



REFERENCE SITE DATA UPDATE

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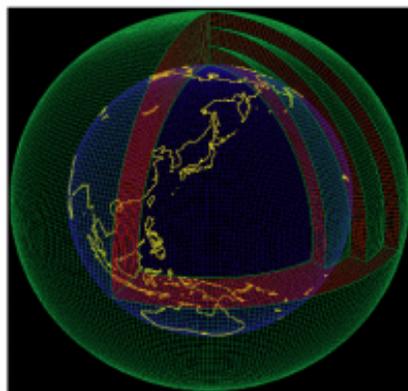
CEOP Model Output Development & Analysis Workshop
UCI, Irvine, California, USA
8-9 March 2004



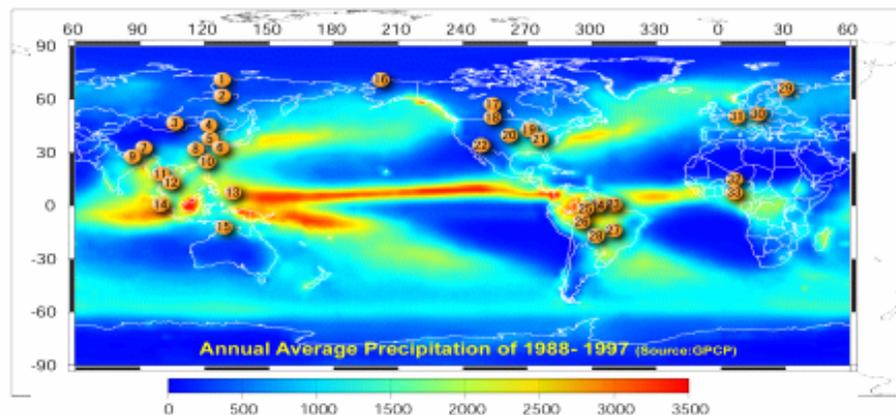
The First Global Integrated Data Sets of the Water Cycle



Model Outputs by Numerical Weather Prediction Centers



Surface Observational (*in-situ*) Data from the 33 CEOP Reference Sites



Satellite Remote Sensing Data

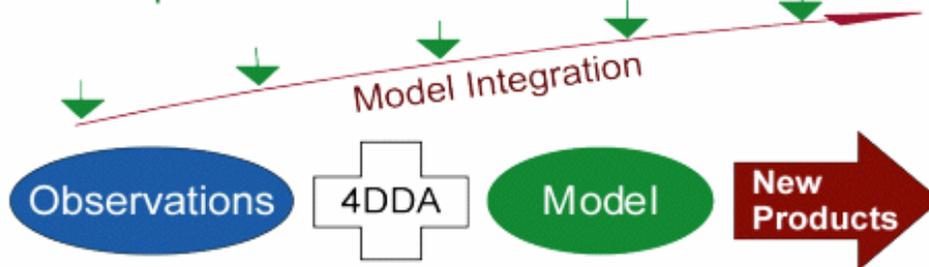


In-Situ Data Archiving Center at UCAR
(Center at University Corporation for
Atmospheric Research) of USA
<http://www.ucar.edu/>

MODEL Output Data
Archiving Center at Max-
Planck Institute of Germany
<http://www.mpg.de/>

Data Integrating/Archiving Center
at University of Tokyo and NASDA
of Japan
<http://monsoon.t.u-tokyo.ac.jp/ceop/>

Input of Observed Data into Model



Global Land Data
Assimilation System at
NASA Goddard Space
Flight Center of USA
<http://ldas.gsfc.nasa.gov/>



Data Archive Center



CEOP DATA MANAGEMENT WWW PAGE

<http://www.joss.ucar.edu/ghp/ceopdm/>



In-Situ Reference Site Data Sets and Information

Data Sets

- CEOP EOP-3 Reference Site Data Sets
- CEOP EOP-1 Reference Site Data Sets
- NASA/GMAO CEOP EOP-1 Reference Site Data Sets in GrADS Format
- Sample Reference Site Data Sets
- CEOP In-Situ Data Source Agency Links
- Baseline Surface Radiation Network (BSRN)
- GEWEX Land Processes Database Map Server

Information

- CEOP Reference Site Data Set Procedures Report (Approved by the SSC 29 July 2003)
- CEOP Reference Site Station Characteristics
- CEOP Reference Site Map
- Reference Site Data Management Update (GEWEX SSG Meeting, 20-24 January 2003)
- CEOP Reference Site Rawinsonde Station Questionnaire
 - Responses

Satellite Data and Information

Data Sets

- EOP-1 Satellite Data Sets
- NASA/GMAO GRADS/DODS ISCCP Surface T and Cloud Amount for CEOP EOP1

Information

- CEOP Satellite Data Source Agency Links

Model Output and Information

Data Policies

- Final DRAFT CEOP Reference Sites Data Release Guidelines
- BALTEX
- CAMP
- CATCH
- GAPP
- LBA
- MAGS

Data Standards Information

- Assistance for Land-surface Modelling activities (ALMA)
- Atmospheric Model Intercomparison Project (AMIP)
- ISO/TC 211

Documents

- CEOP Implementation Plan
- Report from the 2nd CEOP Implementation Planning Meeting (DRAFT - 8 July 2003)
- WESP Major Activities Plan (1 June 2003)
- CEOP Reference Site Station Characteristics Questionnaire
- Establishment of a Global Hydrological Observation Network for Climate" GCOS/GTOS/HWRP Meeting Report (June 2000)

Other Links

- CEOP Home Page
- WCRP Home Page
- GEWEX Home Page
- CLIVAR Home Page
- CLIC Home Page
- ACSYS Home Page
- Global Modeling and Assimilation Office (NASA/GSFC)
- Land Information System (NASA/GSFC)
- Model Parameter Estimation Experiment (MOPEX)
- NASA/Goddard Institute for Space Studies (GISS) Data



Coordinated Enhanced Observing Period (CEOP) Model Output and Information



CEOP Model Data Sets and Information

Model Output Data Sets

- [CEOP Model Data Gateway](#)
- [NASA/GSFC Data Assimilation Office CEOP Data](#)
- [NCEP GFS \(AVN/MRF\) MOLTS output](#)
- [GLDAS CEOP EOP-1 MOLTS output](#)
- [CEOP Model Output Source Agency Links](#)

CEOP Model Output Teleconference Notes

- [Tenth Formal Telecon \(3 December 2003\) \(DRAFT\)](#)
- [Ninth Formal Telecon \(28 October 2003\) \(DRAFT\)](#)
- [Eighth Formal Telecon \(17 September 2003\)](#)
- [Seventh Formal Telecon \(30 July 2003\)](#)
- [Sixth Formal Telecon \(2 June 2003\)](#)
- [Fifth Formal Telecon \(28 April 2003\)](#)
- [Second \(17 Dec 2002\), Third \(3 Feb 2003\), and Fourth \(11 Mar 2003\) Formal Telecons](#)
- [First Formal Telecon \(15 November 2002\)](#)

General Information

- [Guidance for CEOP Model Output Generation at NWP Centers, Met Agencies and the DAO \(10 Dec 2002\)](#)
- [Model Output Variables Requested by CEOP \(28 Mar 2003\)](#)
- [MPI Statement \(1 Nov 2002\)](#)
- [Listing of CEOP proposed MOLTS locations](#)
- [Map of CEOP proposed MOLTS locations](#)

BoM

- [None](#)

CPTEC

- [CPTEC Contribution to CEOP](#) (10 Dec 2002)

ECMWF

- [ECMWF Contribution to CEOP](#) (13 Dec 2002)
- [ECMWF CEOP MOLTS locations](#) (13 Dec 2002)

ECPC

- [ECPC CEOP Contributions](#) (30 May 2003)
- [ECPC Model Characteristics](#) (30 May 2003)
- [ECPC Model Output Times](#) (30 May 2003)
- [ECPC CEOP Variables and Processes](#) (30 May 2003)
- [ECPC SFM/RII MOLTS Characteristics](#) (30 May 2003)

JMA

- [JMA Contribution to the CEOP Dataset](#) (17 Dec 2002)
- [Additional JMA Comments and Questions on the CEOP Dataset](#) (17 Dec 2002)
- [JMA CEOP MOLTS locations](#) (16 Dec 2002)
- [Vertical Levels of JMA CEOP Output Data](#) (16 Dec 2002)
- [Elements available from JMA Operational 3-DVAR Global Analysis](#) (16 Dec 2002)
- [Sample of JMA MOLTS Output](#) (3 Feb 2003)

NASA Global Modeling and Assimilation Office (GMAO; formerly DAO)

- [File Specification for the GEOS-DAS Gridded Output \(Version 4.3\)](#) (4 June 2003)

NASA GLDAS

- [None](#)

NCEP Operational

- [Output for CEOP from NCEP Global Data Assimilation and Forecast Model](#) (14 Mar 2003)
- [NCEP Global Forecast System Implementation](#) (29 Oct 2002)
- [NCEP GRIB Table 2](#) (14 Mar 2003)
- [NCEP Output at International CEOP MOLTS Sites](#) (14 Mar 2003)
- [NCEP Global Model Characteristics at CEOP MOLTS Reference Sites](#) (14 Mar 2003)
- [Vertical Sigma Levels of NCEP Global Model MOLTS Output](#) (14 Mar 2003)
- [NCEP data at MPI](#) (28 Mar 2003)
- [NCEP CEOP Data CERA Storage](#) (28 Mar 2003)
- [Map of proposed NCEP ETA MOLTS locations for NAME](#)
- [Map of current NCEP ETA MOLTS locations around the ARM SGP site](#)

NCMRWF

- [NCMRWF Notes on Gridded Data](#) (19 Nov 2003)
- [NCMRWF CEOP Core Codes](#) (19 Nov 2003)

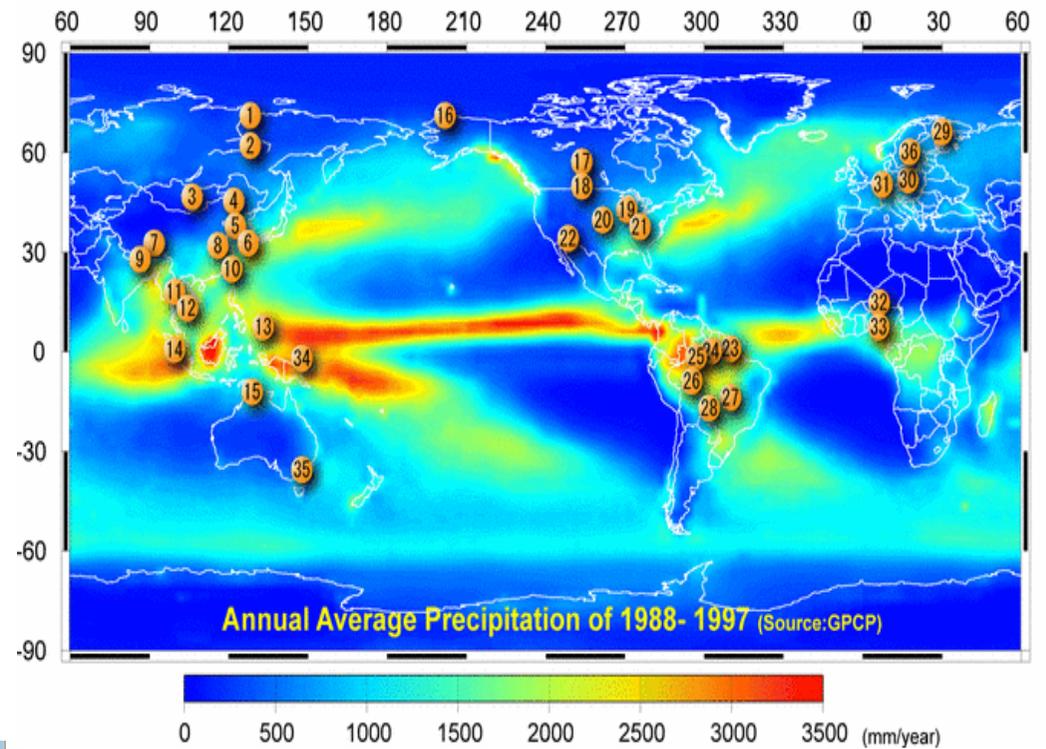
UKMO

- [Met Office Contribution to CEOP](#) (12 Nov 2002)
- [UKMO GRIB Table 2 for CEOP Data](#) (28 Mar 2003)
- [Model Locations of MOLTS Reference Sites](#) (28 Mar 2003)
- [Notes for CEOP MOLTS and Gridded data from UKMO](#) (12 Jun 2003)
- [Met Office Scientific Advisory Committee Presentations](#) (28 Mar 2003)



REFERENCE SITE LOCATIONS

Number	Reference Site Name	Satellite Scene Center Latitude	Satellite Scene Center Longitude
CAMP			
1	Eastern Siberian Tundra	71.617N	128.750E
2	Eastern Siberian Taiga	62.000N	129.667E
3	Mongolia	46.283N	107.298E
4	Inner Mongolia	44.417N	122.867E
5	Korean Peninsula	37.440N	127.900E
6	Korean Haenam	37.550N	126.570E
7	Tibet	32.000N	91.899E
8	Yangtze River	32.000N	116.000E
9	Himalayas	27.959N	86.813E
10	Northern South China Sea - Southern Japan	24.967N	121.181E
11	Chao-Phraya River	17.830N	99.690E
12	North-East Thailand	14.466N	102.379E
13	Western Pacific Ocean	7.050N	134.270E
14	Equatorial Island	0.200S	100.320E
Other			
15	ARM Tropical Western Pacific (Darwin)	12.425S	130.891E
16	ARM North Slope of Alaska (Barrow)	71.320N	156.620W
34	ARM Tropical Western Pacific (Manus)	2.058S	147.425E
MAGS			
17	BERMS (Old Black Spruce)	54.000N	105.000W
GAPP			
18	Ft. Peck	48.310N	105.100W
19	Bondville	40.010N	88.290W
20	ARM Southern Great Plains	36.610N	97.490W
21	Oak Ridge	35.960N	84.290W
22	Mt. Bigelow	32.420N	110.730W
LBA			
23	Caxiuana	1.710S	51.510W
24	Santarem	3.020S	54.970W
25	Manaus	2.610S	60.210W
26	Rondonia	10.080S	61.930W
27	Brasilia	15.930S	47.920W
28	Pantanal	19.560S	57.010W



Number	Reference Site Name	Satellite Scene Center Latitude	Satellite Scene Center Longitude
BALTEX			
29	Sodankyla	67.370N	26.650E
30	Lindenberg	52.200N	14.120E
31	Cabauw	51.970N	4.930E
36	Norunda	60.080N	17.480E
CATCH			
32	Niamey	13.500N	2.500E
33	Oueme	9.500N	2.000E
MDB			
35	Tumbarumba	36.660S	148.150E

GEWEX CSE	GAPP					MAGS
Reference Site Name and Information Links	SGP	Bondville, IL	Ft. Peck, MT	Oak Ridge, TN	Mt. Bigelow, AZ	BERMS
Site Latitude	34N - 39N	40.01N	48.31N	35.96N	32.42N	53.419 - 54.319N
Longitude	94.5W - 100.5W	88.29W	105.10W	84.29W	110.73W	104.24 - 106.32W
MOLTS Locations	36.61N 97.49W	40.01N 88.29W	48.31N 105.10W	35.96N 84.29W	32.42N 110.73W	53.63N (53.99N) [53.92N] 106.20W (105.12W) [104.69W]
MOLTS Elevation (m)	313	~300			2583	600.63 (628.94) [579.27]
Site Maps	X	X	X	X	X	X
Site Contacts	X	X	X	X	X	X
Site Status	A	A	A	A	B	A
Site Type	3D	1D	1D	1D	1D	2.5D
Data Collection Period	1994 to Present	25 Aug 1996 to Present	3 Nov 1999 to Present	1 Jan 1995 to Present	15 Apr 2002 to Present	1 Jan 1997 to Present
Sample Data Sets	X	X	X	X		X
Data Access	X					
EOP-1 Data Received	X	X	X			
UPPER AIR OBSERVATIONS						
Radiosonde (X = on-site, XX = off-site operational)	X	XX	XX	XX	XX	XX
Radar	X					
Lidar	X					
Profiler	X					
RASS	X					
SURFACE OBSERVATIONS						
Air Temperature	X	X	X	X	X	X
Humidity	X	X	X	X	X	X
Wind	X	X	X	X	X	X
Pressure	X	X	X	X	X	X
Precipitation	X	X	X	X	X	X
Skin Temperature	X	X	X	X	X	
Upward Shortwave Radiation	X	X	X	X	X	X
Downward Shortwave Radiation	X	X	X	X	X	X
Upward Longwave Radiation	X	X	X	X	X	X
Downward Longwave Radiation	X	X	X	X	X	X
Upward Photosynthetically Active Radiation						X
Downward Photosynthetically Active Radiation				X		X
Net Radiation	X	X	X	X	X	X

Baltic Sea Experiment (BALTEX)

• Cabauw

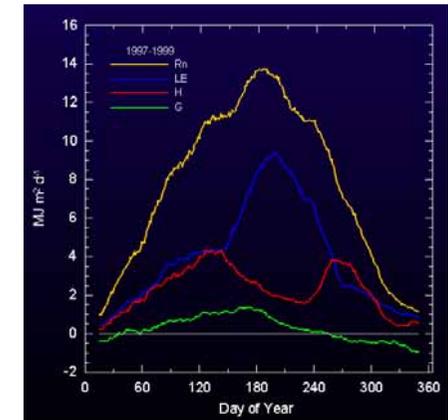
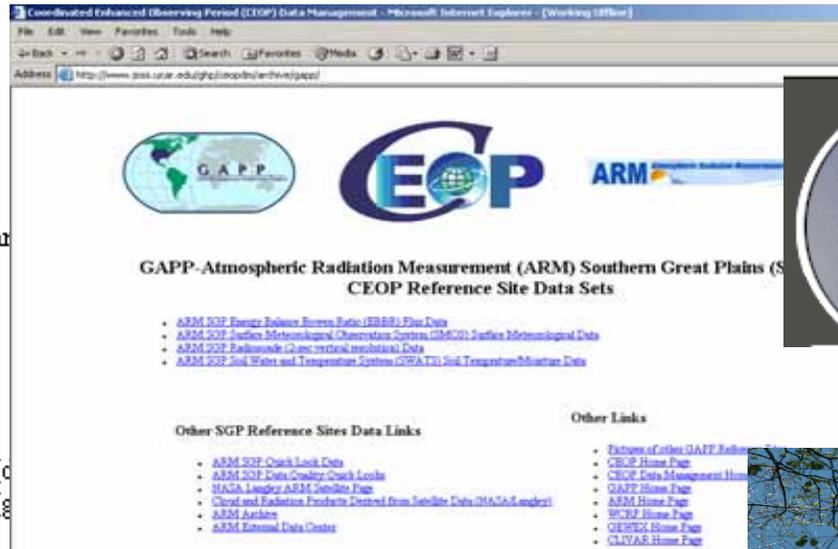
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• Sodankylä

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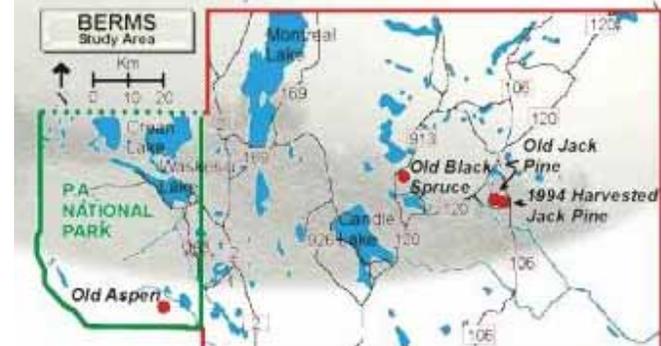
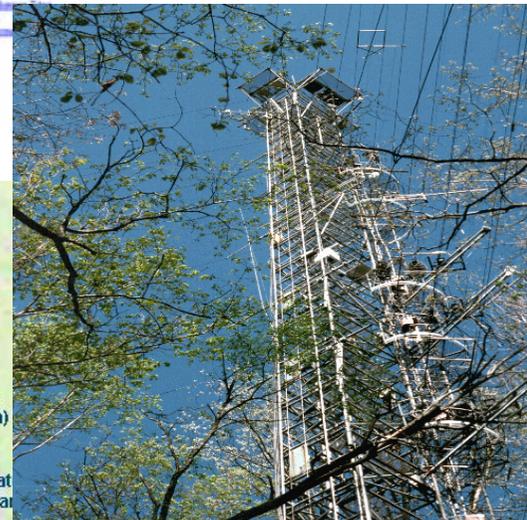


- Half hourly measurements
- Sensors at instrumented tower:
 - Air temperature profile (6 levels)
 - H2O and CO2 concentration profile (6 levels)
 - Top canopy temperature (Infra-red sensor)
 - Wind velocity profile (4 levels)
 - Wind direction
 - Air pressure
 - Precipitation
 - Incoming and reflected solar radiation (short wave radiation)
 - Incoming and emitted terrestrial radiation (long wave radiation)
 - Incoming photosynthetically active radiation (PAR)
- Turbulence measurements above forest canopy:
 - High frequency (10.4 Hz) three wind components, air temperature
 - CO2 concentration (momentum, sensible and latent heat flux at canopy)
- Soil measurements:
 - Soil heat flux (2 plates at depth of 1 cm and 10 cm, respectively)
 - 2 five-level profiles of soil humidity and temperature (sensors at depths of 5, 15, 30, 60 and 100 cm)

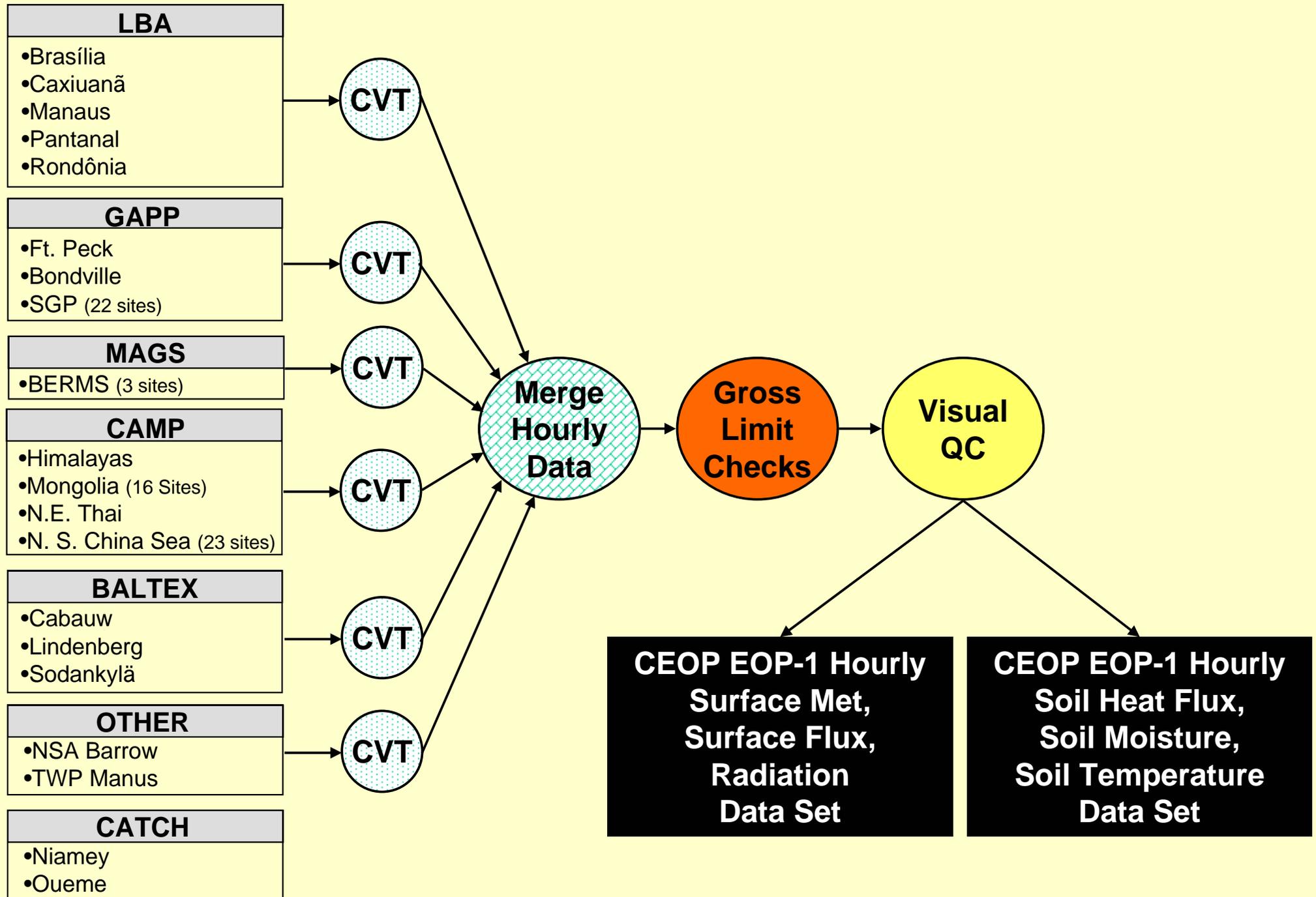
- 10 minutes measurements**
 - Spatial distribution of soil humidity (11 sensors)
 - Additional soil temperature and humidity profile (4 levels)
 - Additional surface soil heat fluxes (2 sensors)

- Weekly measurements**
 - Neutron probe soil humidity (8 profiles)

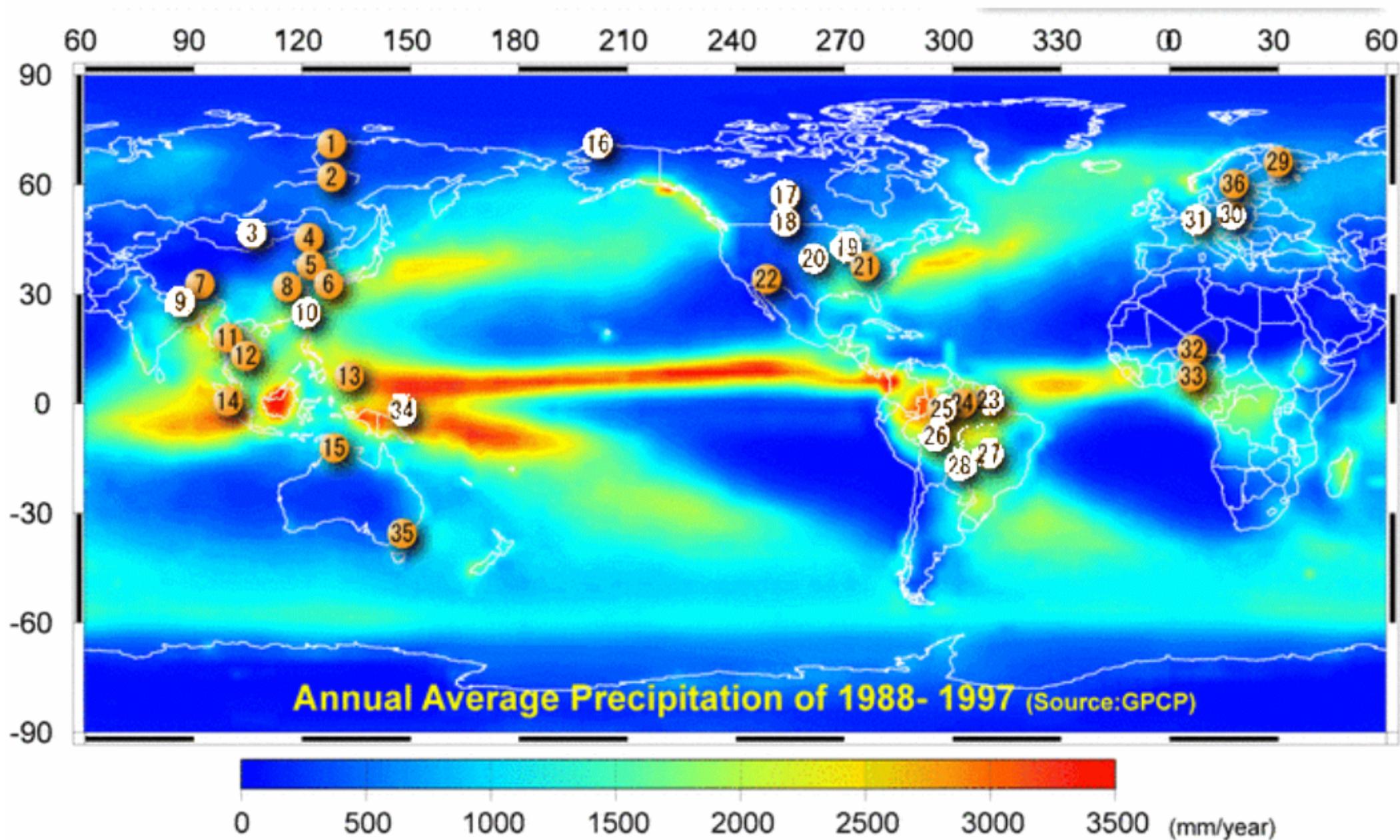
- Monthly measurements**
 - CO2 soil respiration (continuously in Manaus, Caxiuana and Santarém)



EOP-1 “Composite” Data Set Development



CEOP EOP-1 Hourly Converted Format Reference Sites





“Composite” Reference Site Dataset Issues from Berlin Meeting (April, 2003)

- Prepare cold weather precipitation questionnaire to document measurement/collection techniques, instrumentation, and data processing
- Update Reference Site documentation and metadata
- Finalize data parameters and file organization
- Finalize temporal resolution, averaging interval, and data formats
- Document data quality assurance/control procedures
- Document data collection and submission for CEOP Annual Cycle Datasets (schedule)

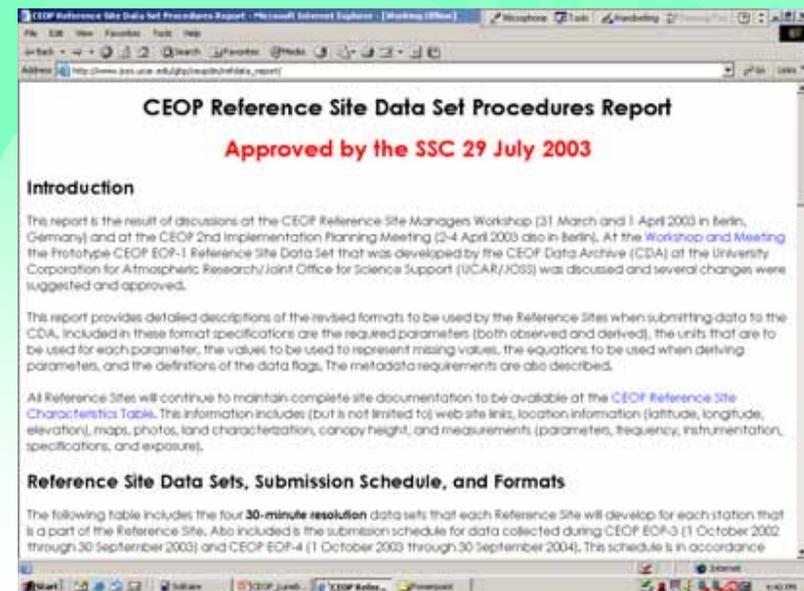


Reference Site Data Set Procedures Report

(Approved by the SSC on 29 July 2003)

- Introduction
- Data Set Description, submission schedule, formats
- Metadata
- Gap filling
- Quality Control/Quality Assurance
- File naming convention
- Submission instructions to CDA
- CDA Composite formation
- CDA Quality Assurance
- Rawinsonde Data Sets
- Ancillary Data Sets

Data Set	Data Category	Submission Date (First Half EOP-3)	Submission Date (Second Half EOP-3)	Submission Date (First Half EOP-4)	Submission Date (Second Half EOP-4)	Detailed Format Description
Surface Meteorological and Radiation Data Set	Category 1	1 October 2003	1 April 2004	1 October 2004	1 April 2005	Surface Meteorological and Radiation Format
Flux Data Set	Category 2	1 July 2004	1 January 2005	1 July 2005	1 January 2006	Flux Format
Soil Temperature and Soil Moisture Data Set	Category 1	1 October 2003	1 April 2004	1 October 2004	1 April 2005	Soil Temperature and Soil Moisture Format
Meteorological Tower Data Set	Category 1	1 October 2003	1 April 2004	1 October 2004	1 April 2005	Meteorological Tower Format



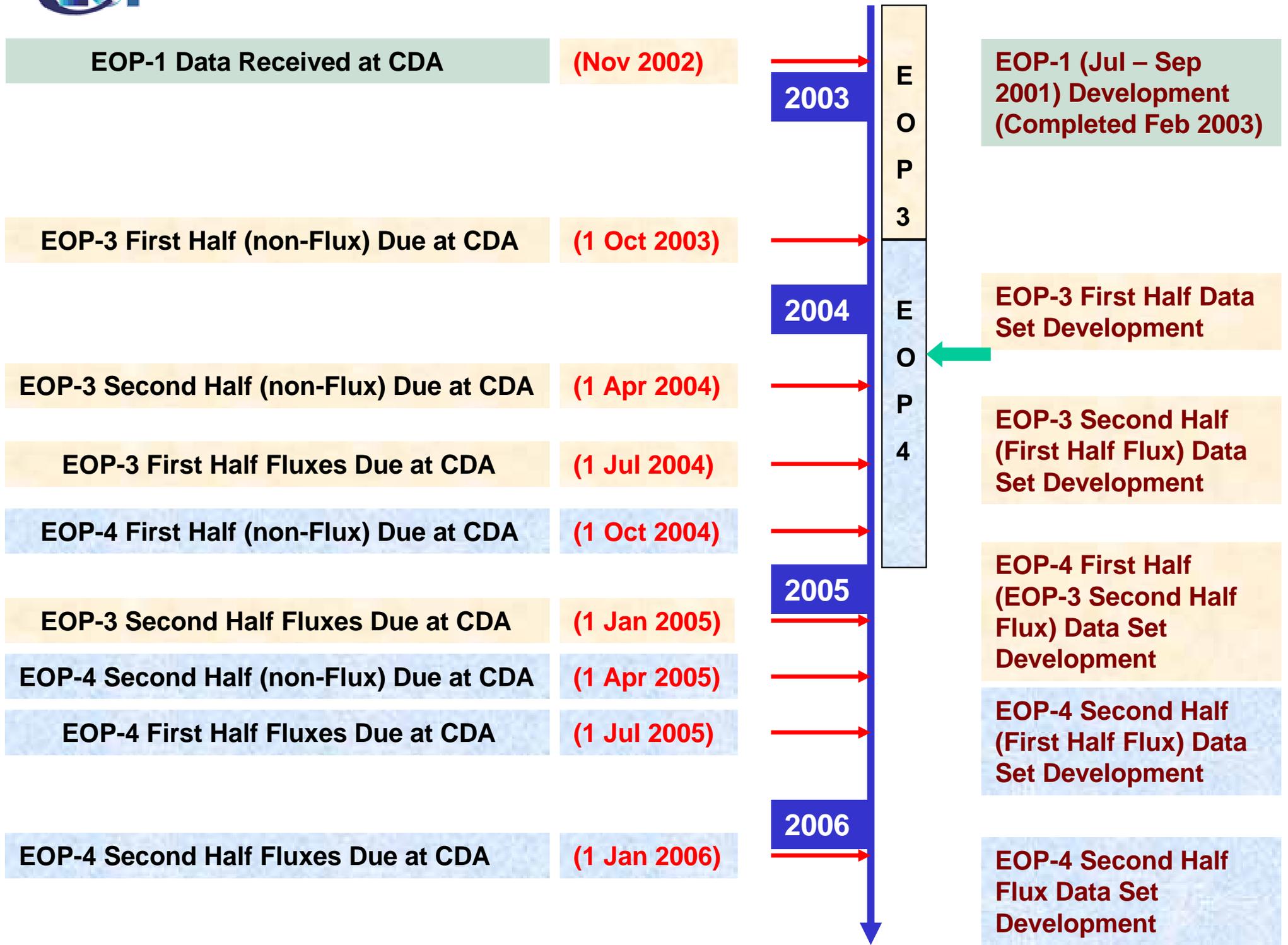


REFERENCE SITE FLUX DATA SET FORMAT

Parameter	C Format	Missing Value	Final Units/Equations/Notes
UTC Nominal Date/Time	16 chars	N/A	yyyy/mm/dd HH:MM, where MM is 00 or 30, only
UTC Actual Date/Time	16 chars	N/A	yyyy/mm/dd HH:MM
CSE Identifier	10 chars	N/A	Fill name with underscores, not spaces.
Reference Site Identifier	15 chars	N/A	Fill name with underscores, not spaces.
Station Identifier	15 chars	N/A	Fill name with underscores, not spaces.
Latitude	f10.5	-99.99999	decimal degrees. South is negative.
Longitude	f11.5	-999.99999	decimal degrees. West is negative.
Elevation	f7.2	-999.99	meters
Sensor Height	f7.2	-999.99	meters; Height of sensor. Positive above ground level. Negative below ground.
Sensible Heat Flux	f8.2	-999.99	W/m ²
Sensible Heat Flux Flag	1 char	M	See Flag values .
Latent Heat Flux	f8.2	-999.99	W/m ²
Latent Heat Flux Flag	1 char	M	See Flag values .
CO2 Flux	f8.2	-999.99	μmol/m ² /s
CO2 Flux Flag	1 char	M	See Flag values .
Soil Heat Flux	f8.2	-999.99	W/m ² ;
Soil Heat Flux Flag	1 char	M	See Flag values .

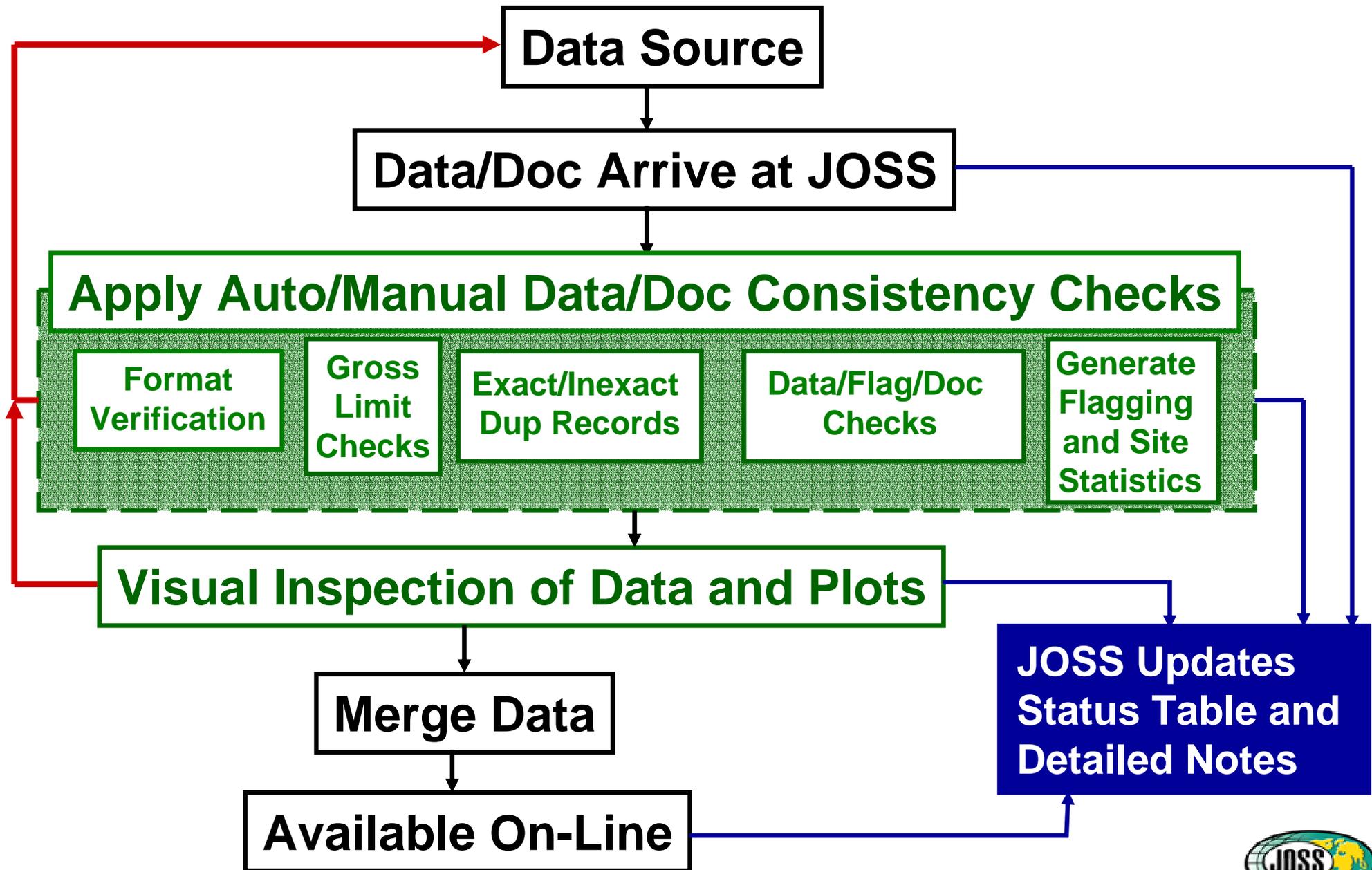


Reference Site Data Set Development Timeline





Reference Site EOP-3 Data Flow



UCAR/JOSS Manual Data and Documentation Consistency Checks

- Examine documentation and data files for completeness.
- Examine in-depth results from UCAR/JOSS automated checking software.
- Consistent CSE, Reference Site, and Station between data file name, data file metadata, and documentation file.
- Consistent station location information between doc and data.
- Consistent sensor heights between doc and data.
- Examine data flag usage.
- Verify data flags properly applied.
- Verify proper units used.
- Examine time series plots of every parameter at every station.





UCAR/JOSS Automated Data Consistency Checks and Statistics for CEOP

Consistency Checks Applied per the 29 July 2003 CEOP SSC Approved Formats:

- File Name in Proper Form (*i.e.*, CSE_RefSite_StnID_BeginDate_EndDate.suffix).
- File is Sorted Correctly.
- File does Not Contain Exact Duplicate Records.
- File does Not Contain In-Exact Duplicate Records (*i.e.*, dates/times/names/lat/lons match but not data).
- Every Record is Correct Length.
- No Control Chars in Any Record.
- Verify Meta Data and Data Field Location and Justification (*i.e.*, locations of slashes, colons, decimal points, spaces, *etc.*).
- Consistency between File Name and Meta Data and Data in File.
- Consistency between Nominal and Actual Date/Times within Each Record.
- Gross Limit Check each Meta Data and Data Value.
- Check for Data Values of -0.00.
- Sensor Height are Valid (Soils ≤ 0.00 ; Tower ≥ 0.00).
- Flag Values are Valid (U,G,D,B,C,M,or I only).
- Missing Data Value Has Missing Flag (*i.e.*, C or M only).
- Identify Completely Missing Records.
- Constant Station Location (lat/lon/elev).

The following statistics are Produced:

- Extreme Values for Each Parameter.
- Count & Percent of Each Flag Type for Each Parameter.
- List of All Station/Lat/Lon Sets Found.
- List of All Sensor Heights Found.
- Tracks/Prints Station Information for Every Station.
- Summarizes Total Error Counts for Data and Meta Data.



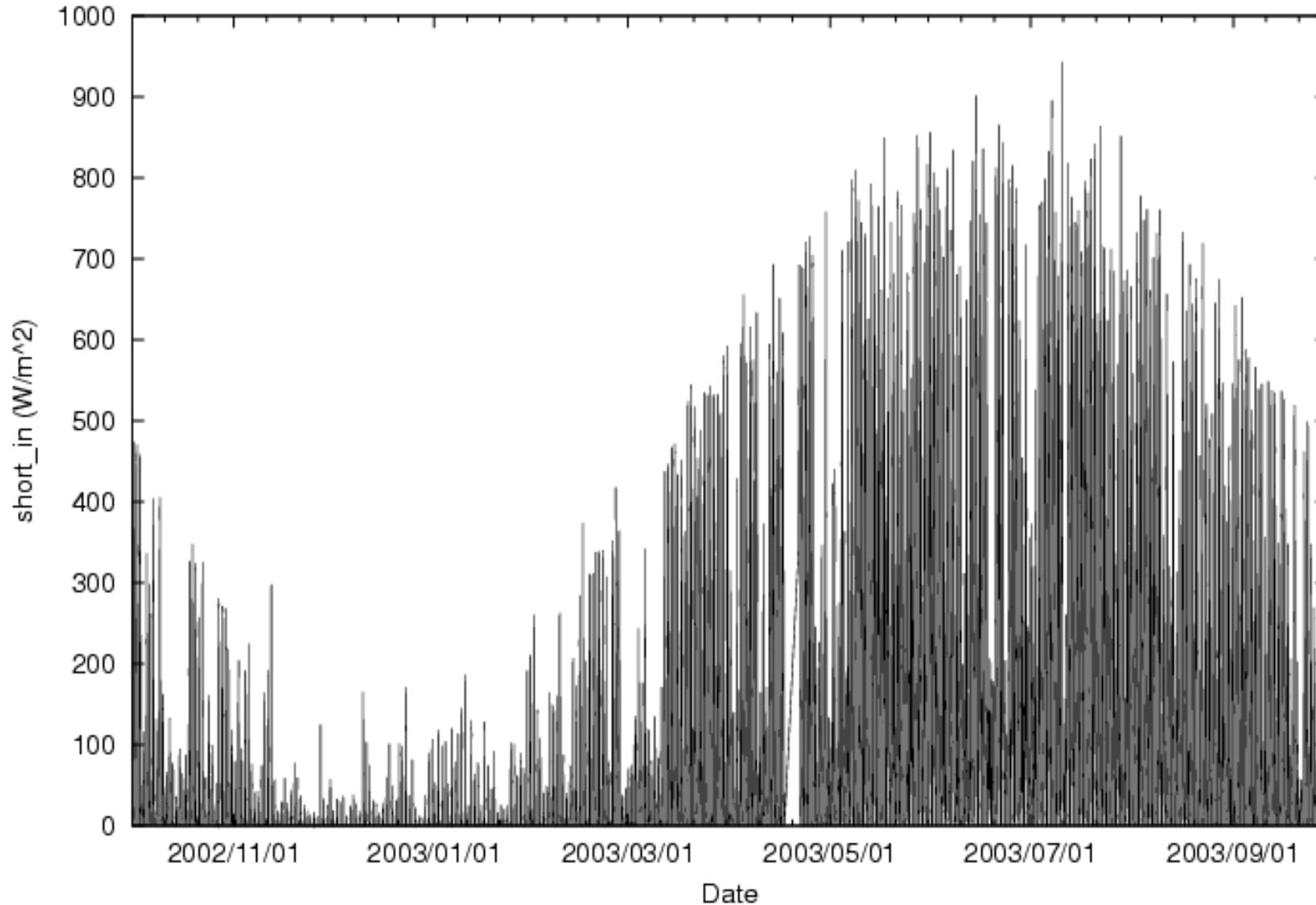
CEOP First Half EOP-3 Data and Documentation Issues

- **Incomplete documentation and/or data files.**
- Information in documentation file does not match data file (e.g. station locations, heights and depths of measurements).
- Incorrect data file format. Incorrect date format.
- Reporting 00:00 UTC observation as 24:00 UTC.
- Incorrect flag applied to missing data. Incorrect missing value used.
- **Inexact duplicates present in the data (e.g. two records of data at the same reporting time but with different parameter values).**
- Using missing values when deriving parameters.
- Large amounts of data flagged as Bad or Dubious without explanation in documentation.
- **Incorrect units used. Incorrect parameters included in data.**
- Sensor heights reported with incorrect sign.
- Reporting the surface pressure at all heights of the tower data.
- **Having multiple measurements of the same parameter at the same height or depth without a way to differentiate.**



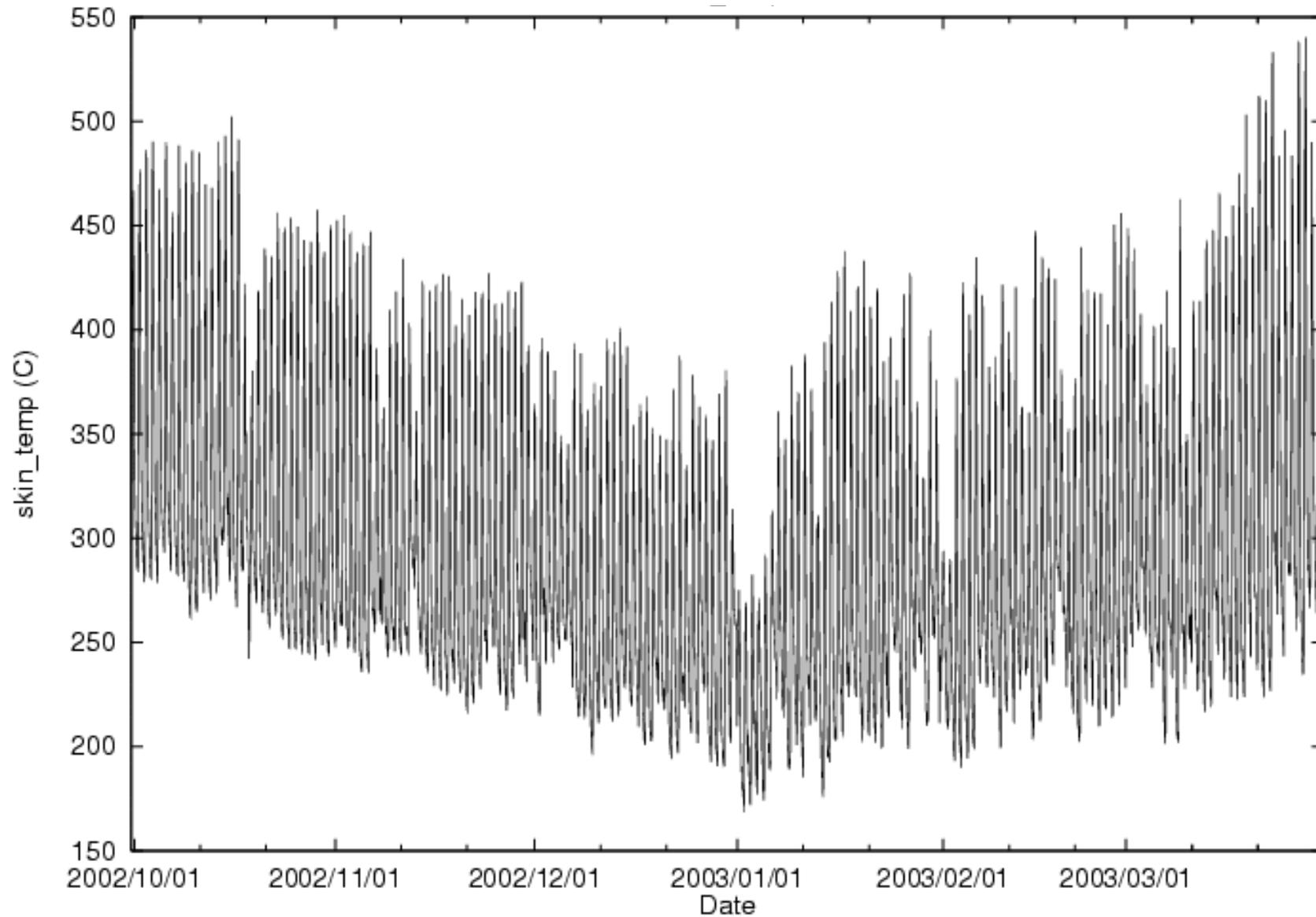
INCOMING SHORTWAVE

CEOP BALTEX short_in Station Norunda



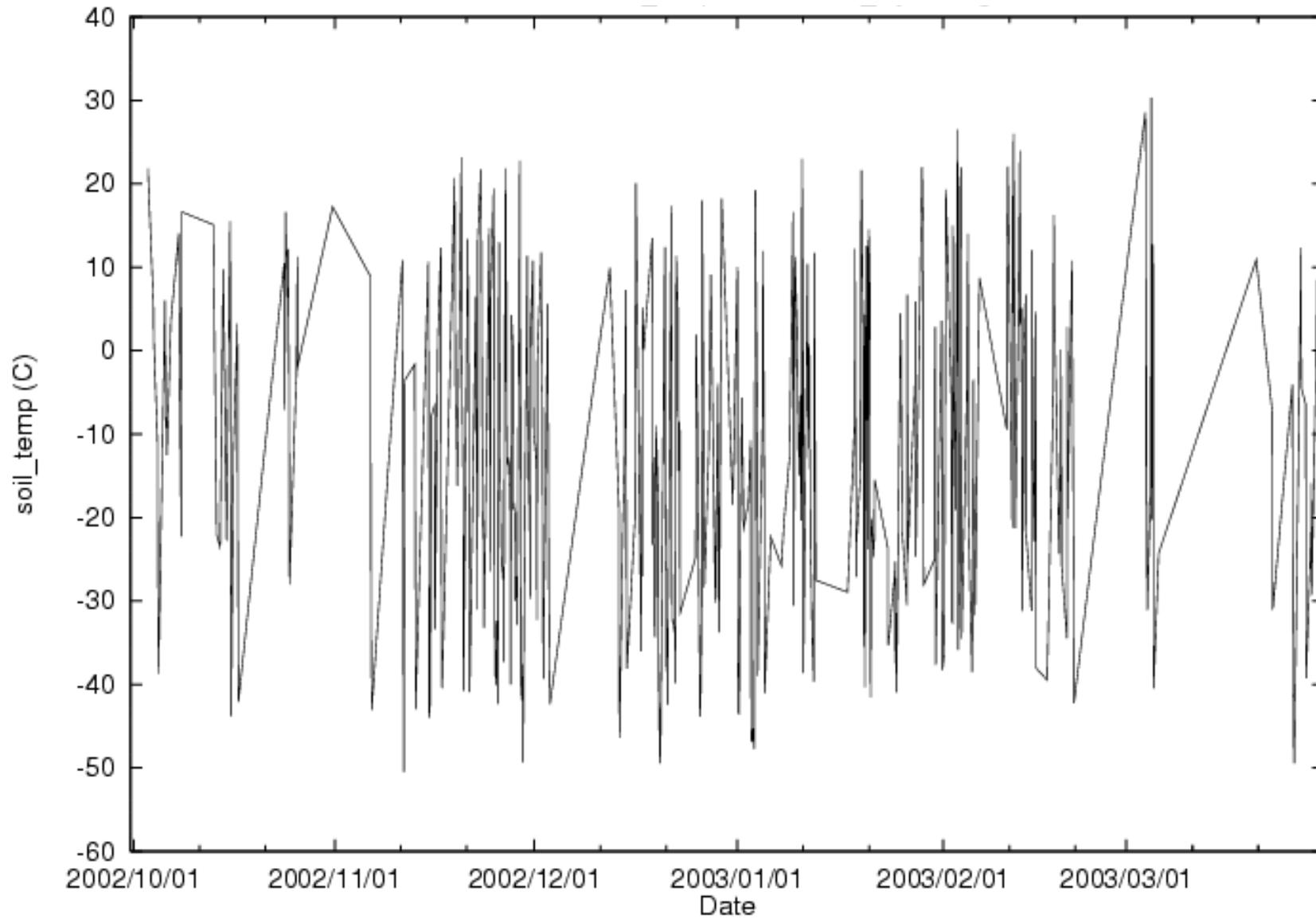


SKIN TEMPERATURE



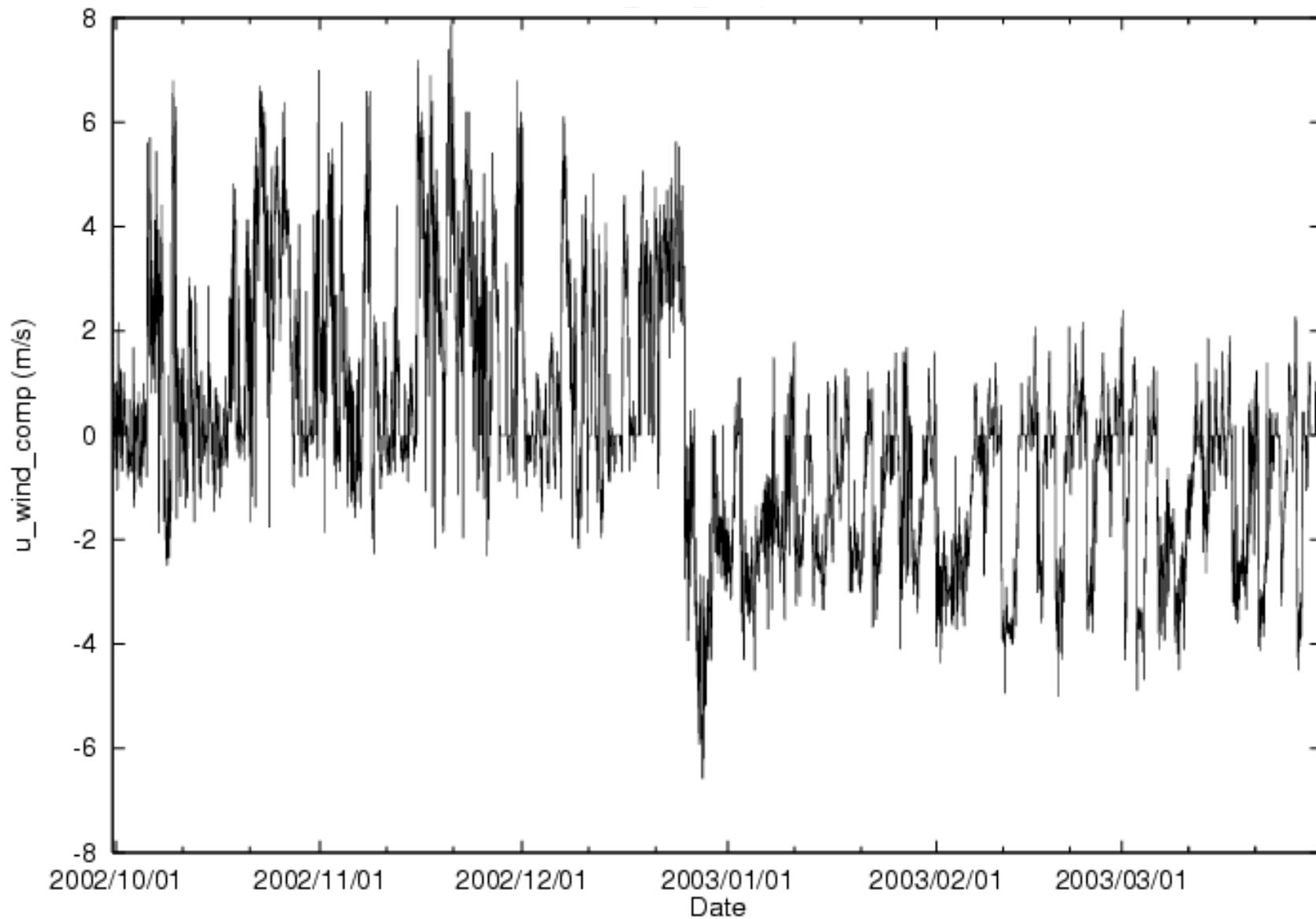


SOIL TEMPERATURE



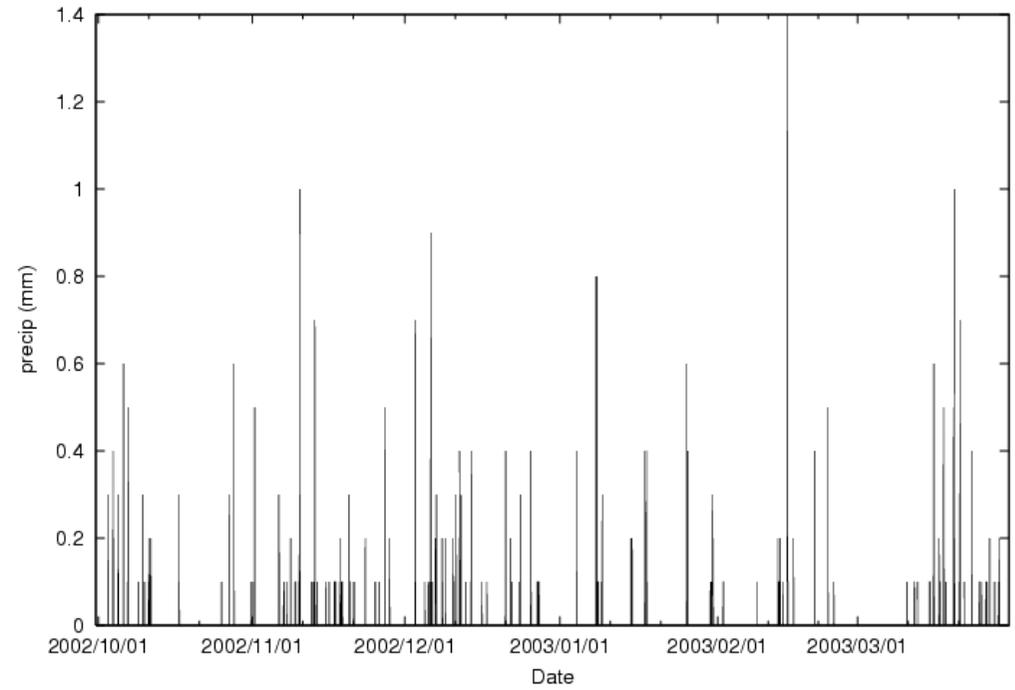
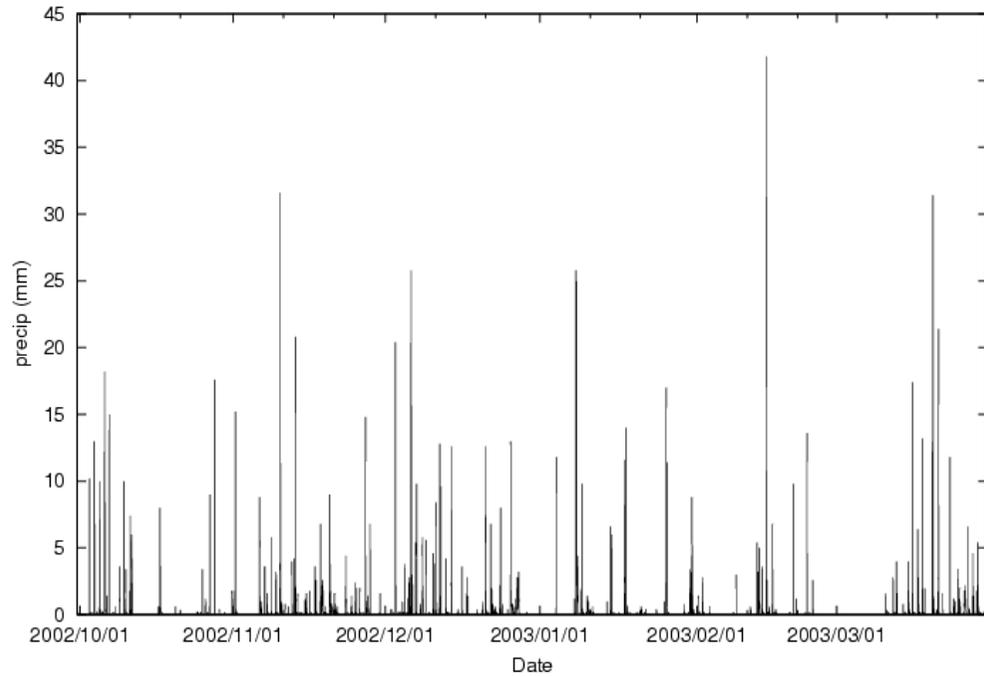


U-WIND COMPONENT



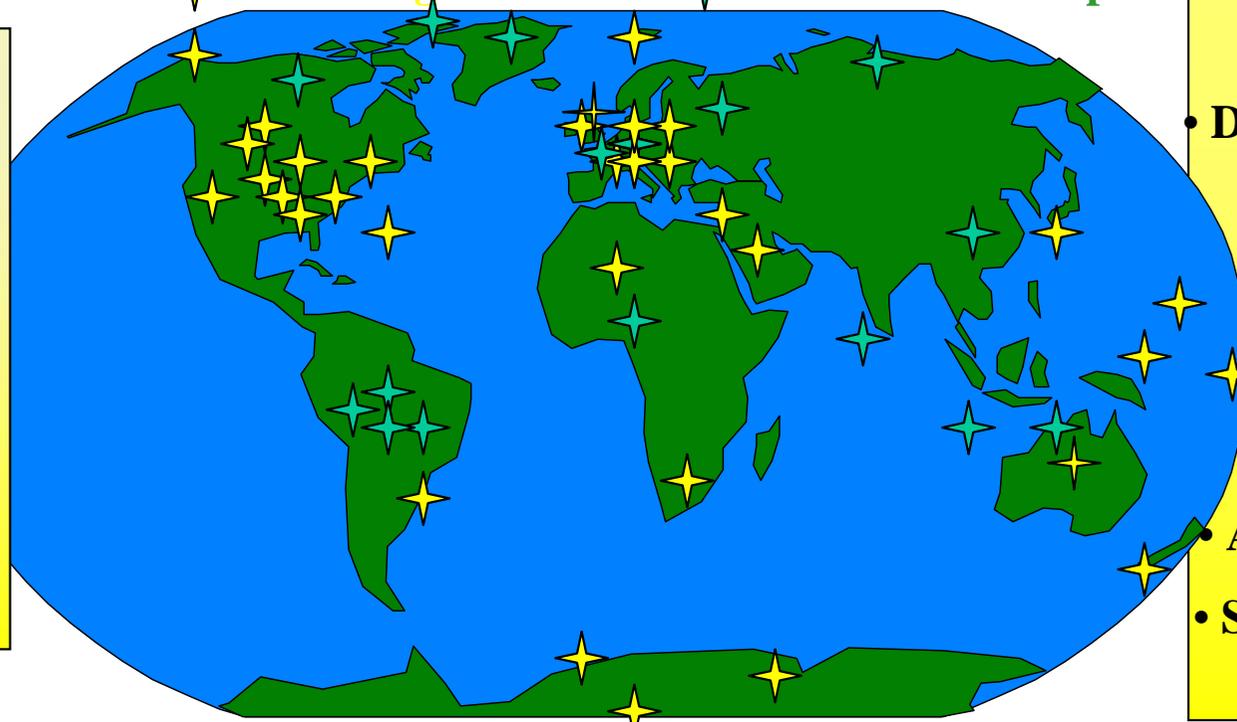


PRECIPITATION DATA CHANGES



★ Archiving

✦ Provisional & Proposed



Goal:

To acquire the highest possible quality, globally-diverse, surface-based radiation measurements for climate research.

Measurements

- Direct & diffuse solar*
- Downward IR *
- Upwelling irradiation
- PAR & UV
- Upper air met.
- Aerosol optical depth
- Surface meteorology*

*all sites

Network Status

- 2561 station-months of data
- 34 archiving sites + 15 potential
- Zurich/ETHZ archive extended
- New Brazilian network
- New site – SIRTA - France
- 2 new Canadian sites proposed
- Progress on a China site(s)
- Potential eventual Siberian site
- GCOS invitation
- July 2004 Mtg. in Exeter U.K.

BSRN Data

Parameters vary by station.

Base data includes:

metadata (location, PI, station characteristics,
Instrumentation details)

Radiation data at 1-minute resolution (global, direct, diffuse,
downward longwave, air temperature, RH, pressure)

Other data might include:

spectral shortwave, upward shortwave, upward longwave

net radiation

UV

SYNOP

radiosonde

ozone

cloud amount and/or heights

tower measurements

CEOP First Half EOP-3 Reference Site Data Set Status (as of 23 January 2004)

BALTEX								
Reference Site	SFC		TWR		STM		FLX	
	Doc	Data	Doc	Data	Doc	Data	Doc	Data
Cabauw	Green	Yellow	Green	Yellow	Green	Yellow	Green	Yellow
Lindenberg	Green	Yellow	Green	Yellow	Green	Yellow	White	White
Norunda	White	White	White	White	White	White	White	White
Sodankyla	Yellow	Yellow	White	White	Black		White	White
MAGS								
BERMS	Green	Yellow	Green	Yellow	Green	Yellow	White	White
MDB								
Tumbarumba	White	White	White	White	White	White	White	White
CATCH								
Niamey	White	White	Black		Black		Black	
Oueme	White	White	Black		Black		Black	
OTHER/ARM								
NSA	Green	Green	Green	Green	Black		Black	
TWP	Green	Green	Black		Black		Black	

CSE	Reference Site Name	Surface Meteorological and Radiation	Meteorological Tower	Soil Temperature and Soil Moisture	Flux	Soundings (Raw Format)
BALTEX	Cabauw					X (02 Mar 2004)
	Lindenberg					
	Norunda					
	Sodanklya					
CAMP	Chao-Phraya River					
	Equatorial Island	X (05 Mar 2004)				X (02 Mar 2004)
	Himalayas					
	Inner Mongolia					
	Korean Haenam					
	Korean Peninsula					
	Mongolia	X (23 Jan 2004)			X (23 Jan 2004)	
	Northeast Thailand					
	Northern South China Sea					X (02 Mar 2004)
	Siberia Taiga (Yakutsk)					
	Siberia Tundra (Tiksi)					
	Tibet					
	Western Pacific Ocean					
	Yangtze River					
CATCH	Niamey					
	Oueme					
GAPP	Bondville	X (23 Jan 2004)		X (23 Jan 2004)	X (23 Jan 2004)	X (02 Mar 2004)
	Ft. Peck	X (23 Jan 2004)		X (23 Jan 2004)	X (23 Jan 2004)	X (02 Mar 2004)
	Mt. Bigelow					X (02 Mar 2004)
	Oak Ridge	X (23 Jan 2004)		X (23 Jan 2004)	X (23 Jan 2004)	X (02 Mar 2004)
	SGP	X (23 Jan 2004)	X (23 Jan 2004)	X (05 Mar 2004)	X (23 Jan 2004)	
LBA	Brasilia					
	Caxiuana					
	Manaus					
	Pantanal					
	Rondonia					
	Santarem					
MAGS	BERMS					
MDB	Tumbarumba					
ARM	TWP	X (23 Jan 2004)				
	NSA	X (23 Jan 2004)	X (23 Jan 2004)			

GEWEX is a World Climate Research Programme to observe and model the hydrologic cycle and energy fluxes in the atmosphere, and at the land and ocean surface.

Global Energy and Water Cycle Experiment



This site is under construction

GEWEX is an integrated program of research, observations, and science activities ultimately leading to the prediction of global and regional climate change.

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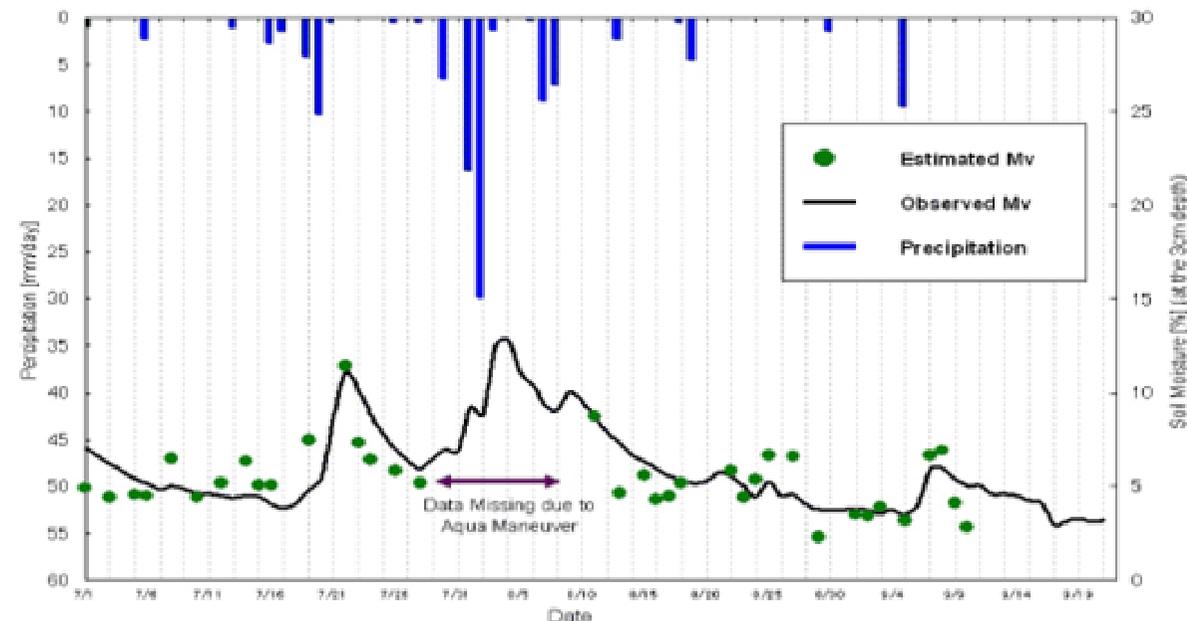
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FIRST CEOP EOP-1 SATELLITE DATA COMPARISON WITH CEOP REFERENCE SITE DATA



CEOP Mongolia Reference site data validation of AMSR-E soil moisture algorithm shows good agreement. Click [here](#) for the complete story.

The CEOP Central Data Archive at UCAR has completed the EOP-1 composite products for July to September 2001, in cooperation with the CEOP reference sites. The products are available via the web at <http://www.joss.ucar.edu/ghp/ceopdm/>.