4. ISCCP PROJECT INFORMATION

4.1. DATA PROCESSING STRATEGY

The strategy adopted for implementing the ISCCP reflects the diverse nature of the spaceborne observing system and the large volume of imaging and other data produced. The primary data processing is done by nine ISCCP centers (Figure 4.1): a Sector Processing Center (SPC) for each satellite (up to two polar orbiters and five geostationary satellites), the Satellite Calibration Center (SCC), and the Global Processing Center (GPC). Another center coordinates the delivery of other satellite and conventional weather data (correlative data) to the GPC for use in the cloud analysis and an additional center acts as the ISCCP Central Archive (ICA) for all data produced by the project. Table 4.1.1 shows the institutional commitments as of January 1996. The main processing task of the SPCs is to reduce the volume of the satellite radiance data by sampling in space and time. The SCC normalizes the calibration of the geostationary satellite radiometers to the reference polar orbiter radiometer; the GPC monitors the calibration of the polar orbiters and makes other short-term calibration adjustments. The GPC conducts the cloud analysis and the ICA archives all of the ISCCP data products. The SAPCs are not currently active.

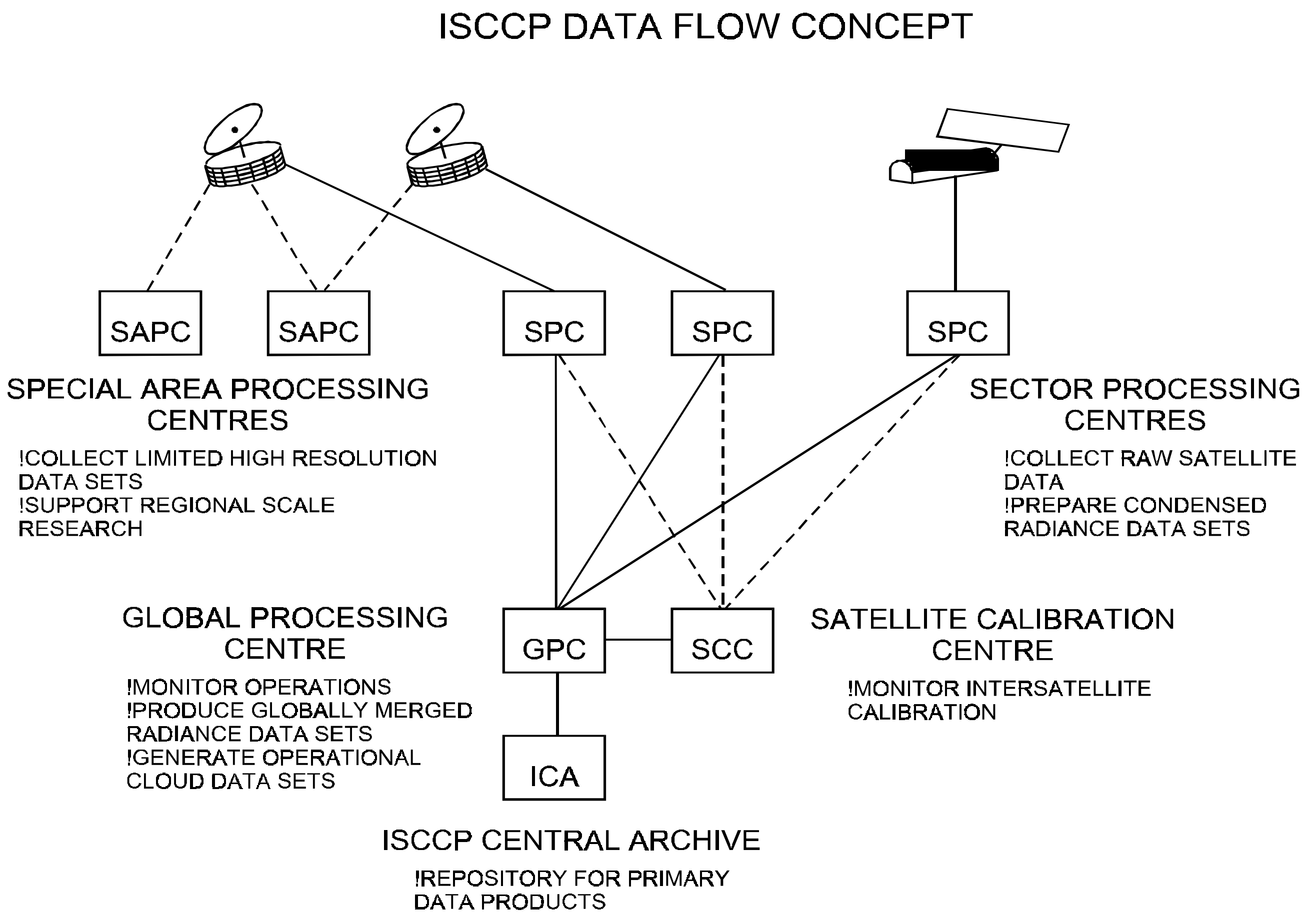

Figure 4.1. Schematic of ISCCP data processing.

Table 4.1.1. 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.

4.2. VALIDATION STRATEGY

Limitations of the satellite radiance measurements and other information, together with the developing nature of cloud analysis methods, make a research program a crucial component of the ISCCP. This research program provides validation of the ISCCP cloud climatology and the basis for developing improved methods for remote sensing of clouds by comparing the ISCCP analysis products with other cloud observations. Validation of the ISCCP cloud climatology addresses not only the quantitative assessment of measurement errors, but also the refinement of the interpretation of the results in terms of atmospheric and cloud processes. This research also improves radiative transfer models of cloudy atmospheres. A major source of comparison observations comes from an on-going series of intensive field experiments conducted by various nations. The results of validation studies have already been used to improve the ISCCP analysis, leading to a replacement and extension of the C-series datasets by the D-series datasets.

The first cloud detection method for ISCCP (Rossow and Garder 1993a) was developed from a three year pilot study that compared the performance of nine different algorithms applied to the same data (Rossow *et al.* 1985). These tests showed that all methods then available detected a majority of the cloudiness on Earth because the spatial and temporal radiance changes produced by most clouds in both the visible and infrared bands are large compared to the total range of radiances observed. However, these methods disagreed most in partially cloudy situations, where there are many radiance values that are only slightly different from those representing clear conditions, in locations where the surface is unusually cold or bright (e.g., winter land areas), which reduces the contrast with clouds, or for certain cloud types that do not cause very large changes in the observed radiances (cirrus in the visible or marine boundary layer clouds in the infrared). The pilot study also provided a practical way to define the accuracy of satellite cloud detections by determining the accuracy of the clear radiances, which are determined primarily by the properties of the Earth's surface: verification of the accuracy of the clear radiances provides a quantitative assessment of the detection accuracy of the analysis. The results of such verification studies, together with comparisons of the ISCCP cloud amount with other observations and climatologies, are reported in Wielicki and Parker (1992), Rossow and Garder (1993b), and Rossow *et al*. (1993). These results led to some re-design of the ISCCP cloud detection method which was used to produce the D-series of cloud products.

Once the radiance data are divided into clear and cloudy populations, quantitative interpretation to infer specific properties of clouds requires a radiative model of the effects of clouds, as well as the atmosphere and surface, on the satellite radiances. The three most important uncertainties in the first radiative model were the effects of the assumed cloud microphysical model (gamma distribution of liquid water spheres with effective radius of 10 μm and variance of 0.15), the effects of the assumed macrophysical model (single, physically thin, plane-parallel cloud layer), and the effects of neglecting the smaller scale (sub-pixel scale < 5 km) variations of cloud properties. A subsequent survey of the droplet radii in liquid water clouds (Han *et al*. 1994) showed that the actual range of variations introduced a random uncertainty in ISCCP optical thickness values of 12% and biases of < 3%. However, the particular microphysical model produced larger errors for ice crystal clouds, approaching 100% in optical thickness and 1 - 2 km in cirrus cloud top locations (Minnis *et al*. 1993). Consequently, an ice crystal microphysical model has been introduced into the revised ISCCP radiative model. One study (Liao *et al*. 1995a, 1995b) shows that the tops of high-level clouds, particularly in the tropics, are diffuse such that IR emission arises from a significant distance below the physical cloud top. Hence, ISCCP cloud top pressure estimates are biased high by 50 - 100 mb, but still represent the radiatively effective top. Other aspects of cloud layer structure and the effects of small scale inhomogeneity are still under study.

4.3. ISCCP WORKING GROUP ON DATA MANAGEMENT

Representatives of the ISCCP Data Management Centers listed in Table 4.1.1 originally formed the ISCCP Working Group on Data Management (WGDM) for the Joint Scientific Committee (JSC) of the World Climate Research Program. Scientific guidance was provided to the project by the International Radiation Commission of IAMAP and by the JSC Working Group on Radiation Fluxes. A re-organization of the WCRP in the early 1990's led to the WGDM being made responsible for all radiation projects within WCRP as part of the Global Energy and Water Experiment (GEWEX). Table 4.3.1 lists the WGDM membership as of July 1995.

Table 4.3.1. Working Group on Data Management.

NAME	AFFILIATION	ISCCP AFFILIATION
CURRENT MEMBERS		
G. Campbell	USA/CSU	SPC GOES-WEST
Y. Desormeaux	France/CMS	SCC
Y. Durocher	Canada/AES	SPC GOES-EAST
R. Francis	EUMETSAT	SPC METEOSAT
V. Gärtner	ESA	SPC METEOSAT
K. Kidwell	USA/NOAA/NESDIS	SPC NOAA, ICA
N. Shimizu	Japan/JMA	SPC GMS
W. Rossow	USA/NASA/GISS	GPC
MEMBERS 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
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
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

4.4. SUMMARY OF PROJECT PHASES

The ISCCP project has several stages of activity, **Phase 1:** (1982 - 1984) initial implementation of data processing systems, (1983 - 1987) complete development of cloud analysis, (1988 - 1992) complete processing of first 8 years of data, (1992 - 1995) refinements of processing system, (1995 - 1997) re-processing of first 8 years of data and completion of next 4 years of data and **Phase 2:** (1995 - 1997) development of enhanced processing for GEWEX, (1997 - 2001) complete processing of next 5 years of data together with enhanced processing.

During ISCCP Phase 2, the Stage DX, D1, and D2 datasets will continue to be produced unchanged; however, several additional data products will be developed. Ideas for other cloud property retrievals that are being explored include the following:

(i) identification of multi-layer cloud systems involving thin cirrus as the upper layer using additional IR wavelengths

(ii) retrieval of effective cloud particle sizes for liquid droplet and ice crystal clouds using additional near-IR and IR wavelengths

(iii) retrieval of cloud liquid and ice water path using combined visible and microwave wavelengths

(iv) improvement of phase discrimination and retrievals of nighttime and winter polar clouds using additional IR wavelengths.

The first series of the ISCCP cloud products, called Stage C1 and C2 data, was produced covering the time period July 1983 - June 1991. No more of these products will be produced. The final version numbers included in the dataset ID for the Stage C1, and Stage C2 datasets and their corresponding TV and IS datasets can be found in a table on the ISCCP Home Page.