The Baseline Surface Radiation Network: Surface Radiation Observations for Climate Research

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WRMC-BSRN
World Radiation Monitoring Center- Baseline Surface Radiation Network

Baseline Surface Radiation Network (BSRN)

- **Conceived and implemented in late 1980s by World Climate Research Programme (WCRP)**

- **In Mid-1990s BSRN designated as contributing network to WMO Global Atmospheric Watch (GAW) Program**

- **In early 2000s designated as the Global Baseline Surface Radiation Network of the Global Climate Observing System (GCOS)**

- **To fulfill institutional obligations to the broader climate/scientific community:**

  – **Currently reports to GCOS/Atmospheric Observations Panel for Climate (AOPC) chaired by Dr Kenneth Holmlund (and panel includes Dr James Butler)**

  – **Under auspices of Global Energy and Water Cycle Experiment (GEWEX) Data and Assessments Panel (GDAP) chaired by Dr. Jörg Schulz**

BSRN Objectives

- **Monitor the surface shortwave and longwave radiative components and their changes with the best methods and instrumentation currently available (*Detailed observations*)**
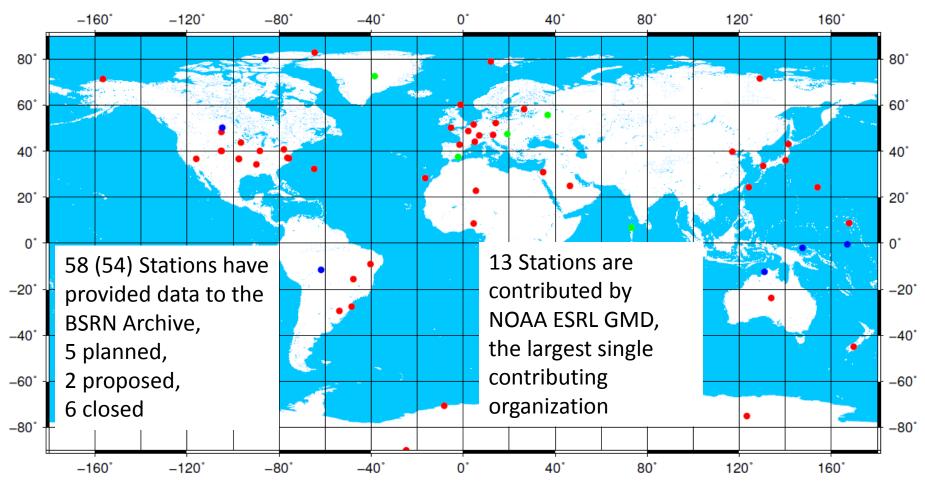 - **Spatially and climatologically diverse sampling**
- **Provide accurate data for the calibration of satellite-based estimates of the surface radiative fluxes (*Global coverage*)**
- **Produce high quality observational data for validating the theoretical computations of radiative fluxes by models (*Climate prediction*)**

BSRN Objectives

- **Intended not only to carry out the measurements, but also to improve fundamental measurement capabilities.**
  - Goal is to provide the highest possible quality data from continuously-operated field sites.
- **BSRN has developed instrumentation, calibration, and operating practices that fulfill highest specifications**
  - McArthur L.J.B. 2004: Baseline Surface Radiation Network (BSRN). Operations Manual. WMO/TD-No. 1274, WCRP/WMO.
- **Volunteer organization, with stations sponsored by host organizations and governments**

Current Stations

Running, planned, and closed BSRN Stations, March 2015

58 (54) Stations have provided data to the BSRN Archive,
5 planned,
2 proposed,
6 closed

13 Stations are contributed by NOAA ESRL GMD, the largest single contributing organization

- Running Stations
- Planned Stations
- Closed Stations

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UND MEERESFORSCHUNG

BSRN Station Requirements

- **Most important: long-term involvement by an expert in surface radiation measurement**
  - **Designated Station Scientist**
  - **Perpetuate long-term measurements**
  - **Participate in the activities of BSRN**
- **Site should be representative of surrounding area**
  - **Though inhomogeneous regions need to be represented also**

BSRN Station Requirements

- **Reasonable access for routine inspections and instrument service to ensure data quality**

- **Timely submission of quality controlled data to Archive**

- **Highly desirable that site be near routine upper-air soundings and have basic meteorological instrumentation**

Measurements

- **Basic measurements:**
  - **Downwelling global, diffuse, and direct SW, downwelling LW**
  - **air temperature, relative humidity, pressure**
- **Basic plus:**
  - **Upwelling SW and LW**
  - **wind speed & direction**
  - **Upper Air obs (sondes) [within 50 km]**
  - **Synoptic meteorological observations (Incl cloud amounts and types, surface met, surface condition, visibility, etc.)**

Measurements

- **Expanded measurements:**
  - Spectral SW
  - UV
  - measured cloud information
  - water vapor, ozone, etc.

- **See: http://bsrn.awi.de/data/measurements.html**

BSRN Archive

- **Denoted as the <u>World Radiation Monitoring Center</u>**

- **Was initiated by Dr Atsumu Ohmura in 1992 and operated at ETH Zurich until 2007**
  - **(German: Eidgenössische Technische Hochschule Zürich)**

- **Since 2008 operated by the Alfred Wegener Institute for Polar and Marine Research (AWI), Germany**
  - **Under the direction of <u>Dr. Gert Koenig-Langlo</u>**

- **All data are interactively available for any scientist who accepts the data release guidelines**

Present State of the WRMC: 7825 (6719) 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	2011	
Alert	ALE	David Halliwell (David.Halliwell@ec.gc.ca)																						
Alice Springs	ASP	Bruce Forgan (B.Forgan@bom.gov.au)					12	12	12	12	12	12	11	12	12	12	12	12						
Barrow	BAR	Ellsworth Dutton (Ellsworth.G.Dutton@noaa.gov)		12	12	12	12	12	12	12	12	12	12	12	12	12							X	
Bermuda	BER	Ellsworth Dutton (Ellsworth.G.Dutton@noaa.gov)		12	12	12	12	12	12	12	12	12	12	12	10								X	
Billings	BIL	Charles Long (chuck.long@pnl.gov)			4	12	12	12	12	12	12	12	11								7	12	4	X	
Bondville	BON	John Augustine (John.A.Augustine@noaa.gov)					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	6				X	
Boulder	BOU	Ellsworth Dutton (Ellsworth.G.Dutton@noaa.gov)		12	12	12	12	12								12	12	12	12	12	2		X	
Brasilia	BRB	Enio Bueno Pereira (eniobp@cptec.inpe.br)														8	10	4	9	12	12	5	X	
Cabauw	CAB	Wouter Knap (knap@knmi.nl)													11	12	12	12	12	12	12	4	X	
Camborne	CAM	Patrick Fishwick (patrick.fishwick@metoffice.com)										12	12	12	12	12	12	6				X	
Carpentras	CAR	Jean-Philippe Morel (jean-philippe.morel@meteo.fr)						12	12	12	12	12	12	12	12	12	12	12	12	12	5	X	
Chesapeake Light	CLH	Fred M. Denn (Frederick.M.Denn@nasa.ge									8	12	11	12	12	12	12	12	12	12	12	6	X	

Serra																							
Solar Village	SOV	Naif Al-Abbadi							3	12	12	12	12										X	
South Pole	SPO	Ells		12	12	10	12	12	12	12	12	12	12	12	12	12	12	12	12	12	2		X	
Syowa	SYO	go.jp)			12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	11	X	
Sioux Falls		stine@noaa.gov)												7	12	12	12	12	12	6			X	
Tamanra		n_mimcuni_dz@yahoo.fr)							10	12	12	12	12	12	12	12	12	12	12	12	4	X	
		nd (ijima@met.kishou.go.jp)					11	12	12	12	12	12	12	12	12	12	12	12	12	12	4	X	
		asilii Kustov (kustov@aar.ru)																		7	9		X	
		Ain Kallis (kallis@aai.ee)								12	12	12	12	12	12	12	12	12	12	12	5	X	
	XIA	Xiangao Xia (xiangaoxia2000@yahoo.com)													12	12	12	8			X	
orical station	Eismitte		1																			X	
	All			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			pre BSRN	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	All

~ 650 (560) years of radiation measurements

Gert König-Langlo, BSRN Meeting 2014
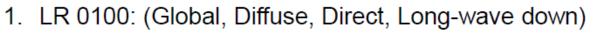
Present State of the WRMC: Datasets

The typical average interval for radiation data is 1 minute: Stations
                                                                  2014 (2012)

1. LR 0100: (Global, Diffuse, Direct, Long-wave down)   58 (54)
2. LR 0300: (Reflex, Long-wave up)   14   (9)
3. LR 0500: (UV)   14 (12)
4. LR 1000: (Synops)   13 (12)
5. LR 1100: (Upper air soundings)   29 (29)
6. LR 1200: (Total ozone)   9   (9)
7. LR 1300: (Aerosol optical depths) (under construction)   (14)
8. LR 1300: (Ceilometer data)   3   (3)
9. LR 30x0: (Radiation measurements from tower)   13   (13)

Total of 23 stations measure complete up and down radiation budget

Gert König-Langlo, BSRN Meeting 2014

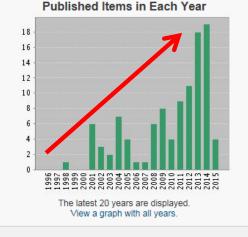# BSRN Scientific Review and Workshop

- **Held Biennially**
- **Hosted by Station Scientist and Institution**
  - **Last: Christian Lanconelli, Institute of Atmospheric Sciences and Climate, Bologna, Italy, 9-12 September 2014**
- **Includes Working Group sessions, Station and Working Group reports, presentations relevant to BSRN goals and data, proposals for new BSRN sites**

- **WCRP Report No. 17/2014, available at:**
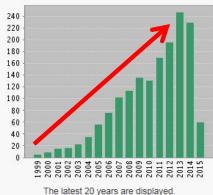 - **http://www.wcrp-climate.org/resources-room/wcrp-reports**

13th BSRN Workshop Participants

Scientific Impact

Cited almost 1500 times without self-citations
In almost 1200 articles
Producing an h-index of 19…
And climbing!

Summary

- **BSRN includes 58 stations with contributed data (13 from GMD)**
  - **~ 650 station-years of observations**
  - **Dispersed from 90° S through 82° N**
- **Has devised specifications for accurate long-term surface radiation observations**
  - **International collaboration of radiative expertise**
- **Increasing recognition, use, and scientific impact**

Thank You!

Chuck.long@noaa.gov; http://bsrn.awi.de

Extra slides

NOAA ESRL GMD BSRN Sites

- **Alert ALE Lincoln Sea, Station scientist: Christopher Cox**
- **Barrow BAR Alaska, USA Station scientist: David Longenecker**
- **Bermuda BER Bermuda, Station scientist: David Longenecker**
- **Bondville BON Illinois, USA   Station scientist: John A. Augustine**
- **Boulder BOS Colorado, USA Station scientist: John A. Augustine**
- **Boulder BOU Colorado, USA, Station scientist: David Longenecker**
- **Desert Rock DRA Nevada, USA, Station scientist: John A. Augustine**
- **Fort Peck FPE Montana, USA, Station scientist: John A. Augustine**
- **Goodwin Creek GCR Mississippi, USA, Station scientist: John A. Augustine**
- **Kwajalein KWA North Pacific Ocean, Station scientist: David Longenecker**
- **Rock Springs PSU Pennsylvania, USA, Station scientist: John A. Augustine**
- **Sioux Falls SXF South Dakota, USA, Station scientist: John A. Augustine**
- **South Pole SPO Antarctica, Station scientist: David Longenecker**

BSRN Working Groups (Active)

- **Infrared Working Group (Julian Gröbner)**
- **Long-Term Data Sets Working Group (Martial Haeffelin)**
- **Archive Working Group (Gert König-Langlo)**
- **Cold Climate Issues Working Group (Chuck Long)**
- **Oceanic Working Group (Gary Hodges)**

BSRN Working Groups

- **Un-Chaired:**
  - **Uncertainties Working Group**
  - **Broadband Pyranometry and Pyrheliometry**
  - **Spectral Radiometry Working Group**
  - **Albedo**
  - **Aerosol Optical Depth (AOD)**
- **Past:**
  - **Clouds Parameters Working Group**
  - **UV and PAR Working Groups**