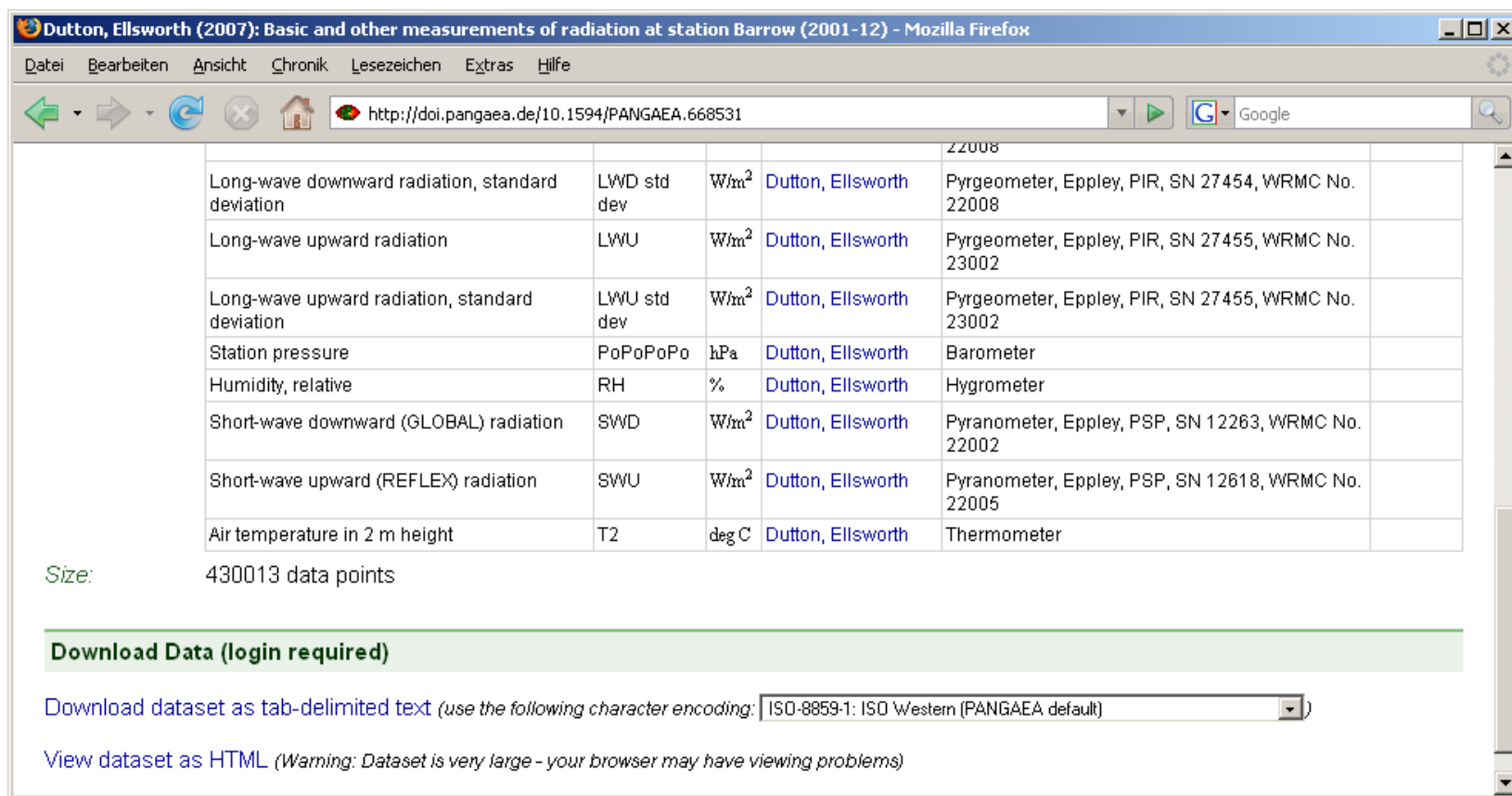
*Other version:* <ftp://ftp.bsrn.awi.de/bar/bar1201.dat.gz>

*Parameter(s):*

Parameter	Short Name	Unit	Principal Investigator	Method	Comment
DATE/TIME	Date/Time				<a href="#">Geocode</a>
HEIGHT above ground	Height	m			<a href="#">Geocode</a>
LATITUDE	Latitude				<a href="#">Geocode</a>
LONGITUDE	Longitude				<a href="#">Geocode</a>
Diffuse radiation	DIF	W/m <sup>2</sup>	Dutton, Ellsworth	Pyranometer, Eppley, 8-48, SN 32870, WRMC No. 22009	
Long-wave downward radiation	LWD	W/m <sup>2</sup>	Dutton, Ellsworth	Pyrgeometer, Eppley, PIR, SN 27454, WRMC No. 22008	

# What offers PANGAEA?

PANGAEA presents well defined metadata for any dataset (no login)



Long-wave downward radiation, standard deviation	LWD std dev	W/m <sup>2</sup>	<a href="#">Dutton, Ellsworth</a>	Pyrgeometer, Eppley, PIR, SN 27454, WRMC No. 22008
Long-wave upward radiation	LWU	W/m <sup>2</sup>	<a href="#">Dutton, Ellsworth</a>	Pyrgeometer, Eppley, PIR, SN 27455, WRMC No. 23002
Long-wave upward radiation, standard deviation	LWU std dev	W/m <sup>2</sup>	<a href="#">Dutton, Ellsworth</a>	Pyrgeometer, Eppley, PIR, SN 27455, WRMC No. 23002
Station pressure	PoPoPoPo	hPa	<a href="#">Dutton, Ellsworth</a>	Barometer
Humidity, relative	RH	%	<a href="#">Dutton, Ellsworth</a>	Hygrometer
Short-wave downward (GLOBAL) radiation	SWD	W/m <sup>2</sup>	<a href="#">Dutton, Ellsworth</a>	Pyranometer, Eppley, PSP, SN 12263, WRMC No. 22002
Short-wave upward (REFLEX) radiation	SWU	W/m <sup>2</sup>	<a href="#">Dutton, Ellsworth</a>	Pyranometer, Eppley, PSP, SN 12618, WRMC No. 22005
Air temperature in 2 m height	T2	deg C	<a href="#">Dutton, Ellsworth</a>	Thermometer

Size: 430013 data points

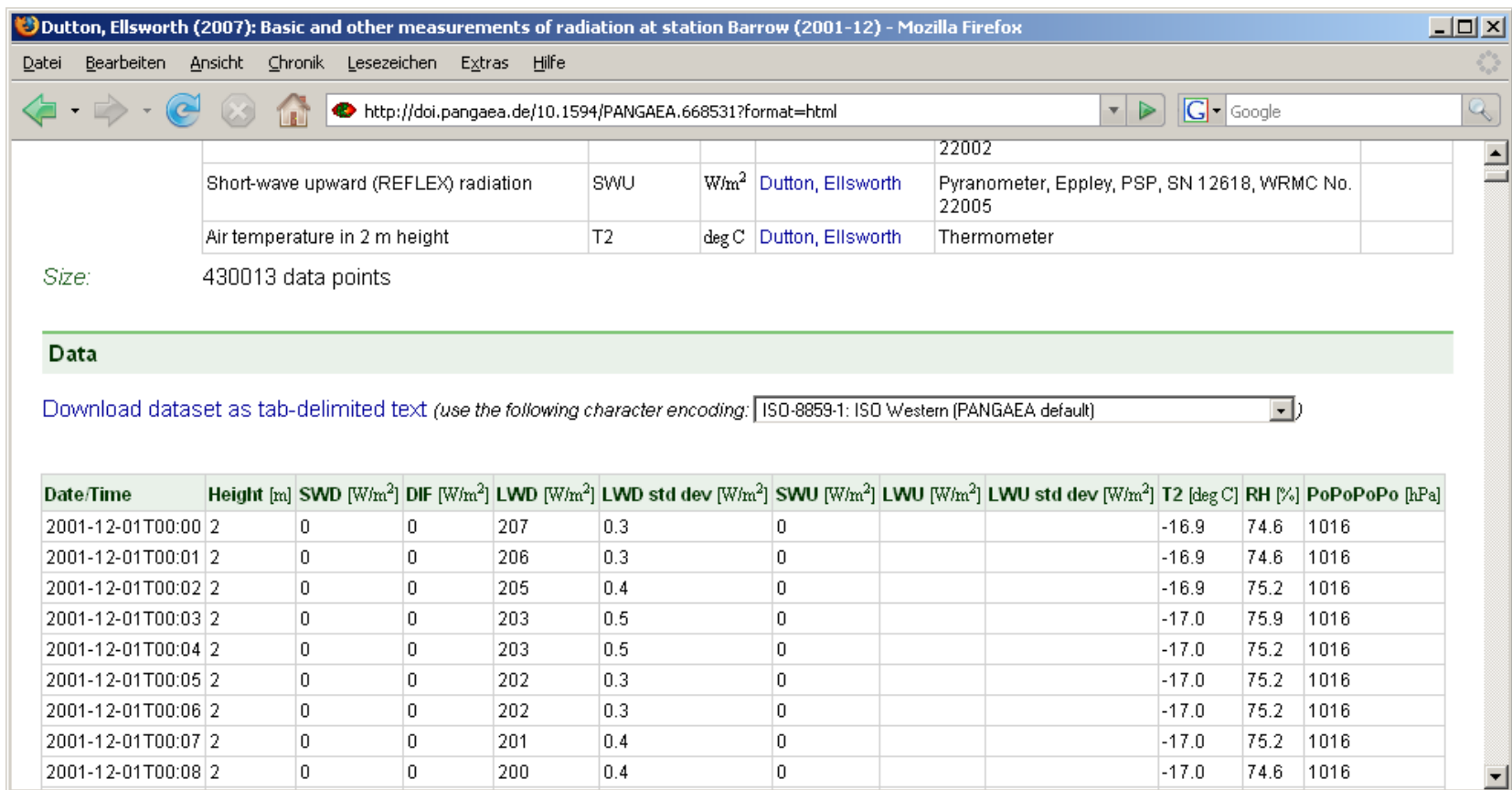
**Download Data (login required)**

Download dataset as tab-delimited text (use the following character encoding: )

View dataset as HTML (Warning: Dataset is very large - your browser may have viewing problems)

# What offers PANGAEA?

PANGAEA presents the data itself in different formats (ftp, text, html)



**Dutton, Ellsworth (2007): Basic and other measurements of radiation at station Barrow (2001-12) - Mozilla Firefox**

http://doi.pangaea.de/10.1594/PANGAEA.668531?format=html

Short-wave upward (REFLEX) radiation	SWU	W/m <sup>2</sup>	Dutton, Ellsworth	22002 Pyranometer, Eppley, PSP, SN 12618, WRMC No. 22005
Air temperature in 2 m height	T2	deg C	Dutton, Ellsworth	Thermometer

Size: 430013 data points

**Data**

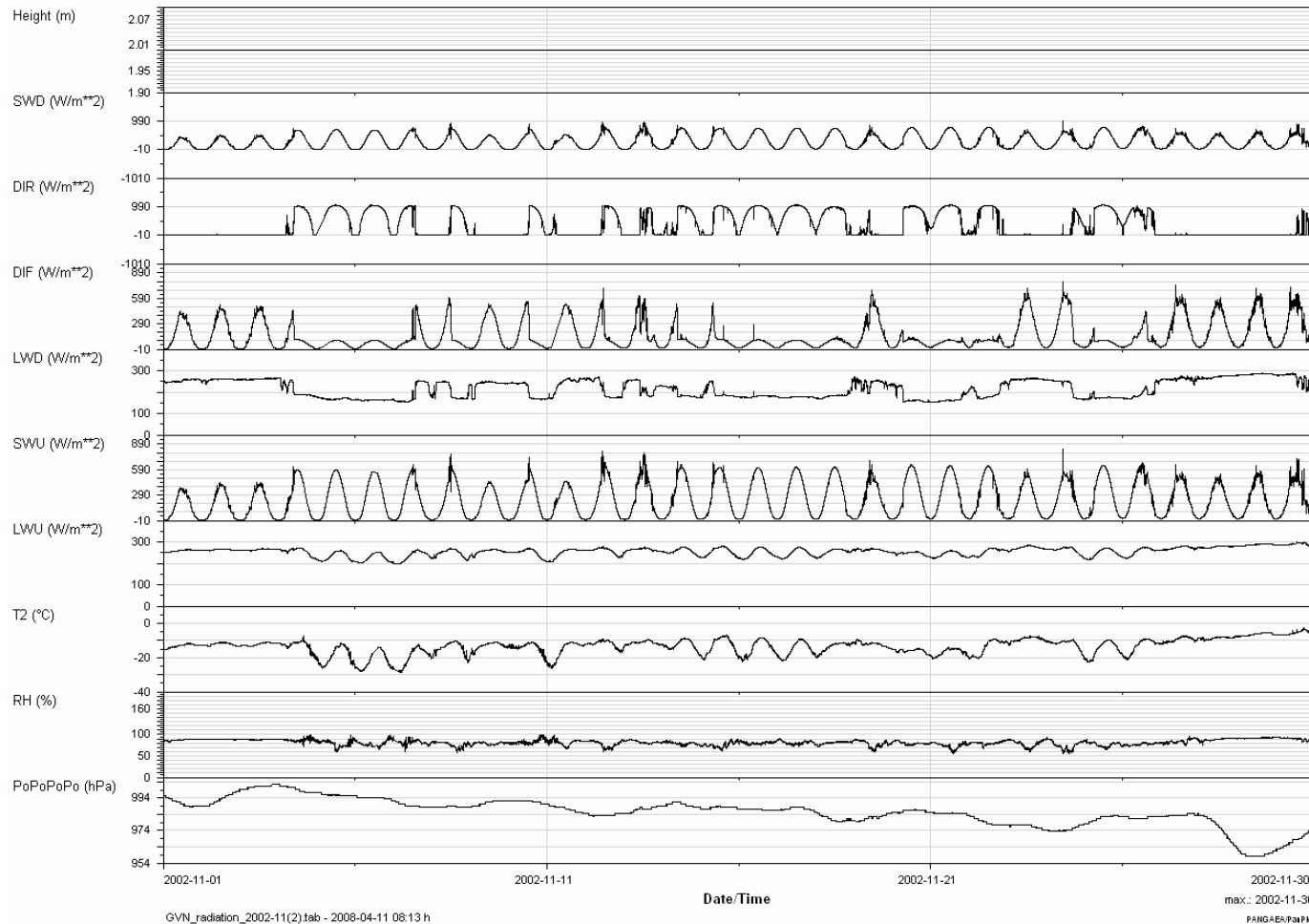
Download dataset as tab-delimited text (use the following character encoding: )

Date/Time	Height [m]	SWD [W/m <sup>2</sup> ]	DIF [W/m <sup>2</sup> ]	LWD [W/m <sup>2</sup> ]	LWD std dev [W/m <sup>2</sup> ]	SWU [W/m <sup>2</sup> ]	LWU [W/m <sup>2</sup> ]	LWU std dev [W/m <sup>2</sup> ]	T2 [deg C]	RH [%]	PoPoPoPo [hPa]
2001-12-01T00:00	2	0	0	207	0.3	0			-16.9	74.6	1016
2001-12-01T00:01	2	0	0	206	0.3	0			-16.9	74.6	1016
2001-12-01T00:02	2	0	0	205	0.4	0			-16.9	75.2	1016
2001-12-01T00:03	2	0	0	203	0.5	0			-17.0	75.9	1016
2001-12-01T00:04	2	0	0	203	0.5	0			-17.0	75.2	1016
2001-12-01T00:05	2	0	0	202	0.3	0			-17.0	75.2	1016
2001-12-01T00:06	2	0	0	202	0.3	0			-17.0	75.2	1016
2001-12-01T00:07	2	0	0	201	0.4	0			-17.0	75.2	1016
2001-12-01T00:08	2	0	0	200	0.4	0			-17.0	74.6	1016



# What offers PANGAEA?

## Quicklook with PanPlot





# Interactions between Archives

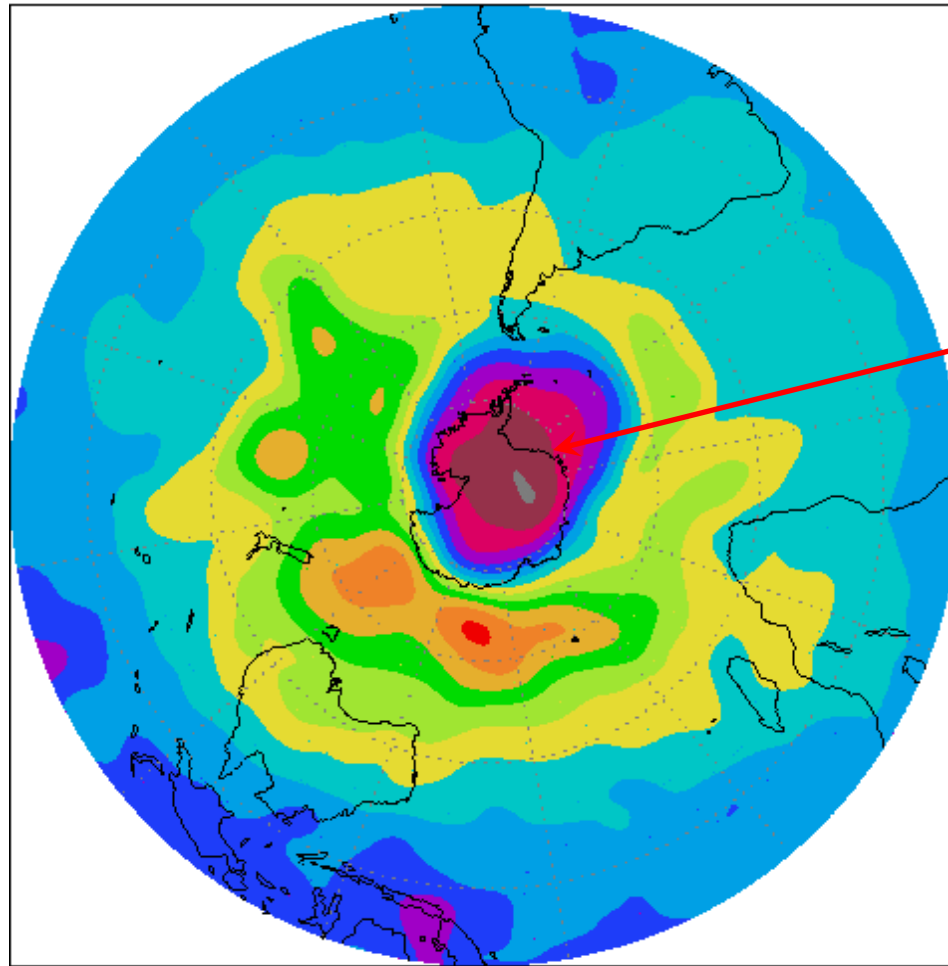
Pangaea can be harvested from other archives (xml metadata are iso conform )

```
<OAI-PMH xsi:schemaLocation="http://www.openarchives.org/OAI/2.0/ http://www.openarchives.org/OAI/2.0/OAI-PMH.xsd">
<responseDate>2009-09-10T19:05:24Z</responseDate>
<request verb="GetRecord" metadataPrefix="iso19139" identifier="oai:pangaea.de:doi:10.1594/PANGAEA.269656">http://ws.pangaea.de/oai/</request>
-
<GetRecord>
-
<record>
-
<header>
<identifier>oai:pangaea.de:doi:10.1594/PANGAEA.269656</identifier>
<datestamp>2009-07-06T16:19:20Z</datestamp>
<setSpec>geocode1599</setSpec>
<setSpec>geocode1600</setSpec>
<setSpec>geocode1601</setSpec>
<setSpec>project4094</setSpec>
</header>
-
<metadata>
-
```

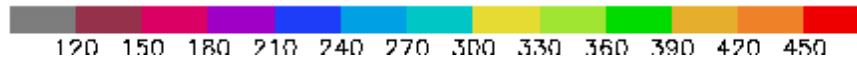
➔ The WRMC became a candidate for a Data Collection or Production Centre (DCPC) within the WMO Information System (WIS)



# Neumayer Station

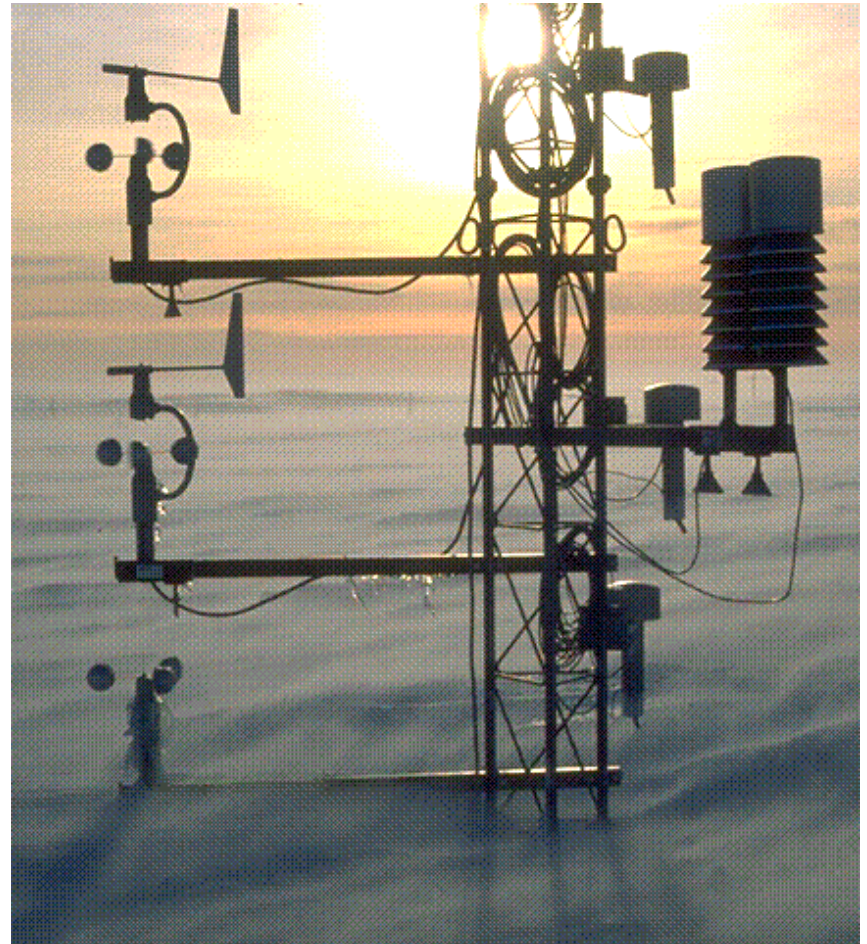


**Neumayer**



Dobson Units

1. **Global Telecommunication System (GTS)**
2. **Baseline Surface Radiation Network (BSRN)**
3. **Network for the Detection of Atmospheric Composition Change (NDACC)**
4. **Global Atmospheric Watch (GAW)**
5. **World Ozone and Ultraviolet Radiation Data Centre (WOUDC)**





## CERTIFICATE OF RECOGNITION

This Certificate is awarded to the operators of

89002 Neumayer  
Germany (Antarctica)

*in recognition of high-quality observations  
for the GCOS Surface Network,  
by having met ([✓]) the following criteria:*

- [✓] Station provided at least 75% of CLIMAT reports in 2003 and 2004
- [✓] Station has sent at least 50% of all possible historical daily data to the GSN Archive
- [ ] Station provided 100% of CLIMAT reports in 2003 and 2004, and has sent at least 75% of all possible historical daily data, amounting to at least 40 years in total, to the GSN Archive

Global Climate Observing System Secretariat  
Geneva, Switzerland  
July 2005



## CERTIFICATE OF RECOGNITION

This Certificate is awarded to the operators of

89002 Neumayer  
Germany (Antarctica)

*in recognition of high-quality observations  
for the GCOS Upper-Air Network,  
by having met ([✓]) the following criteria:*

- [✓] Station showing at least 90% performance in 2003 and 2004 in temperature, wind, and humidity observations
- [ ] Station showing at least 95% performance in 2003 and 2004 in temperature, wind and humidity observations, no month with less than 50%, and regular twice-daily reporting

Global Climate Observing System Secretariat  
Geneva, Switzerland  
July 2005



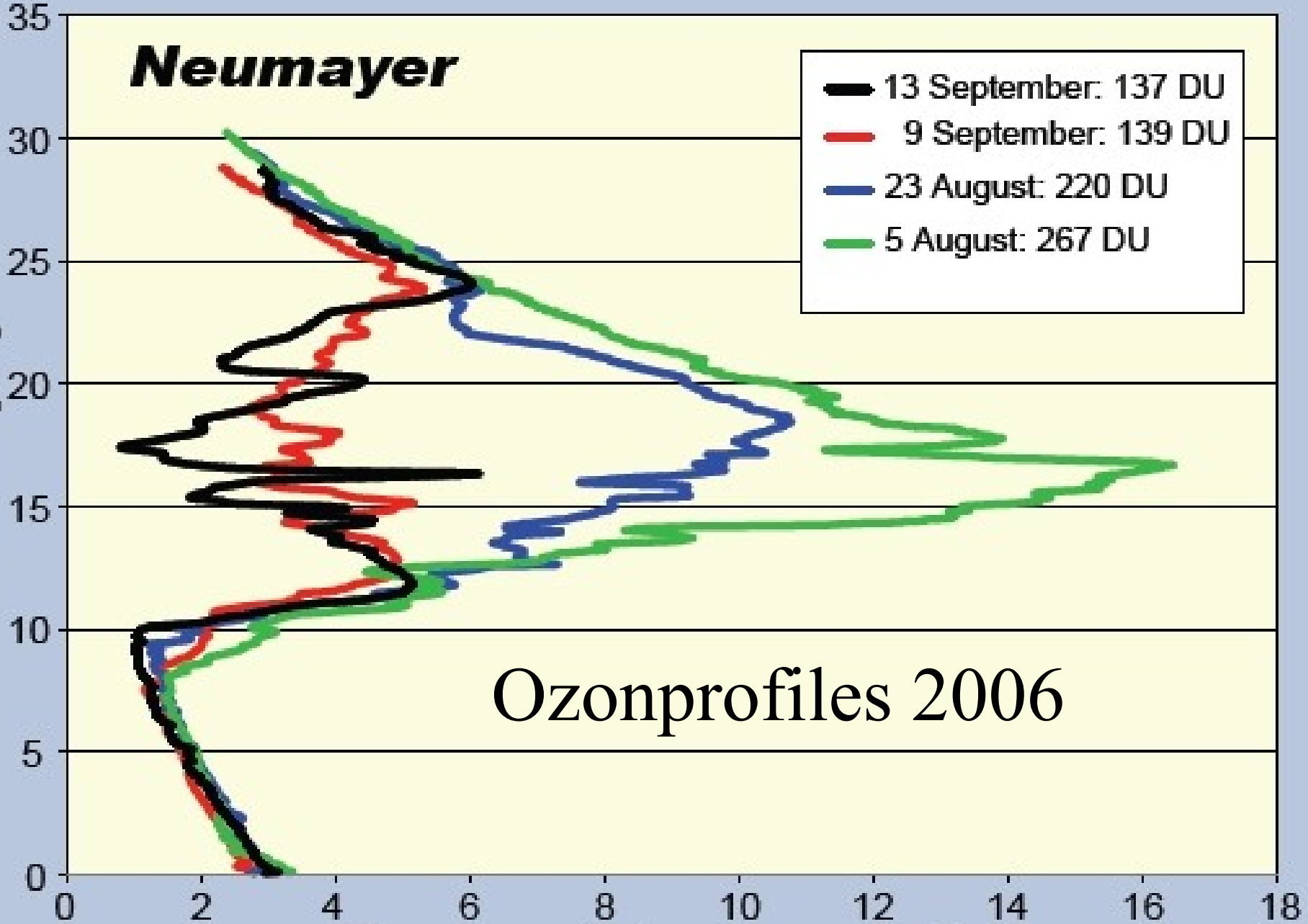
# Neumayer

- 13 September: 137 DU
- 9 September: 139 DU
- 23 August: 220 DU
- 5 August: 267 DU

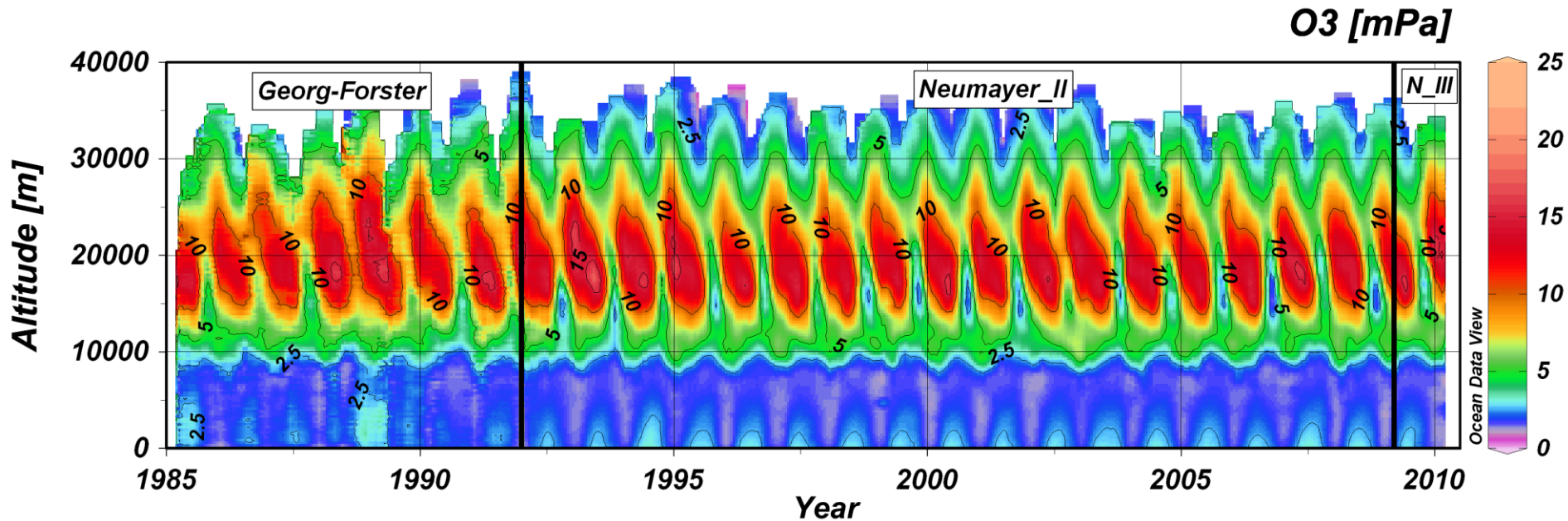
Altitude [km]

Ozonprofiles 2006

Ozone partial pressure [mPa]



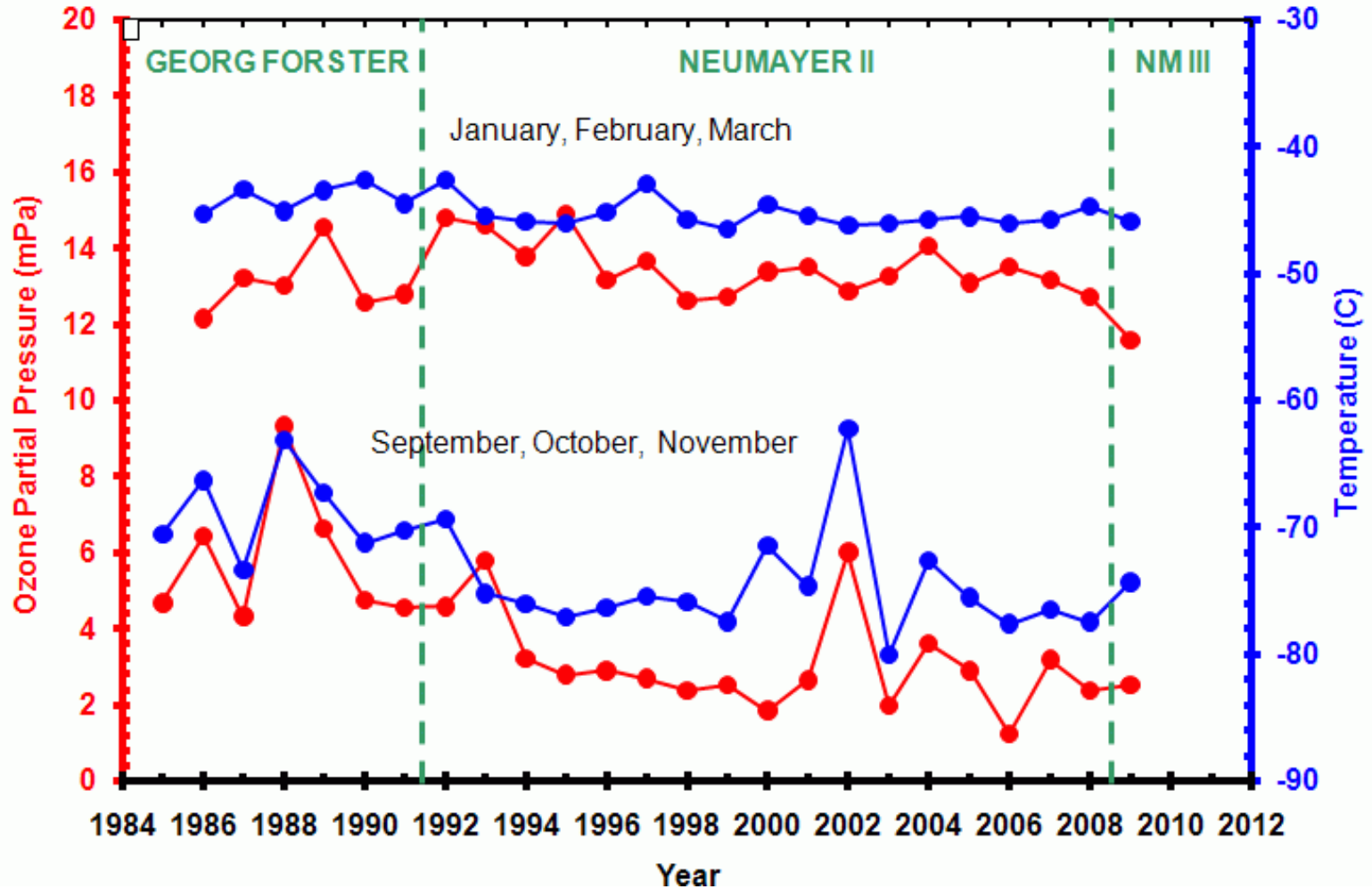
# 25 Years of Ozone Soundings







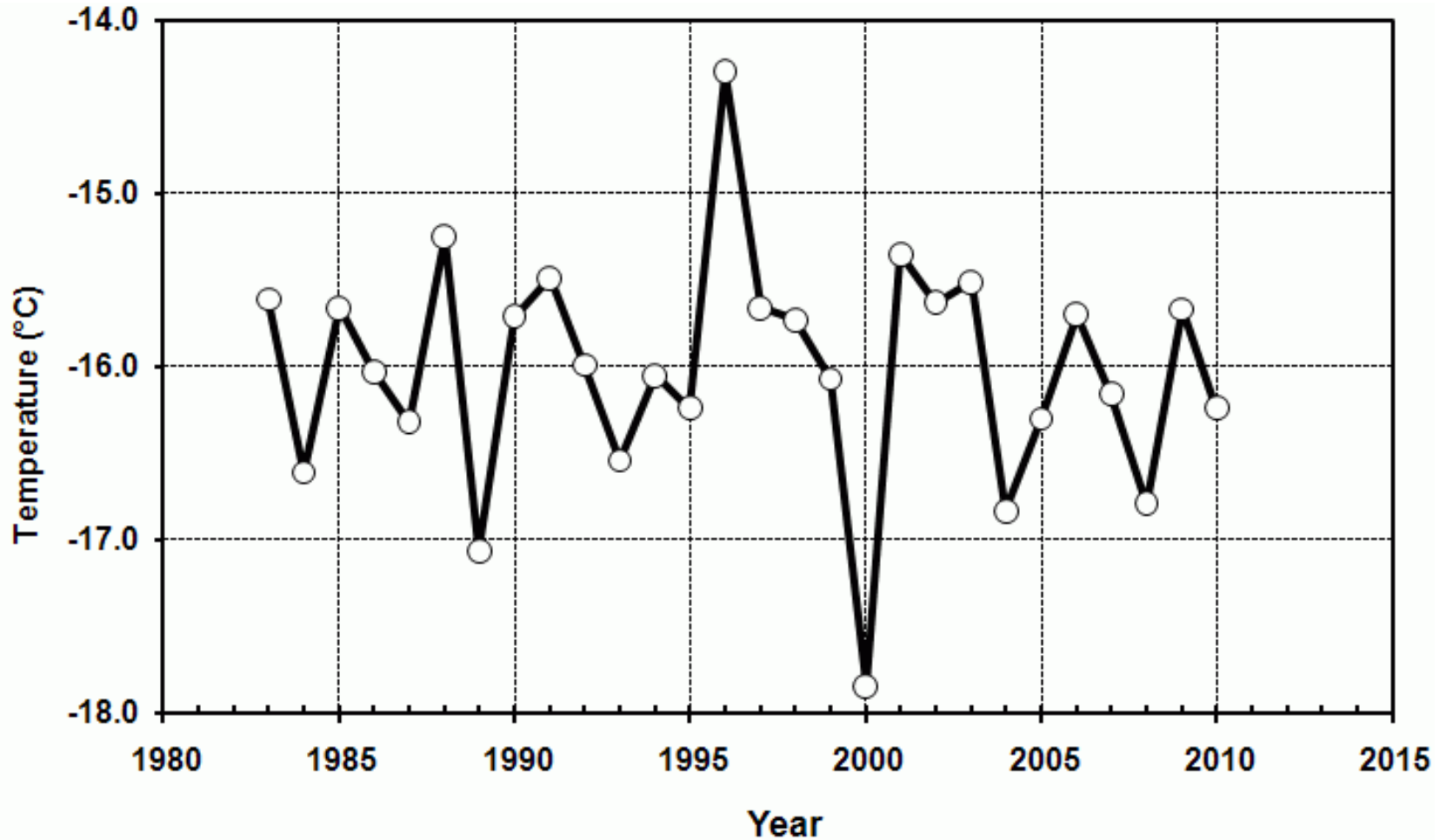
# 25 Years of Ozone Soundings







# Yearly Averaged Air Temperature at Neumayer



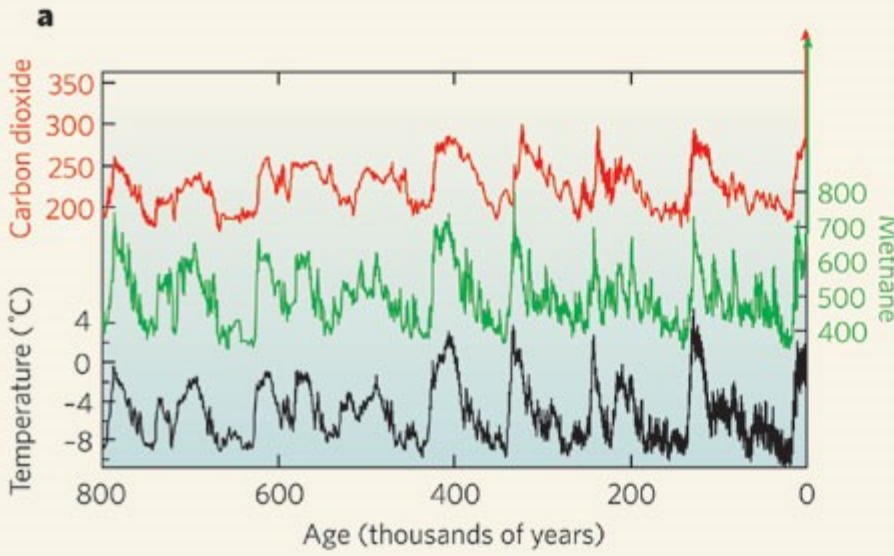
category	sampling method	analysed compounds	institute
long lived trace gases	compressed air (200 bar)	SF <sub>6</sub> , CH <sub>4</sub> , <sup>13</sup> CH <sub>4</sub> , CH <sub>3</sub> <sup>2</sup> H, <sup>14</sup> CH <sub>4</sub>	UHEI-IUP
		<sup>85</sup> Kr, N <sub>2</sub> O, δ <sup>15</sup> N-N <sub>2</sub> O*, δ <sup>18</sup> O-N <sub>2</sub> O*	UHEI-IUP/IAR
	compressed air (2 bar) (flask sampling)	CO <sub>2</sub> , <sup>13</sup> C-CO <sub>2</sub> , <sup>18</sup> O-CO <sub>2</sub> N <sub>2</sub> O, CH <sub>4</sub> , SF <sub>6</sub> , CO, H <sub>2</sub>	UHEI-IUP
	absorption (in NaOH)	<sup>14</sup> CO <sub>2</sub>	UHEI-IUP
water vapour			
	cryogenic sampling	H <sub>2</sub> O, δ <sup>2</sup> H- H <sub>2</sub> O, δ <sup>18</sup> O- H <sub>2</sub> O, <sup>3</sup> H- H <sub>2</sub> O	UHEI-IUP
reactive trace gases	low volume sampling (teflon/nylon filter combination)	SO <sub>4</sub> <sup>2-</sup> , NO <sub>3</sub> <sup>-</sup> , Cl <sup>-</sup> , MSA, Na <sup>+</sup> , NH <sub>4</sub> <sup>+</sup> , HNO <sub>3</sub> , SO <sub>2</sub>	AWI
aerosol	high volume sampling	SO <sub>4</sub> <sup>2-</sup> , NO <sub>3</sub> <sup>-</sup> , Cl <sup>-</sup> , MSA, Na <sup>+</sup> , NH <sub>4</sub> <sup>+</sup> , ...	UHEI-IUP/AWI
	(Whatman 541 filter)		
		trace elements*	AWI
	high volume sampling	<sup>210</sup> Pb, <sup>7</sup> Be, <sup>10</sup> Be*	UHEI-IUP
fresh snow		SO <sub>4</sub> <sup>2-</sup> , NO <sub>3</sub> <sup>-</sup> , Cl <sup>-</sup> , MSA, Na <sup>+</sup> , NH <sub>4</sub> <sup>+</sup> , <sup>210</sup> Pb, <sup>10</sup> Be, ...	AWI/UHEI-IUP

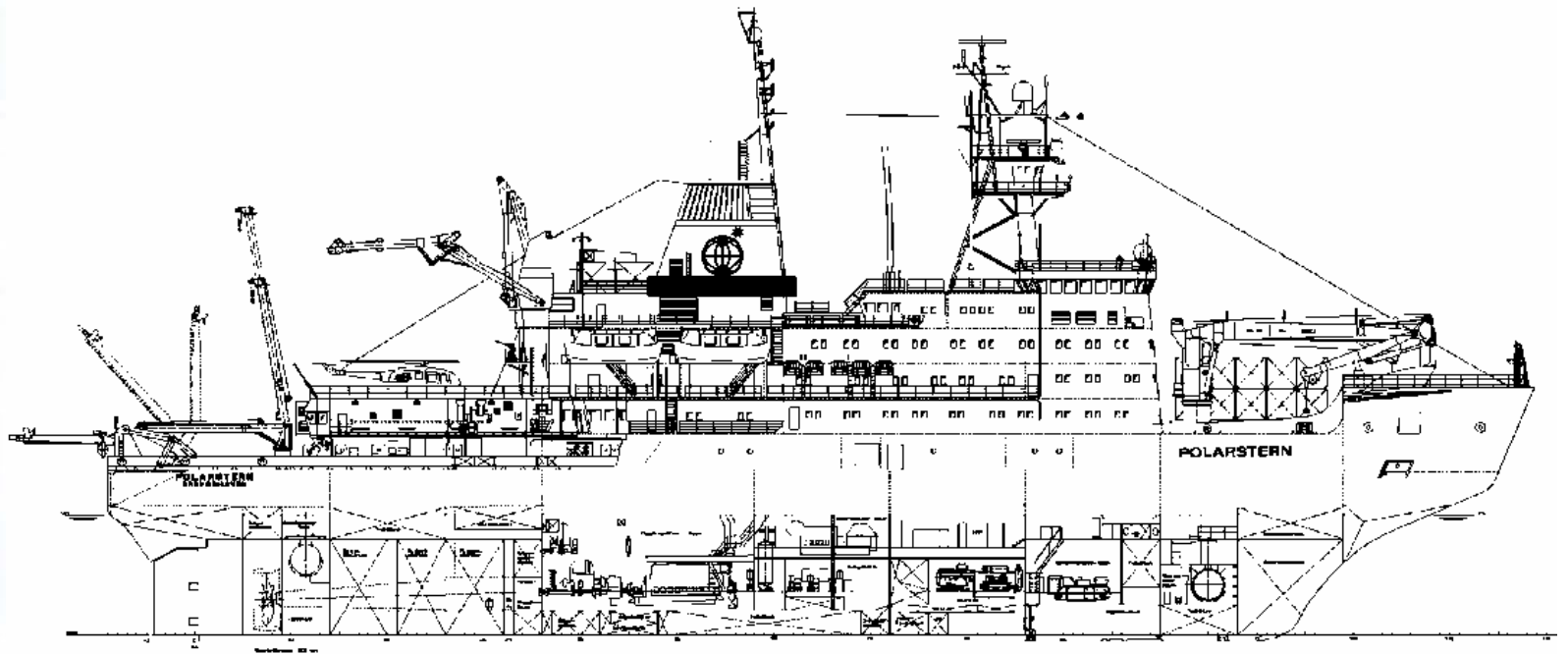


# Air Chemistry Observatory at Neumayer

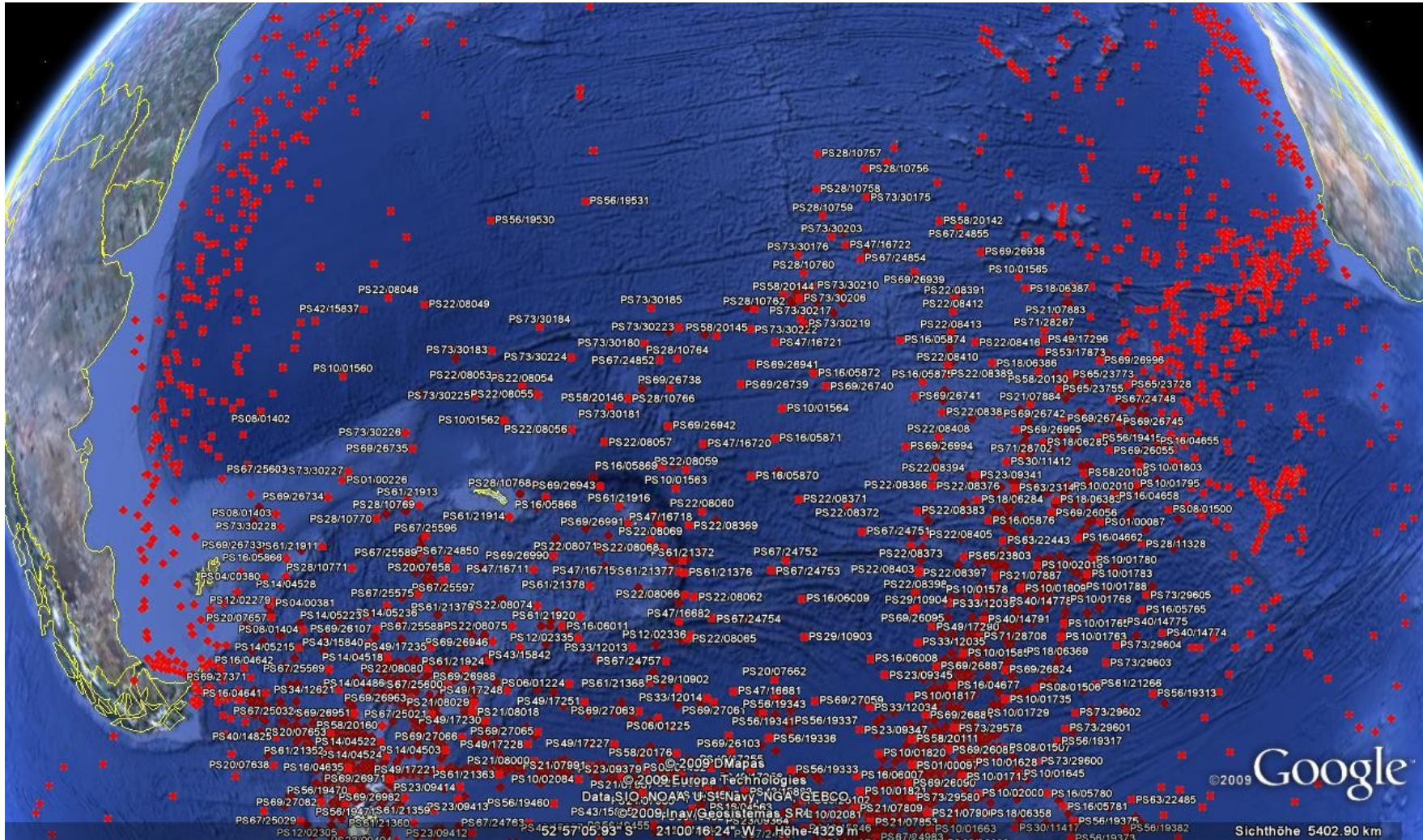
category	property	method	institute
aerosols physical properties	particles (>10 nm)	condensation particle counter (CPC)	AWI
	ultra fine particles (>3 nm)	CPC	AWI
	non volatile particles	thermo-denuder / CPC	DLR/AWI
	aerosol size distribution 0.5-20 $\mu\text{m}$	optical particle counter	AWI
	black carbon, aerosol absorption	Aethalometer and Multi Angle Absorption Photometer (MAAP)	DLR/AWI
	aerosol scattering	integrating nephelometer	AWI
trace gases	$^{222}\text{Rn}$	$\alpha$ -spectroscopy of $^{214}\text{Po}$	UHEI-IUP
	surface $\text{O}_3$	UV-absorption	AWI
trace gases	column density of $\text{O}_3$ , $\text{NO}_2$ , $\text{OCIO}$ , ...	UV spectroscopy (DOAS)	IUPH

# Ice Coring











# **WDC-MARE Reports**

0004  
**2006**



## **25 Years of Polarstern Meteorology (1982-2006)**

---

Gert König-Langlo, Bernd Loose, Benny Bräuer

---

**WORLD DATA CENTER FOR MARINE ENVIRONMENTAL SCIENCES**

Alfred Wegener Institute for Polar and Marine Research, Bremerhaven  
MARUM Center for Marine Environmental Sciences, Bremen



## Oceanographic observations made by the AWI

The web interface to the Oceanographic Database with XBT -, CTD -, Bottle -, and Mooring Data was no longer supported. All Datasets for external and free access were transferred to [PANGAEA](#).

Use the search tool in „PangaVista“ or one of the pre-defined collections below:

[XBT North](#)

[XBT South](#)

[XBT Atlantic Transects](#)

[CTD Arctic](#) [CTD Fram Strait](#)

[CTD Antarctic](#) [CTD Prime Meridian](#) [CTD Weddell Sea](#)

[Moorings Arctic](#)

[Moorings Antarctic](#)

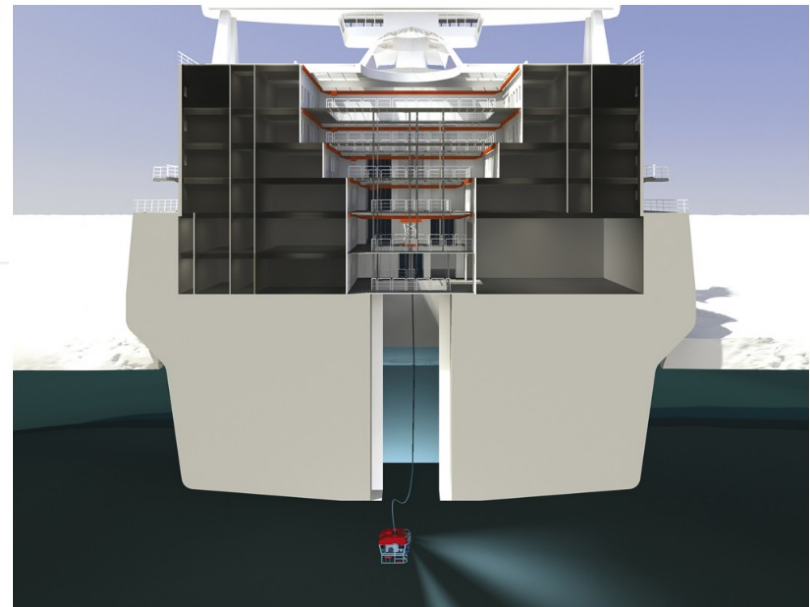
For data sets which were not found in PANGAEA send an inquiry by email to:

[G. Rohardt](#)

[Weddell Sea Moorings](#)



# Aurora Borealis



Mittwoch, 17. November 2010

## **Neues Forschungsschiff POLARSTERN II**

Auf der letzten Sitzung des Wissenschaftsrates des Bundes wurde entschieden, die Entwicklung eines Forschungsschiffneubaus weiter voranzutreiben.

Die mit ca. 450 Mio. Euro veranschlagte POLARSTERN II könnte dann ca. 2016 in Betrieb gehen und die mittlerweile doch schon ziemlich betagte POLARSTERN I ablösen.



# WDC Mare at AWI/Marum

**WDC-MARE - World Data Center for Marine Environmental Sciences**  
Biogeochemistry, Circulation, and Life of Present and Past Oceans

**HOME**  
PROJECTS  
DATA  
REPORTS  
SERVICE  
ABOUT

**Database status**  
Projects: 180  
Data sets: 494,493  
Data items: 5,694,007,260

**Image of the day**

**Objectives**  
The World Data Center for Marine Environmental Sciences (WDC-MARE) is aimed at collecting, scrutinizing, and disseminating data related to Global Change and earth system research in the fields of environmental oceanography, marine geosciences, and marine biology. It focuses on georeferenced data using the PANGAEA information system as its long-term archive and publication unit.  
WDC-MARE is maintained by the Alfred Wegener Institute for Polar and Marine Research (AWI), a research center of the Helmholtz Association, and the Center for Marine Environmental Sciences (MARUM), University of Bremen. Additional support is provided by the DFG Research Center Ocean Margins (rcom).

**Latest News** [Archive]

- 2010-05-11**  
A copy of the [European Pollen Database \(EPD\)](#) is transferred to PANGAEA for archiving
- 2010-05-07**  
The WDC-MARE web site is included in the historic collection of Internet materials of the [United States Library of Congress](#)
- 2010-03-09/10**  
4th data curators workshop at MARUM, Bremen
- 2009-06-02**  
[International Science Council to Revamp World Data Centers](#)
- 2009-06-01**  
A project is under way to set up a [portal for the new World Data System](#) led by Michael Diepenbroeck, director of WDC-MARE.
- 2009-05-01**  
PANGAEA becomes archive for supplementary data related to publications from marine research through a cooperation with Elsevier (Example [doi:10.1016/j.marmicro.2007.09.002](#)).
- 2009-03-01**  
Data warehouse operational
- 2008-02-01**  
Data rescue for NoE EUR-OCEANS starts
- 2007-11-12**  
The information system PANGAEA wins one of the [InfoWorld 100 Awards](#).
- 2007-11-13/14**  
During the 3rd curators workshop, improvements of data flow and access are discussed by 17 project data curators.
- 2007-10-11/12**  
Data archiving becomes integral part of the DFG priority program for polar research. WDC-MARE is defined as one of the major data archives for marine research within the International Polar Year 2007/2009 (IPY).
- 2007-05-07/09**  
[International Conference of World Data Centers](#) in Bremen, organized by WDC-MARE ([find a note in AGU EOS](#)).
- 2006-12-07-09**  
WDC-MARE is presented during the annual SCOR meeting in London.

All text is available under the terms of the [GNU Free Documentation License](#) [info@wdc-mare.org](mailto:info@wdc-mare.org)





# Advanced Data Management



C3 Consortium

## Scientific Users

MPI-M  
(Max Planck Institute for Meteorology)  
IFM-GEOMAR  
(Leibniz Institute of Marine Sciences)  
University of Cologne  
Freie Universität Berlin  
PIK  
(Potsdam Institute for Climate Impact Research)  
DLR  
(German Aerospace Center)  
AWI  
(Alfred Wegener Institute for Polar and Marine Research)  
GKSS

## Partners in information sciences

University of Dortmund  
Zuse Institute Berlin (ZIB)

## Data provider

*World Data Centers*  
– WDC Climate  
– WDC Mare  
– WDC RSAT

DWD  
(German Meteorological Service)

DKRZ  
(German Climate Computing Center)  
PIK  
(Potsdam Institute for Climate Impact Research)  
AWI  
(Alfred Wegener Institute for Polar and Marine Research)  
IFM-GEOMAR  
(Leibniz Institute of Marine Sciences)

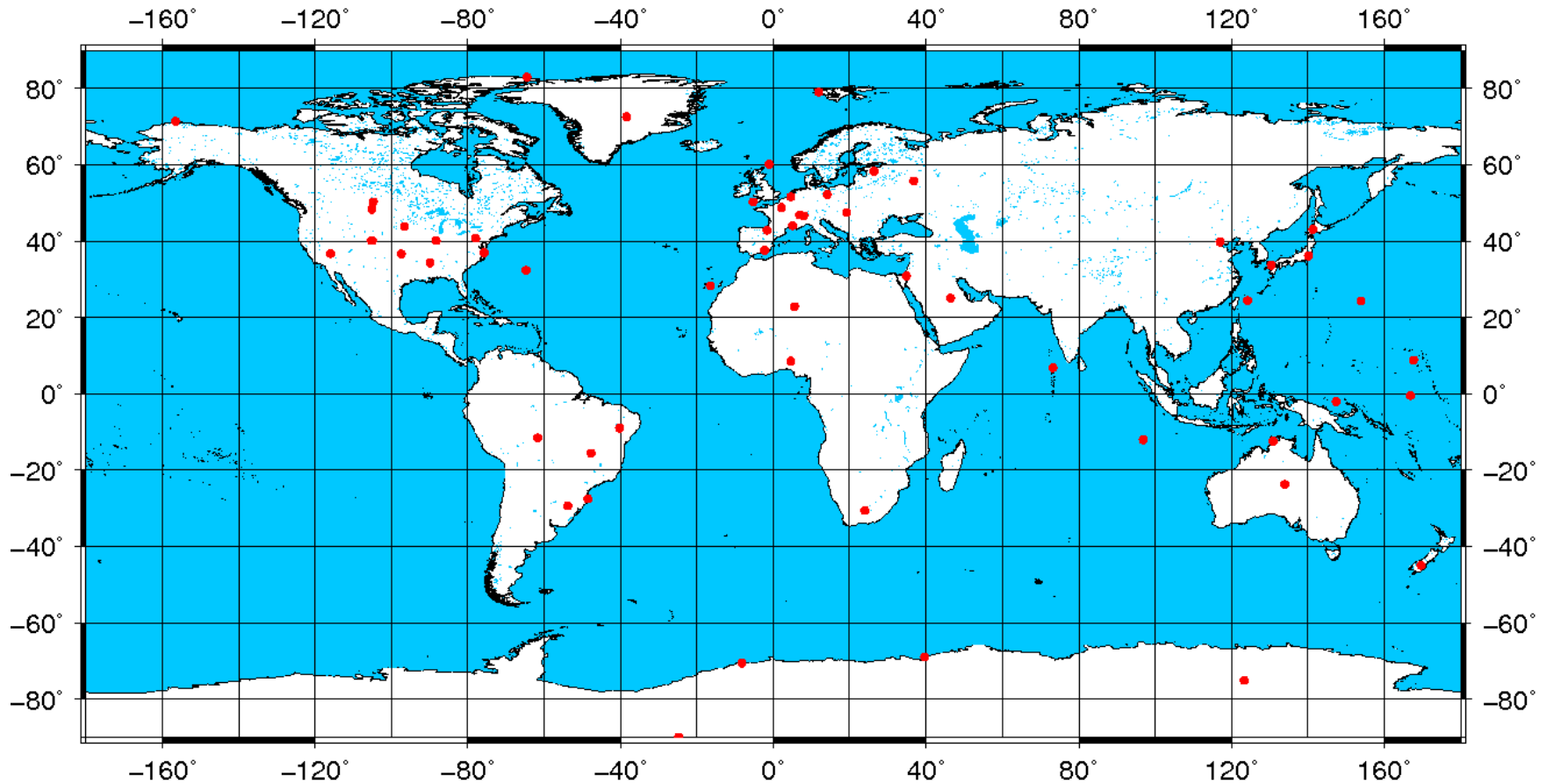
## Associate Partners

University of Hannover  
University of Bonn  
Forschungszentrum Karlsruhe

Sun Microsystems, Inc.  
NEC Corporation  
Brockmann Consult



# Building Capacity





# Building Capacity

Ilorin: Nigeria

De Aar: South Africa

## WASCAL

West African Science Service  
Center on Climate and Adapted  
Land Use

### BMBF WASCAL-Initiative?

Gesamt-Leiter: Paul Vlek,  
Meteorologie: Harald Kunstmann  
Im Rahmen von WASCAL sollen mit  
Hilfe des DWD auch Klimamessungen  
in Afrika unterstützt .

### WASCAL Graduiertenschule?

Meteorologie in Nigeria  
(Universität Akure).

