

MEASUREMENT
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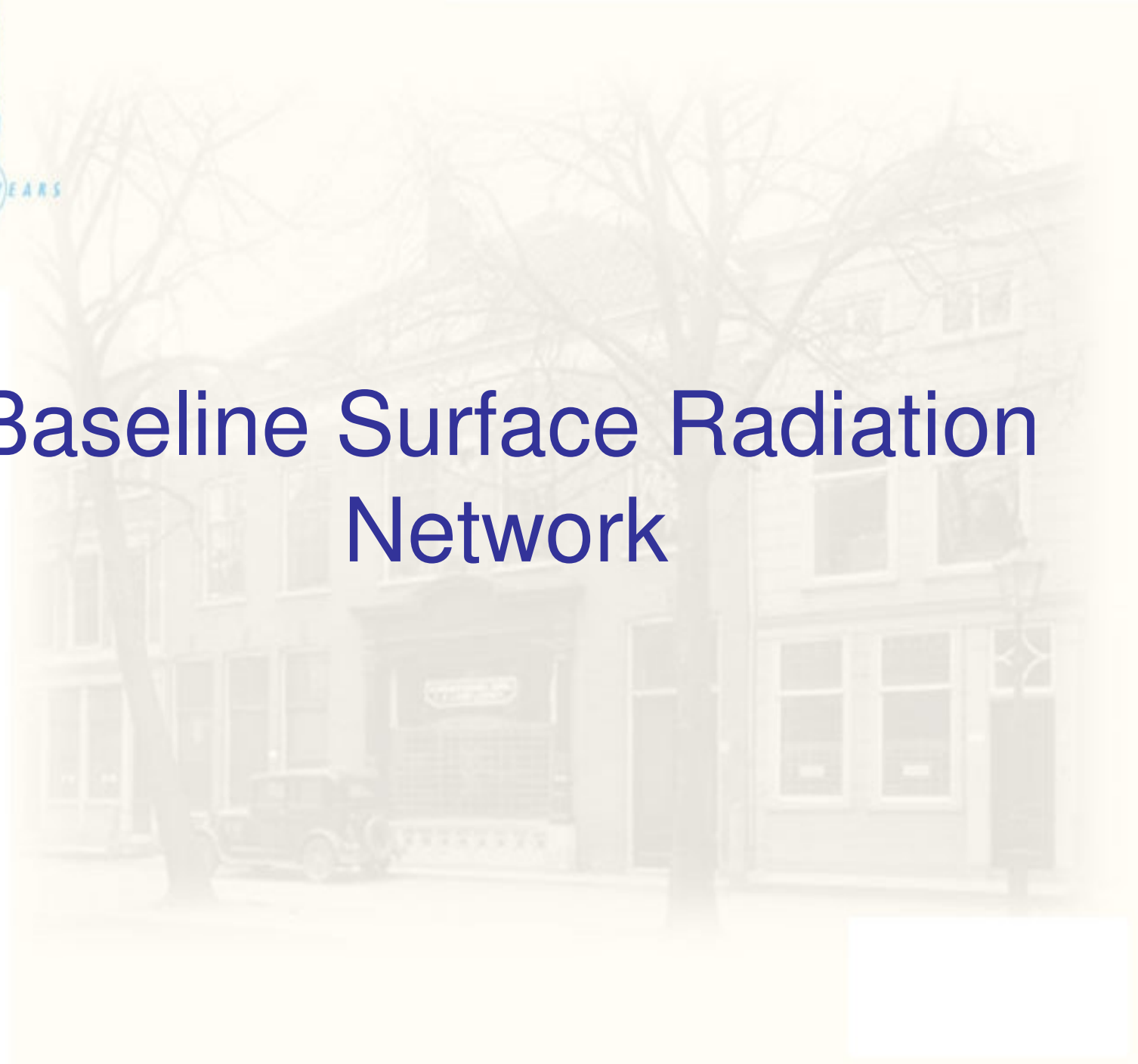


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175 YEARS

BSRN SOLAR MONITORING STATION

Baseline Surface Radiation Network



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BSRN Mission Objective ...

To establish and maintain a worldwide instrument network for the continuous measurement of radiative fluxes at the Earth's surface, for the purpose of quantifying short and long-term trends in global climate temperature.

BSRN Solar Monitoring Station

- ☀ Solar Tracker: K&Z 2AP-GD / With Shading
- ☀ Normal Incidence Pyrheliometer: K&Z CH-1
- ☀ Diffuse Pyranometer: K&Z CMP22/CMP21
- ☀ Total Global Pyranometer: K&Z CMP21
- ☀ Down-welling IR Pyrgeometer: K&Z CG4
- ☀ Surface Reflected Pyranometer: K&Z CMP21
- ☀ Upwelling Global IR Pyrgeometer: K&Z CG4
- ☀ CV2 Ventilation for Global Radiometers
- ☀ Data Logger: Campbell Scientific CR23X



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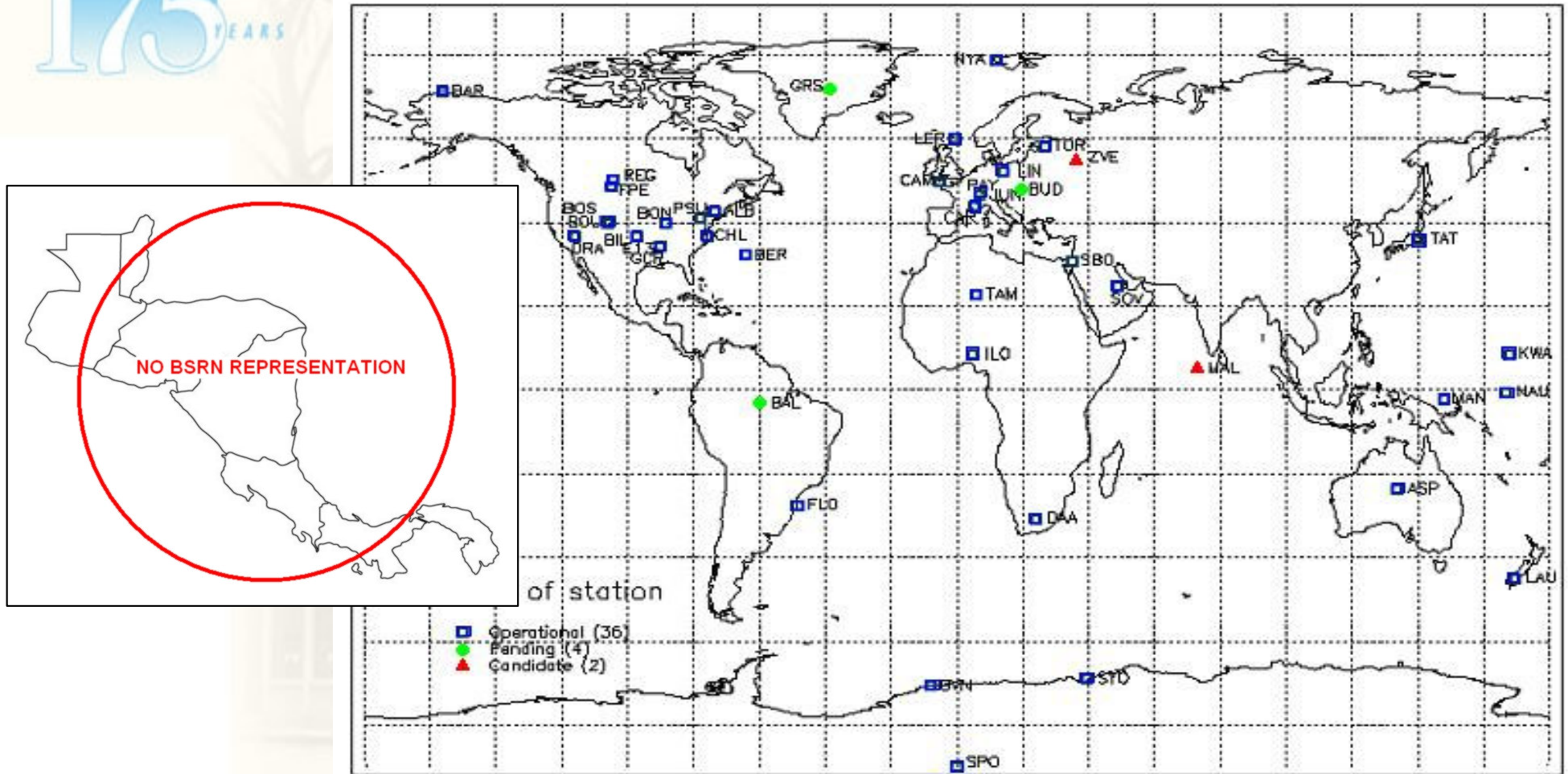


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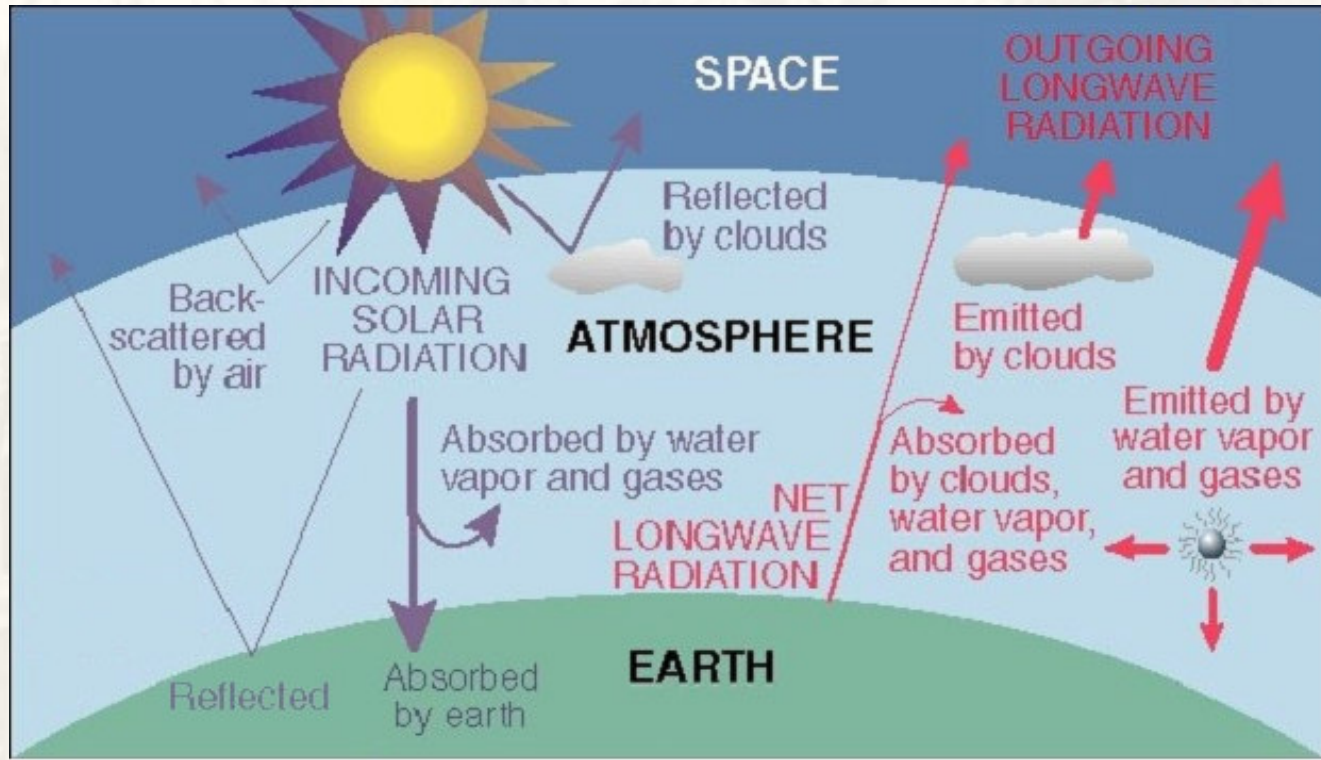
BSRN Global Site Map



Note: Currently no BSRN representation in Central America

Solar Constant
1.94 cal cm⁻² min⁻¹

Global Energy Balance



Global Irradiance

$$K_{\downarrow} = S + D$$

Net SW radiation

$$K^* = (S + D) - (S + D)a$$

Reflected Solar

$$K_{\uparrow} = (S + D)a$$

FIR
(L_↓)

Net FIR
 $L^* = L_{\downarrow} - L_{\uparrow}$

(L_↑)
FIR

Total Net Radiation

$$Q^* = [(S + D) - (S + D)a] + L_{\downarrow} - L_{\uparrow}$$

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Radiometry

Radiometry is the detection and measurement of radiant energy, either as separate wavelengths or integrated over a broad wavelength band, and the interaction of radiation with matter in such ways as absorption, reflectance and emission.

GLOBAL PYRANOMETERS

SPECIFICATIONS	CM21	CM6B
Operating range	0.1 - 1100 W/m ²	0.1 - 1100 W/m ²
Accuracy	±0.5%	±0.5%
Response time	100 ms	100 ms
Temperature range	-40 to 70 °C	-40 to 70 °C
Material	Aluminum	Aluminum
Weight	1.2 kg	1.2 kg
Dimensions (H x W x D)	110 x 110 x 110 mm	110 x 110 x 110 mm
IP rating	IP65	IP65
Output	4-20 mA	4-20 mA
Power supply	12V DC	12V DC
Calibration	Factory	Factory

FIR PYRGEOMETERS CG SERIES

SPECIFICATIONS	CG3	CG4	CG5
Operating range	0.1 - 1100 W/m ²	0.1 - 1100 W/m ²	0.1 - 1100 W/m ²
Accuracy	±0.5%	±0.5%	±0.5%
Response time	100 ms	100 ms	100 ms
Temperature range	-40 to 70 °C	-40 to 70 °C	-40 to 70 °C
Material	Aluminum	Aluminum	Aluminum
Weight	1.2 kg	1.2 kg	1.2 kg
Dimensions (H x W x D)	110 x 110 x 110 mm	110 x 110 x 110 mm	110 x 110 x 110 mm
IP rating	IP65	IP65	IP65
Output	4-20 mA	4-20 mA	4-20 mA
Power supply	12V DC	12V DC	12V DC
Calibration	Factory	Factory	Factory

UV RADIOMETERS UV-S SERIES

SPECIFICATIONS	UV-S-1C	UV-S-2C	UV-S-3C	UV-S-4C
Operating range	0.1 - 1100 W/m ²	0.1 - 1100 W/m ²	0.1 - 1100 W/m ²	0.1 - 1100 W/m ²
Accuracy	±0.5%	±0.5%	±0.5%	±0.5%
Response time	100 ms	100 ms	100 ms	100 ms
Temperature range	-40 to 70 °C	-40 to 70 °C	-40 to 70 °C	-40 to 70 °C
Material	Aluminum	Aluminum	Aluminum	Aluminum
Weight	1.2 kg	1.2 kg	1.2 kg	1.2 kg
Dimensions (H x W x D)	110 x 110 x 110 mm	110 x 110 x 110 mm	110 x 110 x 110 mm	110 x 110 x 110 mm
IP rating	IP65	IP65	IP65	IP65
Output	4-20 mA	4-20 mA	4-20 mA	4-20 mA
Power supply	12V DC	12V DC	12V DC	12V DC
Calibration	Factory	Factory	Factory	Factory

PYRHELIOMETERS

SPECIFICATIONS	PRO-6
Operating range	0.1 - 1100 W/m ²
Accuracy	±0.5%
Response time	100 ms
Temperature range	-40 to 70 °C
Material	Aluminum
Weight	1.2 kg
Dimensions (H x W x D)	110 x 110 x 110 mm
IP rating	IP65
Output	4-20 mA
Power supply	12V DC
Calibration	Factory

BL TEMPERATURE PROFILER MTP5

SPECIFICATIONS	MTP5
Operating range	0.1 - 1100 W/m ²
Accuracy	±0.5%
Response time	100 ms
Temperature range	-40 to 70 °C
Material	Aluminum
Weight	1.2 kg
Dimensions (H x W x D)	110 x 110 x 110 mm
IP rating	IP65
Output	4-20 mA
Power supply	12V DC
Calibration	Factory

BSRN Site Selection Considerations

- ☀ Select site representative of large area, $\geq 100 \text{ Km}^2$
- ☀ Environmental conditions should be consistent with region (non micro-climate area)
- ☀ Selected process should consider possible impact of unnatural manmade structures
- ☀ Site selection should consider long-term regional development of surrounding area (ideally non)
- ☀ Site should not be in the proximity of airports and other sources of industrial emissions
- ☀ Select site where no significant land use changes are planned to maintain consistent albedo
- ☀ Site selection should consider possible long-term changes in local horizon
- ☀ *Note: Selected site should minimize masking of global & regional climatic trends.*

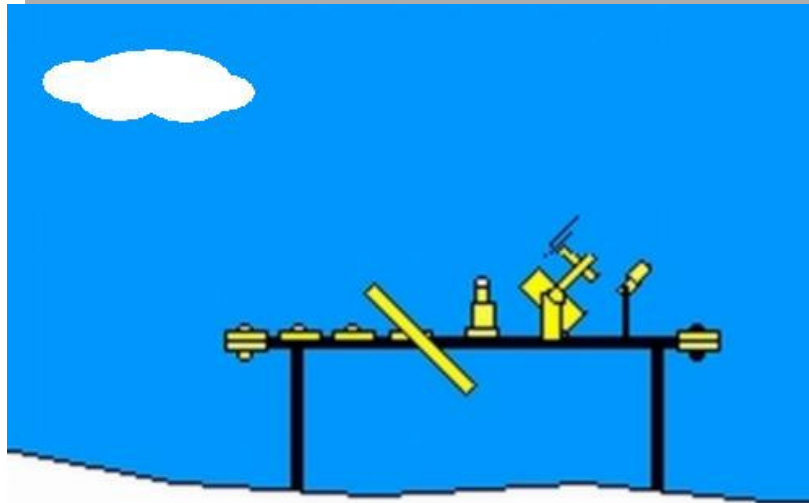
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BSRN SITE, NEUMAYER ANTARCTICA

- ☀ Global SW Radiation
- ☀ Reflected SW Radiation
- ☀ Global Diffuse
- ☀ Direct Solar
- ☀ PAR

- ☀ Global UVA & UVB
- ☀ Sunshine Duration
- ☀ AOD (Sunphotometer)
- ☀ Up & Down-welling FIR



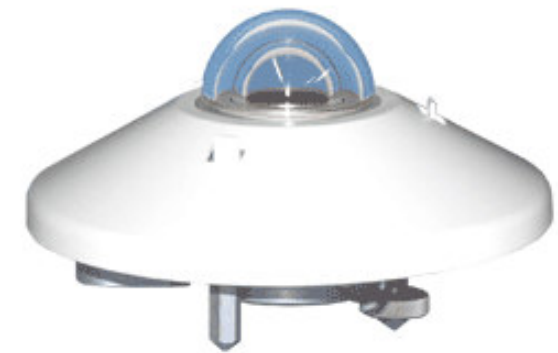
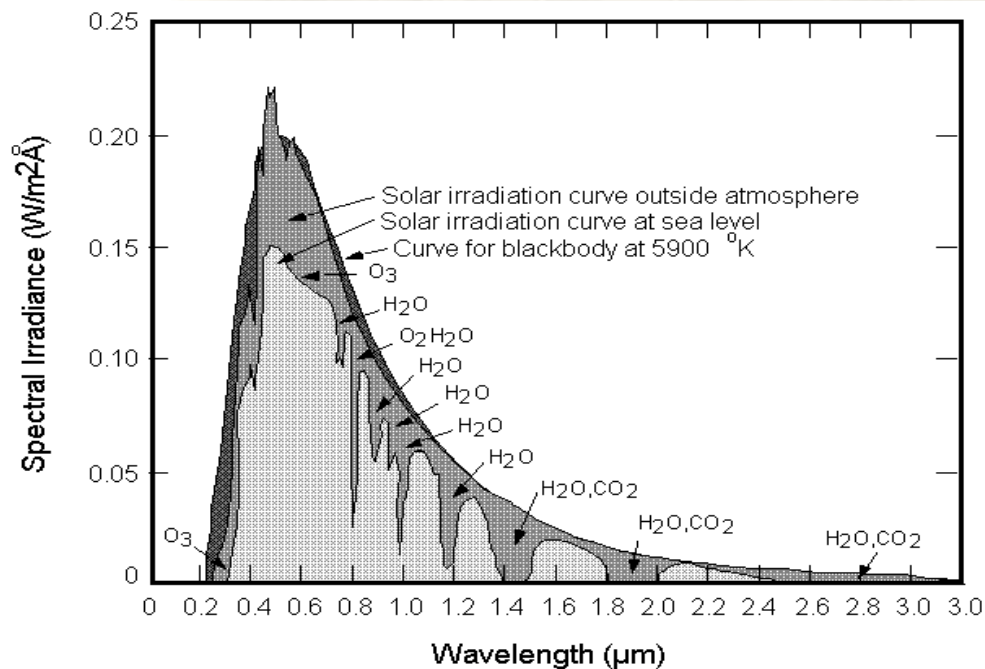
K & Z Superior Manufacturing

- ☀ ISO 9001-2000 Certified
- ☀ WMO / ISO Compliant
- ☀ Characterized Cosine Response
- ☀ Characterized Temp Dependence
- ☀ ISO 9847 Calibration, WRR Traceable

K & Z Superior Performance

- ☀ Directional Response
- ☀ Leveling Accuracy
- ☀ Thermal Offset A & B Effects
- ☀ Temperature Dependence
- ☀ Long Term Stability
- ☀ Non Linearity

Global Solar Radiation



CM
HIGH PRECISION PYRANOMETER

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Normal Incidence Direct Solar Radiation

CH1
NORMAL INCIDENCE PYRHELIOMETER



High Reliability

- ☀ ISO 9001-2000 Certified
- ☀ WMO / ISO 9060 Compliant
- ☀ Double Shell Aluminum Housing
- ☀ Active Temperature Compensation
- ☀ Calcium Fluoride Window Option
- ☀ Long Term Stability

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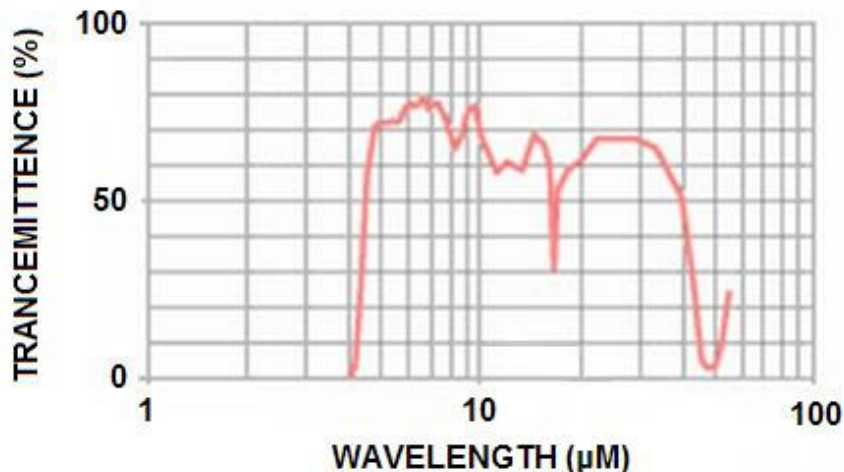
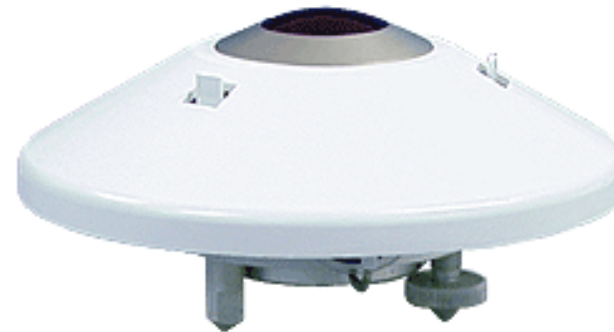
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K & Z Innovative Engineering ...

- ☀ Elliptical Dome (180° FOV)
- ☀ Hard Carbon Coating
- ☀ Improved Dome Thermal Interface
- ☀ Dome Thermistor Eliminated
- ☀ Even Interference Filter Layer
- ☀ For Shade & Unshaded Applications

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CG4
PYRGEOMETER



$$L_d = \frac{U_{emf}}{S} + 5.67 \cdot 10^{-8} \cdot T_b^4$$

L_d = Downward atmospheric longwave radiation [W/m²]

$\frac{U_{emf}}{S}$ = Net - radiation (Difference between the downward longwave radiation emitted from the atmosphere and the upward irradiance of the CG 4 sensor) [W/m²]

$5.67 \cdot 10^{-8} \cdot T_b^4$ = Upward irradiance of the CG 4 sensor [W/m²]

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2AP-GD Solar Tracker



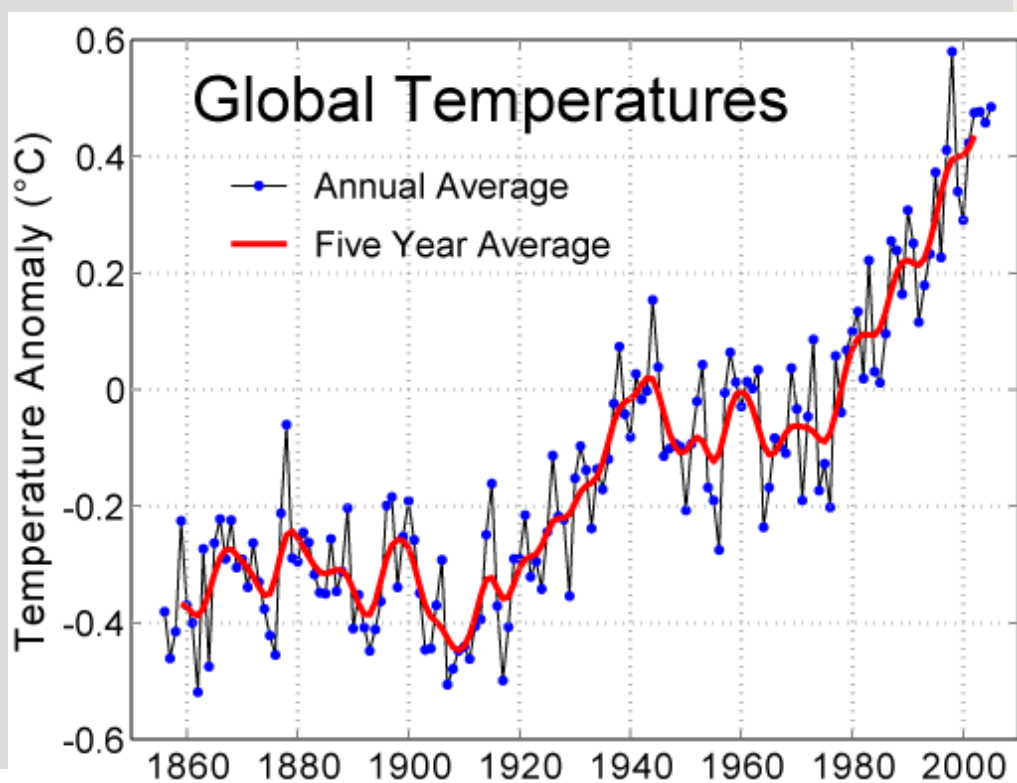
Maximum Versatility ...

- ☀ High Payload Capacity, 65 kg
- ☀ Positioning Accuracy, 0.05°
- ☀ Auto Positioning Correction
- ☀ Extreme Temp Range, -50 to +50° C
- ☀ Durability, Choice of ARM & BSRN

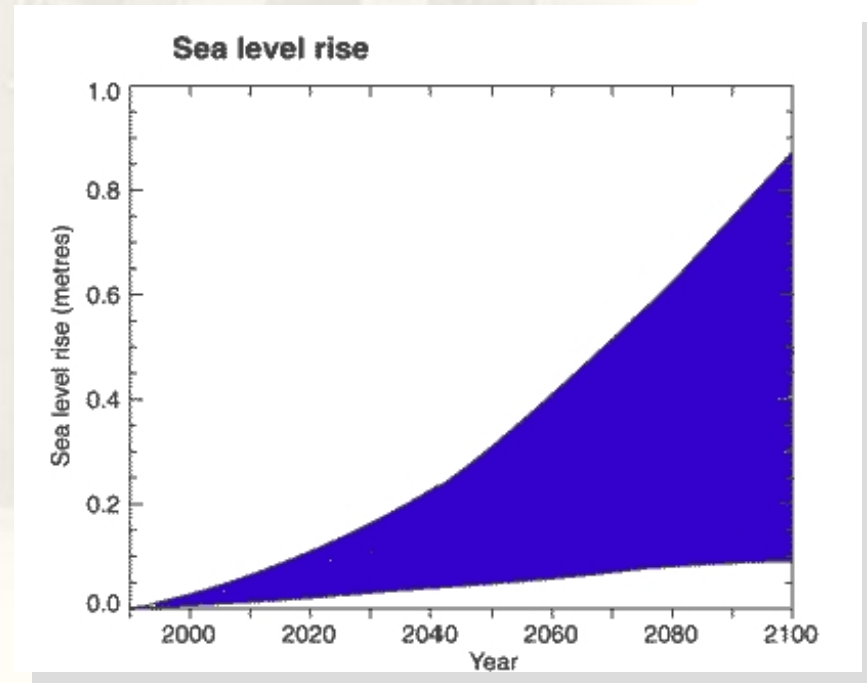
Climate Change

Global Warming Impact ...

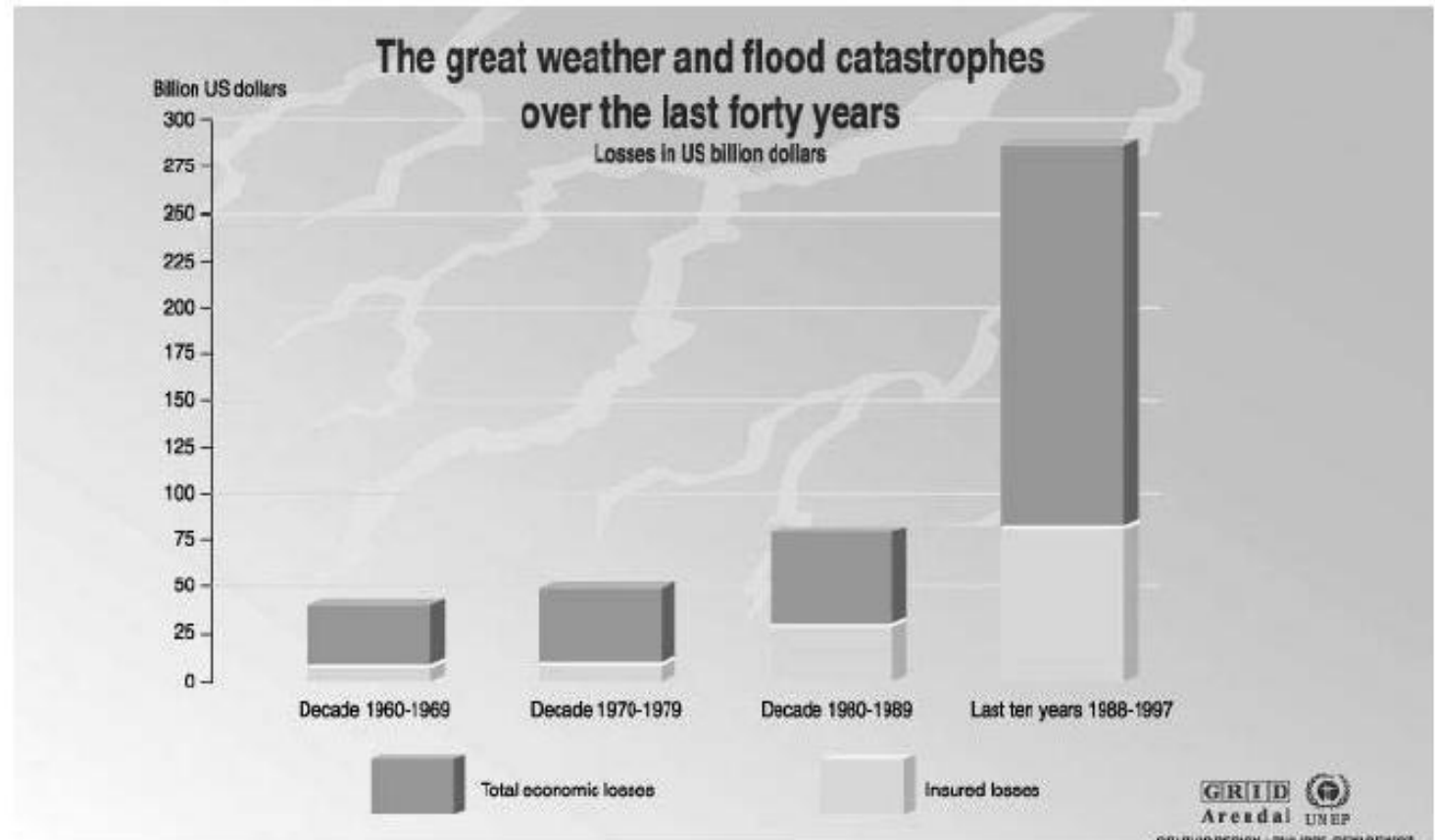
- ☀ 1 °C Rise In Global Temp by 2100
- ☀ 30 CM Rise In Sea Levels by 2050
- ☀ 1 M Rise In Sea Levels By 2100
- ☀ Increase Tidal Surge & Flooding
- ☀ Change In Coastlines & Wetlands



Why Join BSRN Network ?



Weather-related economic damages have increased



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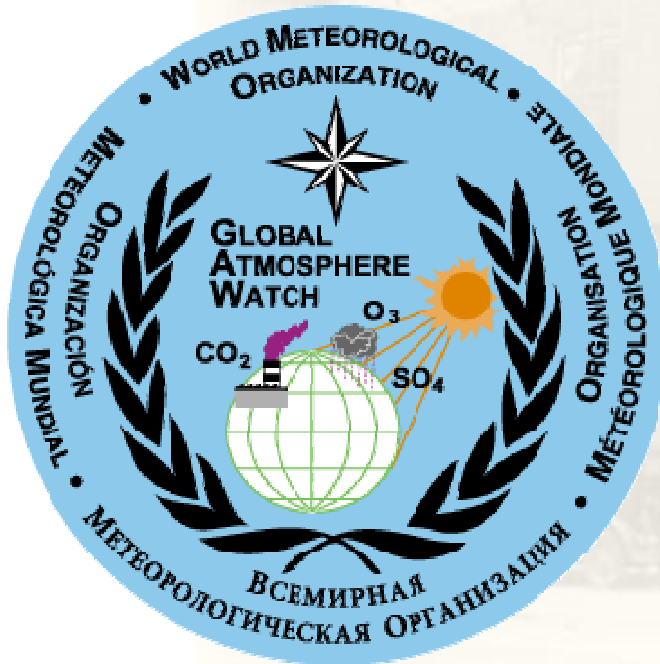


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BSRN Program Affiliations



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The End

