1. INTRODUCTION

1.1. PROJECT OVERVIEW

The Preliminary Plan for the World Climate Research Program (WCRP), published in January 1981, stresses the importance of clouds in controlling the Earth's radiation budget and recognizes the need to develop a global climatology to further research on climate processes. The International Satellite Cloud Climatology Project (ISCCP) was established as the first project of WCRP for this purpose (Schiffer and Rossow 1983). The general approach and strategy has been developed in a series of planning meetings (see WCP reports, Nos. 6 and 28) and is summarized in the ISCCP Preliminary Implementation Plan (WCP-35). The present document describes the reduced resolution version of the raw satellite radiance measurements that is used to determine a climatology of cloud radiative properties (Schiffer and Rossow 1985).

Investigation of the role of clouds in climate involves a complex interrelated study of many different processes and addresses many different questions. The ISCCP will not explicitly investigate all of these research problems, but will focus on the study of the distribution and variation of cloud radiative properties. The scientific objectives are:

- To produce a global, reduced resolution, infrared and visible, calibrated and normalized radiance dataset containing basic information on the radiative properties of the atmosphere from which cloud parameters can be derived.

- To stimulate and coordinate basic research on techniques for inferring the physical properties of clouds from the condensed radiance dataset and to apply the resulting algorithms to derive and validate a global cloud climatology for improving the parameterization of clouds in climate models.

- To promote research using ISCCP data and contributing to improved understanding of the Earth's radiation budget (top of atmosphere and surface) and hydrological cycle.

The strategy adopted for implementing the ISCCP reflects the diverse nature of the spaceborne observing system and the large volume of imaging data produced by operational weather satellites (Fig. 1.1). The primary data processing is done by eight institutions: a Sector Processing Center (SPC) for each satellite (usually two polar orbiting

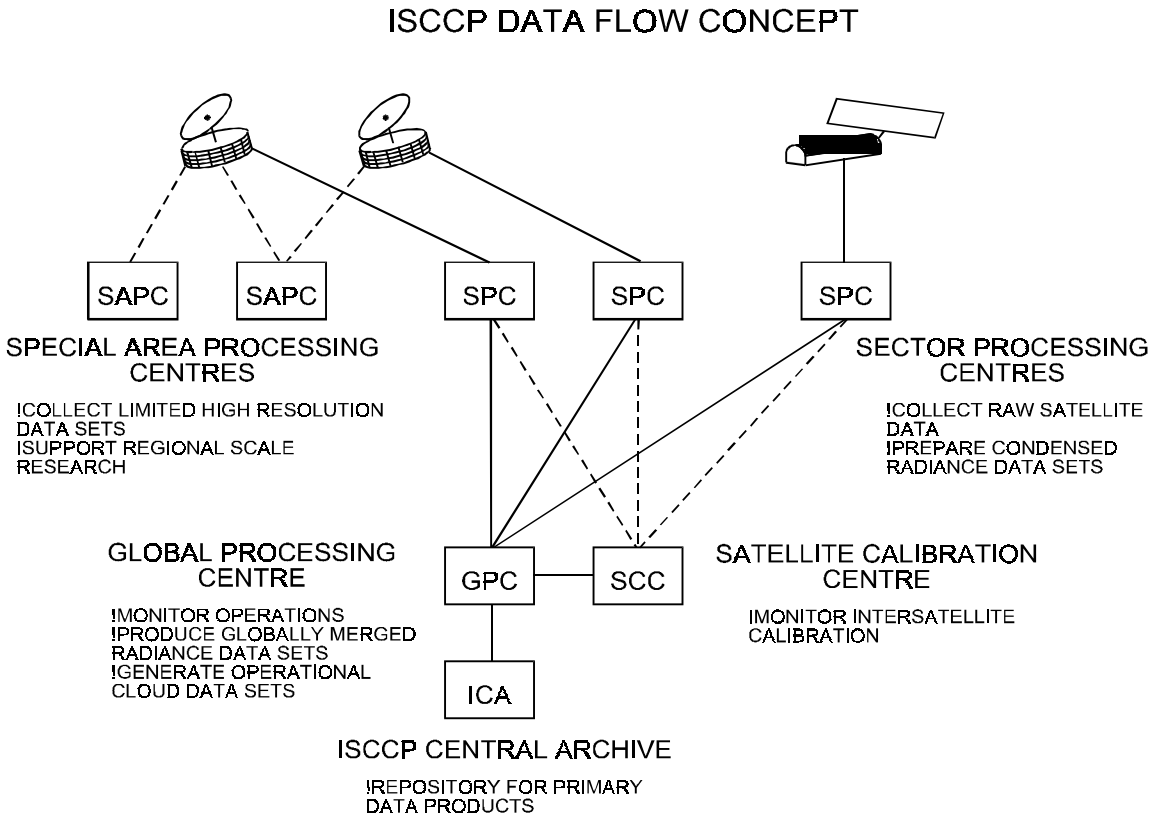

Figure 1.1. ISCCP data management concept.

Table 1.1. ISCCP Data Management Commitments.

RESPONSIBILITY	PRIMARY INSTITUTION	BACKUP INSTITUTION
SPC for NOAA/TIROS-N	USA/NOAA/NESDIS	+
SPC for METEOSAT	EUMETSAT*	+
SPC for GOES-EAST	Canada/AES**	USA/UWS
SPC for GOES-WEST	USA/CSU	USA/UWS
SPC for GMS	Japan/JMA	+
SPC for INSAT	India (no commitment)	+
SCC	France/CMS***	+
Correlative Data Center	USA/NOAA/NESDIS	+
GPC	USA/NASA/GISS	+
ICA	USA/NOAA/NESDIS	+

\+ No commitment sought.

* ESA served as the SPC for METEOSAT from July 1983 to November 1995.

** USA/UWS served as the SPC for GOES-EAST from July 1983 to July 1984.

*** FRG/U. Koln served as SCC for the Data Management Systems Test and assisted France/CMS in the development of the radiance normalization technique.

and up to five geostationary satellites), the Satellite Calibration Center (SCC), and the Global Processing Center (GPC). Additional Special Area Processing Centers (SAPC) provide special high resolution datasets from designated satellites for regional research projects. Another center coordinates the delivery of other satellite and conventional weather data (correlative data) to the GPC for use in the cloud analysis. All data are archived and made available to researchers by the ISCCP Central Archives (ICA). Table 1.1 shows the institutional commitments as of June 1996.

The basic SPC task is to collect raw satellite imaging data (Stage A) and reduce its volume in four steps (see Section 3.3). First, time sampling of geostationary observations reduces the frequency of observation of a given location to once every three hours. Second, the higher resolution visible channel data are averaged (if necessary) to match the lower resolution of the infrared channel data. Third, overlapping image pixels are removed. Fourth, spatial sampling of the images is done (if necessary) to reduce resolution to ~ 10 km. The resulting image data (Stage B1) are archived at the ICA. The SPCs also produce Stage B2 data, which are the result of a further reduction in volume by sampling to produce a resolution ~ 30 km; these data are sent to the GPC for further processing (see Fig. 1.2).

The SCC receives special high resolution imaging data (Stage AC) from the SPCs, which constitute simultaneous observations of the same locations by the polar orbiter and each geostationary satellite. These data are used to normalize the calibrations of all geostationary satellites to the polar orbiter which is taken as the reference standard (see Section 4.2, also Desormeaux et al. 1993). These normalization coefficients (Stage BC) are sent to the GPC (see Fig. 1.2).

The GPC combines the Stage BC and B2 data to produce the primary radiance data product (Stage B3), described in this document, which has a nominal spatial resolution of ~ 30 km, a time resolution of three hours, and radiance values normalized to a single standard radiometer. Additional adjustments are made to the calibrations based on long-term monitoring of the polar orbiter measurements and detection of short-term anomalies (Section 4.3, Brest and Rossow 1992; Brest et al. 1996). The final calibration coefficients are also archived as a separate dataset for each image collected from

each satellite (Stage BT). The Stage B3 data are navigated and placed into a common format. The GPC also analyzes the B3 data to obtain cloud properties (first version is C data, second version is D data). All data products are archived at the ICA (see Fig. 1.2).

Representatives of the ISCCP Data Management Centers listed in Table 1.1 form the JSC Working Group on Data Management for Radiation Projects. The data documentation presented here is based on material provided by the Working Group members and the satellite operating agencies. Table 1.2 lists the Working Group membership as of June 1996.

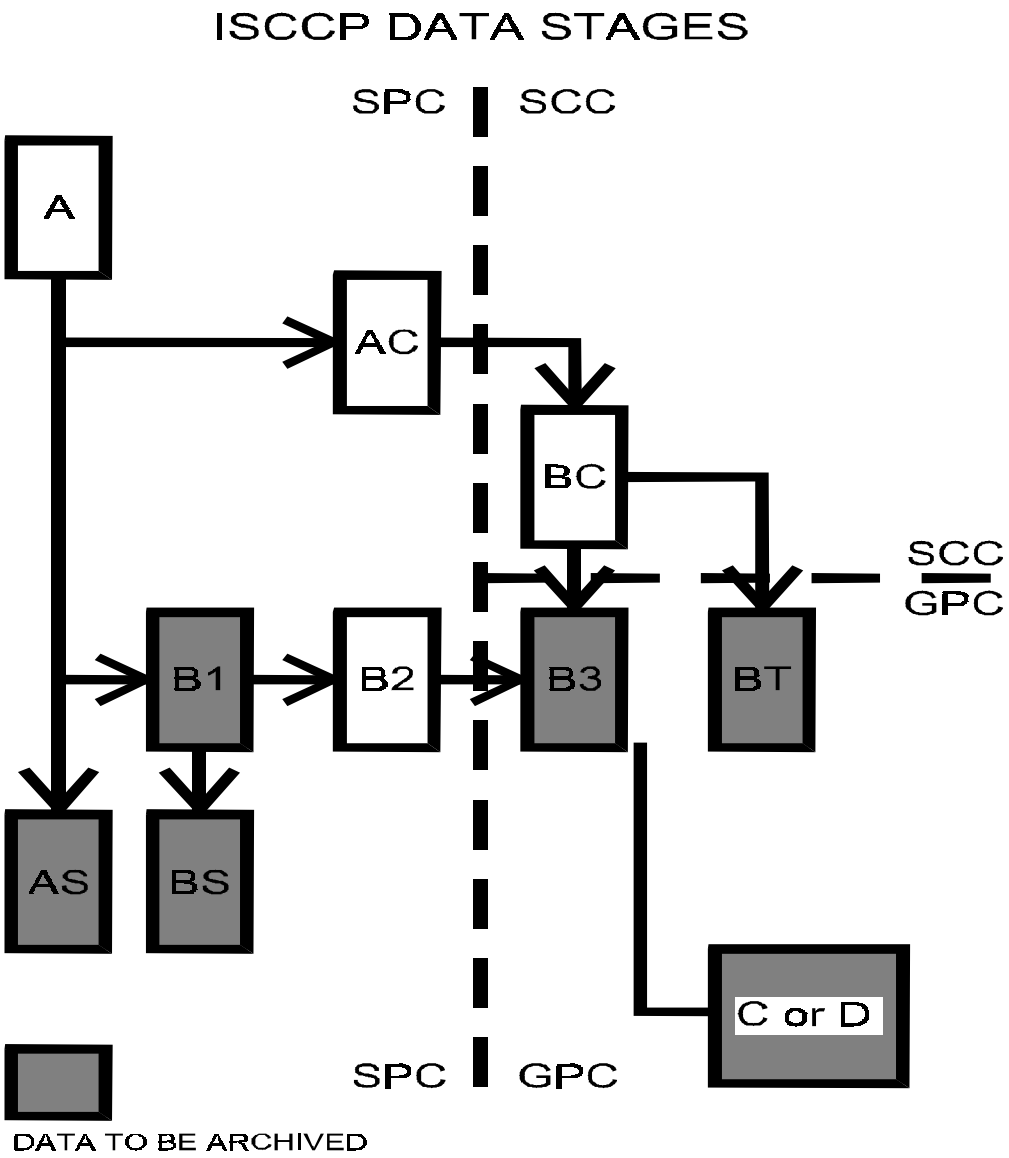

Figure 1.2. ISCCP data stages showing types of data produced by each center (see text). Shaded boxes indicate data stages which are archived.

Table 1.2. Working Group on Data Management.

NAME	AFFILIATION	ISCCP AFFILIATION
	CURRENT MEMBERS	
S. Akagi	Japan/JMA	SPC GMS
G. Campbell	USA/CSU	SPC GOES-WEST
Y. Desormeaux	France/CMS	SCC
Y. Durocher	Canada/AES	SPC GOES-EAST
R. Francis	EUMETSAT	SPC METEOSAT
K. Kidwell	USA/NOAA/NESDIS	SPC NOAA, ICA
W. Rossow	USA/NASA/GISS	GPC
	MEMBER FROM JSC/CAS WORKING GROUP ON RADIATION FLUXES	
E. Raschke	Germany/GKSS	N/A
	EX-OFFICIO MEMBERS	
R. Schiffer	USA/NASA	Project Manager
S. Benedict	JPS for WCRP ICSU/WMO	N/A
	PREVIOUS MEMBERS	
N. Beriot	France/CMS	SCC
K. Black	ICSU/RSA	SAPC METEOSAT
F. Bowkett	Canada/AES	SPC GOES-EAST
H. Drahos	USA/NOAA/NESDIS	SPC NOAA, ICA
R. Fox	USA/UWS	SPC GOES-EAST
V. Gärtner	ESA	SPC METEOSAT
J. Gibson	USA/NOAA/NESDIS	SPC NOAA, ICA
H. Jacobowitz	ISCCP Office NOAA	N/A
S. Kadowaki	Japan/JMA	SPC GMS
T. Kaneshige	JPS for WCRP ICSU/WMO	N/A
I. Kubota	Japan/JMA	SPC GMS
A. Kurosaki	Japan/JMA	SPC GMS
S. Lapczak	Canada/AES	SPC GOES-EAST
B. Mason	ESA	SPC METEOSAT
M. Mignono	USA/NOAA/NESDIS	SPC NOAA, ICA
C. Norton	USA/UWS	SAPC GOES-EAST/WEST
T. Nuomi	Japan/JMA	SPC GMS
R. Reeves	NOAA	N/A
R. Saunders	ESA	SPC METEOSAT
N. Shimizu	Japan/JMA	SPC GMS
K. Shuto	Japan/JMA	SPC GMS
T. Vonder Haar	USA/CSU	JSC/CAS Working Group
S. Woronko	Canada/AES	SPC GOES-EAST
D. Wylie	USA/UWS	SAPC GOES-EAST/WEST

1.2. SUMMARY OF CHANGES

Since the last documentation for the ISCCP Reduced Resolution Radiance data was published in 1987, there have been some changes concerning the contents of the dataset but not its format. The major changes are: (1) revision of the radiance calibrations and (2) addition of data from later or newer versions of the operational weather satellites. The first version of the radiance calibrations still had small (< 10%) artificial changes and differences among the satellite radiances that have been reduced in a refined analysis (see Section 4). The original ISCCP data collection period was to cover July 1983 through June 1988, but this has now been extended through 2000. This document describes the other satellites providing data up through June 1996 (see below).

There have been two minor changes to the B3READ software to correct small errors, so that **users should check that they have a version dated 10 July 1987**.

The revision of the radiance calibrations was made by adding additional comparison tests and tightening the required agreement among measurements obtained from different satellites (see Section 4). In addition, the calibration reference standard was changed from the AVHRR on NOAA-7 to that on NOAA-9. The independent calibration of this radiometer is much better determined than that of any other radiometer (see Brest and Rossow 1992; Brest et al. 1996), having absolute uncertainties of about 5-7% for the solar wavelength channels and about 2-3% for the thermal infrared channels. To avoid reproducing all of the Stage B3 data tapes every time that the calibrations are revised, a new dataset has been created, called the BT dataset, that reports the same radiance calibration tables contained in each image header record. Version 0 of this dataset reports the original B3 radiance calibrations obtained for the period July 1983 through June 1991; Version 1 reports the revised calibration. For B3 data from July 1991 onwards, the BT calibration dataset is Version 0. Thus, **users of ISCCP B3 data should always obtain the corresponding BT datasets** (separate for each satellite) **with the highest available version number** (see the ISCCP Web Home Page for the latest information) **and read the calibration tables from the BT data for each image**.

The ISCCP data collection period now covers July 1983 through June 1996 and will extend through 2000. In that time, each satellite system has changed many times (see Section 7 for more details). This document provides information on the following satellites. The NOAA polar orbiters operating in the "afternoon" orbit are NOAA-7, NOAA-9, NOAA-11 and NOAA-14. There is a 5-month gap in coverage between NOAA-11 and NOAA-14. The NOAA polar orbiters operating in the "morning" orbit are NOAA-8, NOAA-10 and NOAA-12. There is a 29-month gap in coverage between NOAA-8 and NOAA-10. The METEOSAT geostationary satellites are METEOSAT-2, METEOSAT-3, METEOSAT-4 and METEOSAT-5, operating at 0° longitude. There are no gaps in coverage but operations switched back-and-forth between METEOSAT-3 and METEOSAT-4 in several months from September 1989 until April 1990. The GMS geostationary satellites are GMS-1, GMS-2, GMS-3, GMS-4 and GMS-5, operating at 140°E longitude. The only gap in GMS coverage is in June-1984. GMS-5 is a new version of the GMS satellite with images collected in two additional spectral bands. The GOES geostationary satellites operate at two positions, EAST (75°W longitude) and WEST (135°W longitude). Satellites in the EAST position are GOES-5, GOES-7 and GOES-8. Satellites in the WEST position are GOES-6, GOES-7 and GOES-9. After the failure of GOES-5 in July 1984, GOES-6 operated alone for 32 months moving back and forth between longitudes near 105° W and returned to the WEST position after the launch of GOES-7. After the failure of GOES-6 in January 1989, GOES-7 operated alone near 105°W for 39 months until METEOSAT-3 was moved to the EAST position, at which time GOES-7 moved to the WEST position. GOES-8 replaced METEOSAT-3 in the EAST position in March 1995 and GOES-9 replaced GOES-7 in January 1996. GOES-8 and GOES-9 are new versions of the GOES satellites collecting images in three additional spectral bands. Although a series of INSAT satellites have operated over the Indian Ocean since early 1984, only 13 months of complete data have been obtained for ISCCP.

To include these extra satellites, the Sector Processing Center code numbers and Satellite Code numbers used in the B3 dataset have been augmented as follows:

SPC	Code Number	Satellite	Code Number
NOA	1	NOAA-7, 9, 11, 14	11, 12, 13, 14
NOM	1	NOAA-8, 10, 12	61, 62, 63
CSU	2	GOES-6, 9	21, 22
UWS, AES, CME*	3	GOES-5, 7**, 8	31, 32, 33
ESA, EUM, MTI	4	METEOSAT-2, 3†, 4, 5	41, 42, 43, 44
JMA	5	GMS-1, 2, 3, 4, 5	51, 52, 53, 54, 55
CIN††	6	INSAT-1B	71

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* CSU processing METEOSAT-3 data in GOES-EAST position.
** CSU also processed GOES-7 data.
† METEOSAT-3 also operated in GOES-EAST position.
†† CSU processing INSAT-1B data.
MTI is METEOSAT 5 positioned in section 63°E

1.3. DATA PRODUCTS

In the first phase of the project, Stage B3, BT and the gridded, 3-hourly (Stage C1) and monthly (Stage C2) datasets were made available (Rossow and Schiffer 1991; Rossow et al. 1991). These datasets cover the period from July 1983 through June 1991. In the second phase of the project, new versions of these two gridded products are being made available, called Stage D1 (3-hourly) and Stage D2 (monthly), as well as a "pixel-level" product (Stage DX). These products will cover the time period from July 1983 through June 1991 and beyond.

Reduced Resolution Radiance Data (B3)

Resolution:	4-7 km pixel at 30 km interval, 3 hr, individual satellites
Volume:	1.1 Gbyte per data month for global coverage
Contents:	Radiances with calibration and navigation appended; uniform format for all satellites

Calibration Table Dataset (BT)

Resolution:	3 hr, individual satellites
Volume:	0.9 Gbyte per data year
Contents:	Updated calibration tables for B3 dataset

Pixel-Level Cloud Product (CX -- not available publically)

Resolution:	30 km mapped pixels, 3 hr, individual satellites
Volume:	3.4 Gbyte per data month for global coverage
Contents:	Calibrated radiances and viewing geometry, cloud detection results, cloud and surface properties from radiative analysis

Pixel-Level Cloud Product - Revised Analysis (DX)

Resolution:	30 km mapped pixels, 3 hr, individual satellites
Volume:	5 Gbyte per data month for global coverage
Contents:	Calibrated radiances and viewing geometry, cloud detection results, cloud and surface properties from radiative analysis

Gridded Cloud Product (C1)

Resolution:	280 km equal-area grid, 3 hr, global
Volume:	216 Mbyte per data month
Contents:	Spatial averages of CX quantities and statistical summaries; satellites are merged into global grid; atmosphere and surface properties from TOVS appended

Gridded Cloud Product - Revised Analysis (D1)

Resolution:	280 km equal-area grid, 3 hr, global
Volume:	320 Mbyte per data month
Contents:	Spatial averages of DX quantities and statistical summaries, including properties of cloud types; satellites are merged into global grid; atmosphere and surface properties from TOVS appended

Climatological Summary Product (C2)

Resolution:	280 km equal-area grid, monthly, global
Volume:	4 Mbyte per data month
Contents:	Monthly average C1 quantities including mean diurnal cycle; distribution and properties of total cloudiness and cloud types

Climatological Summary Product (D2)

Resolution:	280 km equal-area grid, monthly, global
Volume:	7.5 Mbyte per data month
Contents:	Monthly average D1 quantities including mean diurnal cycle; distribution and properties of total cloudiness and cloud types

1.4. CONTACTS FOR ASSISTANCE AND DATA ORDERS

All of the ISCCP datasets are **produced** by the

ISCCP Global Processing Center
NASA Goddard Space Flight Center
Institute for Space Studies
2880 Broadway
New York, NY 10025
USA

For **technical** questions concerning data formats and software, contact

Alison W. Walker
Science Systems and Application Inc. at
NASA Goddard Institute for Space Studies
2880 Broadway
New York, NY 10025

Phone: 212-678-5542
FAX: 212-678-5552
e-mail: alison@giss.nasa.gov

For **scientific** questions about the cloud data products, contact

Dr. William B. Rossow
NASA Goddard Institute for Space Studies
2880 Broadway
New York, NY 10025

Phone: 212-678-5567
FAX: 212-678-5662
e-mail: clwbr@giss.nasa.gov

General **questions and comments** can be e-mailed to

isccp@giss.nasa.gov

The **ISCCP Home Page** provides more information about the ISCCP organization and data products, sample data and browse images, software, documentation and errata, radiance calibrations, current project status, and data availability. The World Wide Web URL is:

http://isccp.giss.nasa.gov

All ISCCP data products (except Stage DX data) are **available from**

ISCCP Central Archives	Phone: 704-271-4800 (option #5)
NOAA/NESDIS/NCDC	FAX: 704-271-4876
Climate Services Division/	e-mail: satorder@ncdc.noaa.gov
Satellite Services Branch	
FOB3, Room G233	
Suitland, MD 20233	

All ISCCP data products (including Stage DX data) are also **available from** the EOS Distributed Active Archive Center at

User and Data Services	Phone: 804-864-8656
Langley DAAC	FAX: 804-864-9807
Mail Stop 157B	e-mail: userserv@eosdis.larc.nasa.gov
NASA Langley Research Center	telnet: eosdis.larc.nasa.gov
Hampton, VA 23681-0001	(logon ims, password larcims)