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GREEN

WCRP

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CLIMATE CHANGE BUILDING BLOCKS

- **IPCC PRIORITIES:**

- 1. SOURCES AND SINKS OF GREENHOUSE GASES**
- 2. CLOUDS AND RADIATIVE BALANCE, INCLUDING PRECIPITATION**
- 3. OCEANS**
- 4. LAND-SURFACE HYDROLOGICAL PROCESSES**
- 5. POLAR ICE SHEETS**
- 6. ECOLOGICAL PROCESSES**

- **EOS PRIORITIES:**

- 1. WATER AND ENERGY CYCLES (2)**
- 2. OCEANS (3)**
- 3. CHEMISTRY OF TROPOSPHERE AND LOWER STRATOSPHERE (1)**
- 4. LAND SURFACE HYDROLOGY AND ECOSYSTEM PROCESSES (4&6)**
- 5. GLACIERS AND POLAR ICE SHEETS (5)**

GEWEX OBJECTIVES

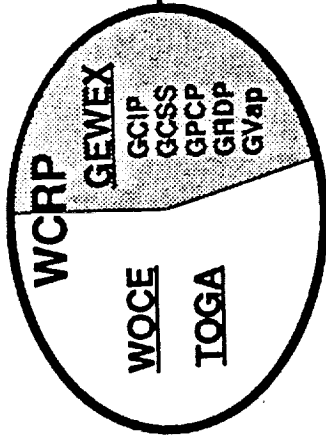
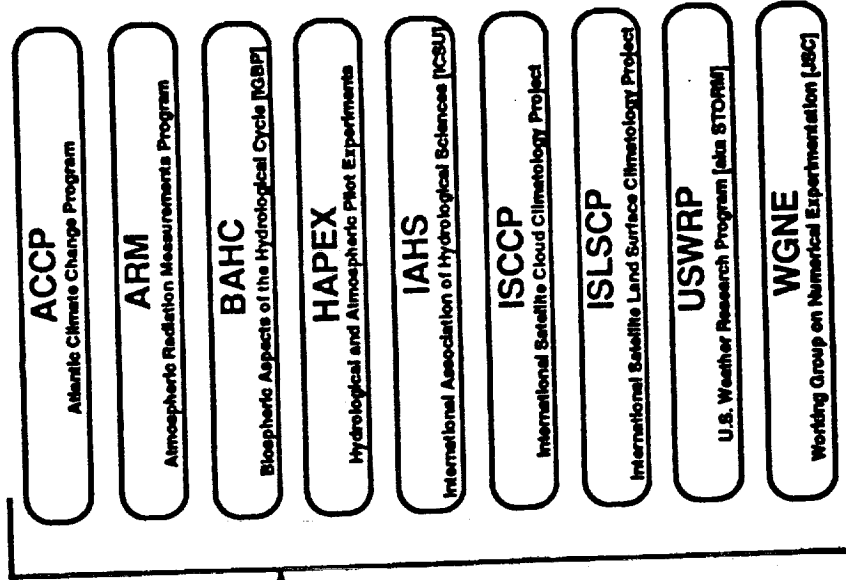
- **DETERMINE THE HYDROLOGIC CYCLE AND ENERGY FLUXES BY MEANS OF GLOBAL MEASUREMENTS OF OBSERVABLE ATMOSPHERIC AND SURFACE PROPERTIES**
- **MODEL THE GLOBAL HYDROLOGIC CYCLE AND ITS EFFECTS ON THE ATMOSPHERE AND OCEANS**
- **FOSTER THE DEVELOPMENT OF OBSERVING TECHNIQUES AND DATA MANAGEMENT AND ASSIMILATION SYSTEMS**
- **DEVELOP THE ABILITY TO PREDICT THE VARIATIONS OF GLOBAL AND REGIONAL HYDROLOGIC PROCESSES AND WATER RESOURCES, AND THEIR RESPONSE TO ENVIRONMENTAL CHANGE**

GEWEX STRATEGY

- **BUILD ON EXISTING PROGRAMS AND DATA**
- **MAKE RECOMMENDATIONS TO ESA, NASA AND NASDA WITH RESPECT TO INSTRUMENTS PLANNED FOR SPACE PLATFORMS**
- **CONDUCT MODELLING PROGRAMS**
 - **MODEL ALL ASPECTS OF THE HYDROLOGIC AND ENERGY CYCLES WITH EVOLVING, FULLY COUPLED ATMOSPHERE-LAND-OCEAN MODEL COMPONENTS**
- **CONDUCT PILOT PROJECTS**
 - **INTERNATIONAL PARTICIPATION**
 - **ENCOMPASS FULL RANGE OF EXPERIMENT SCALES**
 - **SMALL-SCALE (1X1 TO 100X100 KM) PROCESS STUDIES**
 - **CONTINENTAL SCALE**
 - **GLOBAL**

RELATIONSHIP OF GEWEX TO OTHER PROGRAMS AND ACTIVITIES

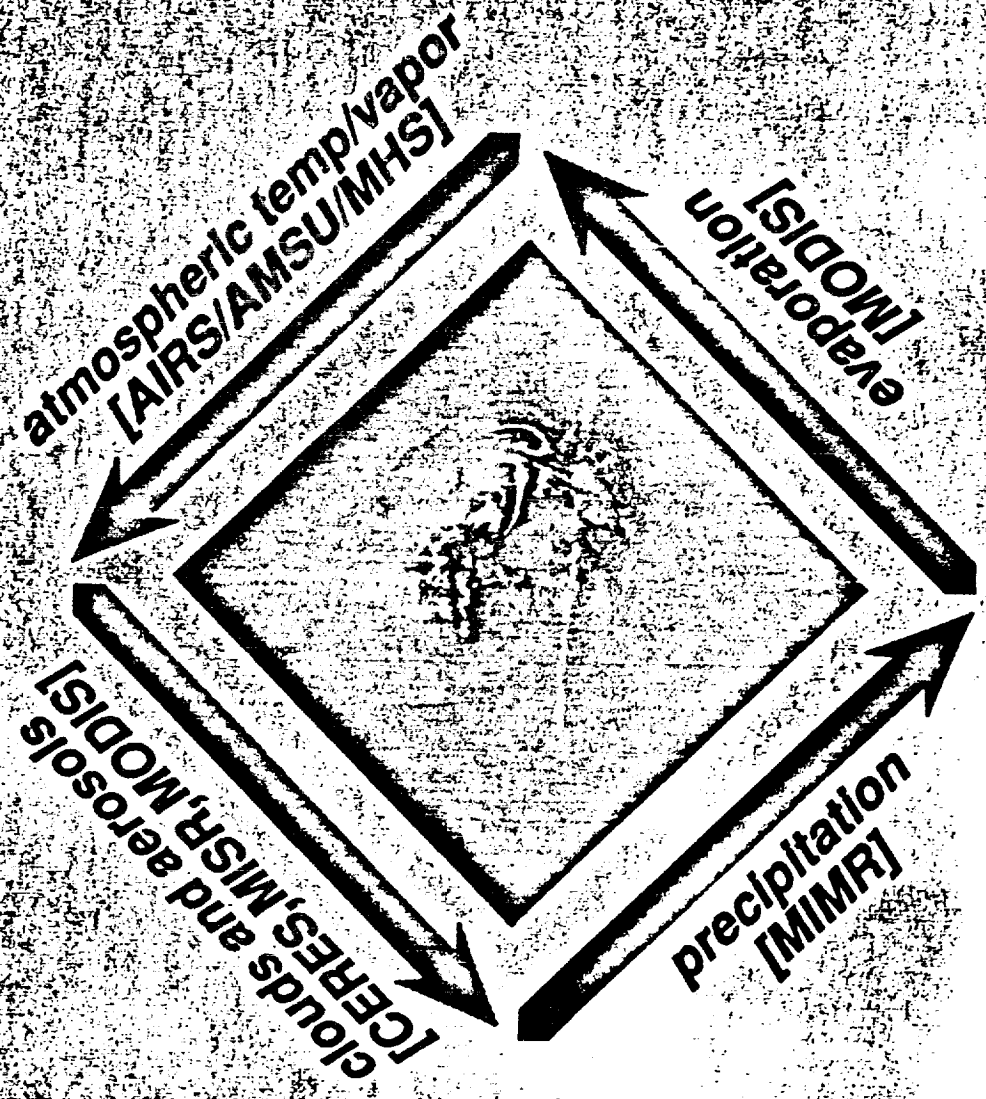
Other independent programs:



GEWEX SUBPROJECTS:
 CCIP = GEWEX Continental-Scale International Project
 GCSS = GEWEX Cloud System Study
 GPCP = Global Precipitation Climatology Project
 GRDP = Global Runoff Data Project
 GVap = GEWEX Water Vapor Climatology Pilot Project

OTHER ACTIVITIES:
 ICSU = International Council of Scientific Unions
 IOBP = International Geosphere/Biosphere Program
 JSC = Joint Scientific Committee
 TOGA = Tropical Oceans/Global Atmosphere
 WCRP = World Climate Research Programme
 WOCE = World Ocean Circulation Experiment

USING EOS TO STUDY THE ROLE OF WATER IN CLIMATE CHANGE



TYPES OF GLOBAL DATA NEEDED FOR GEWEX

BASIC METEOROLOGICAL PARAMETERS

- ATMOSPHERIC TEMPERATURE AND HUMIDITY
- OCEAN SURFACE TEMPERATURE, STRESS AND TOPOGRAPHY
- SURFACE METEOROLOGICAL OBSERVATIONS

TROPOSPHERIC WIND VECTOR

- GLOBAL DOPPLER WIND LIDAR*
- UPPER AIR WINDS

PRECIPITATION

- GLOBAL RAIN RADAR DATA**
- RAIN GAUGE AND LAND-BASED RAIN RADAR DATA
- OCEAN SALINITY

RADIATION AND CLOUDS

- SOLAR IRRADIANCE
- SPECTRAL OUTGOING LONG-WAVE RADIATION
- REFLECTED SOLAR RADIATION AT THE TOP OF THE ATMOSPHERE
- NET FLUX AT THE SURFACE
- EARTH RADIATION BUDGET
- GREENHOUSE TRACE GASES
- AEROSOLS
- STRATOSPHERIC WATER VAPOR
- CLOUD AMOUNT, TYPE AND HEIGHTS OF BASE AND TOP

LAND SURFACE DATA

- SURFACE ALBEDO AND ROUGHNESS
- SKIN SURFACE TEMPERATURE AND EMISSIVITY
- VEGETATION INDEX
- SNOW COVER, DEPTH AND WATER CONTENT
- SOIL MOISTURE AND WATER RUNOFF

- * REQUIRES 3000 WATTS OF POWER ON-ORBIT
- ** NON-SUNSYNCHRONOUS ORBIT REQUIRED TO SAMPLE DIURNAL VARIABILITY

The GEWEX Global Observing System

1988 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001

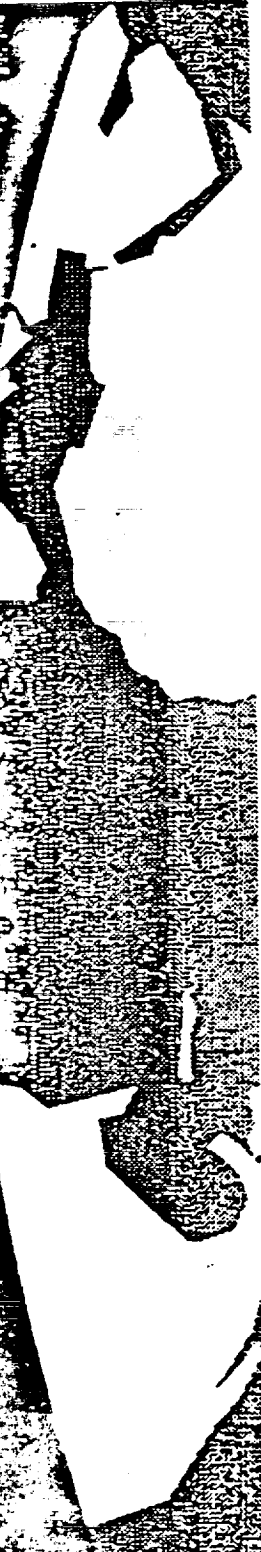
Ongoing Operational Meteorological and Hydrological Observations



GEWEX Continental Scale (GCP)

Validate Advanced Sensors

GEWEX Global Scale

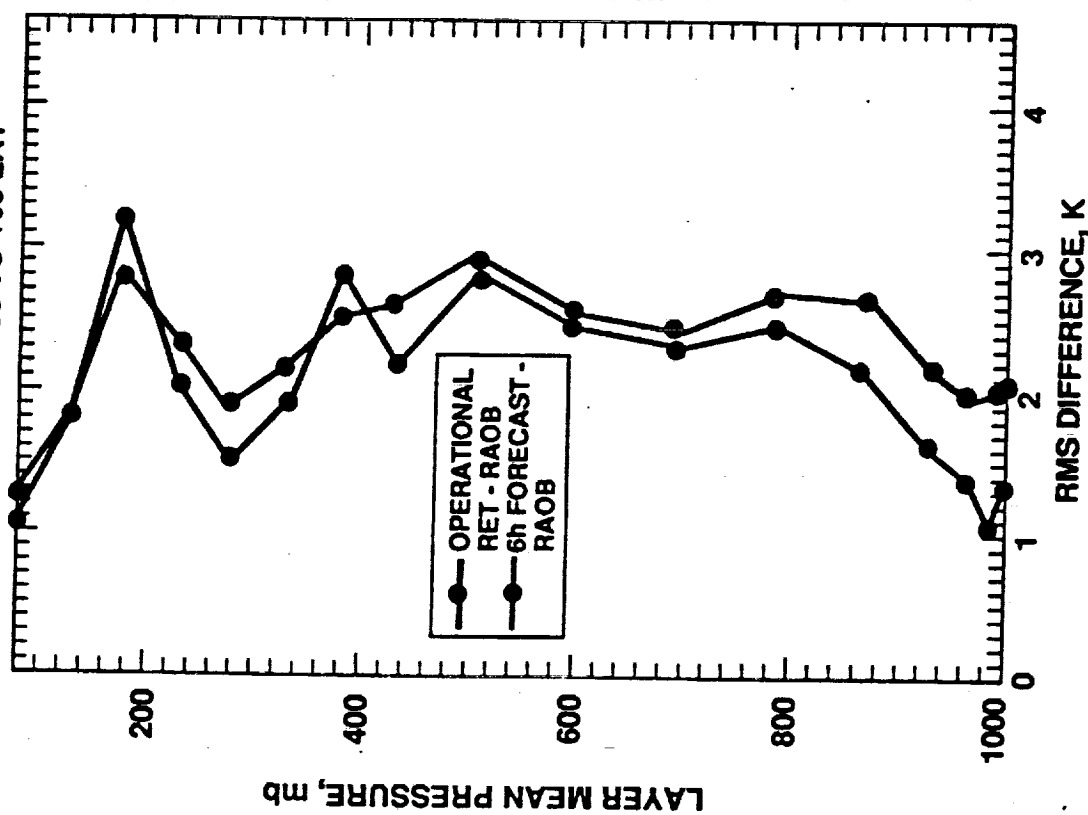


4-D DATA ASSIMILATION

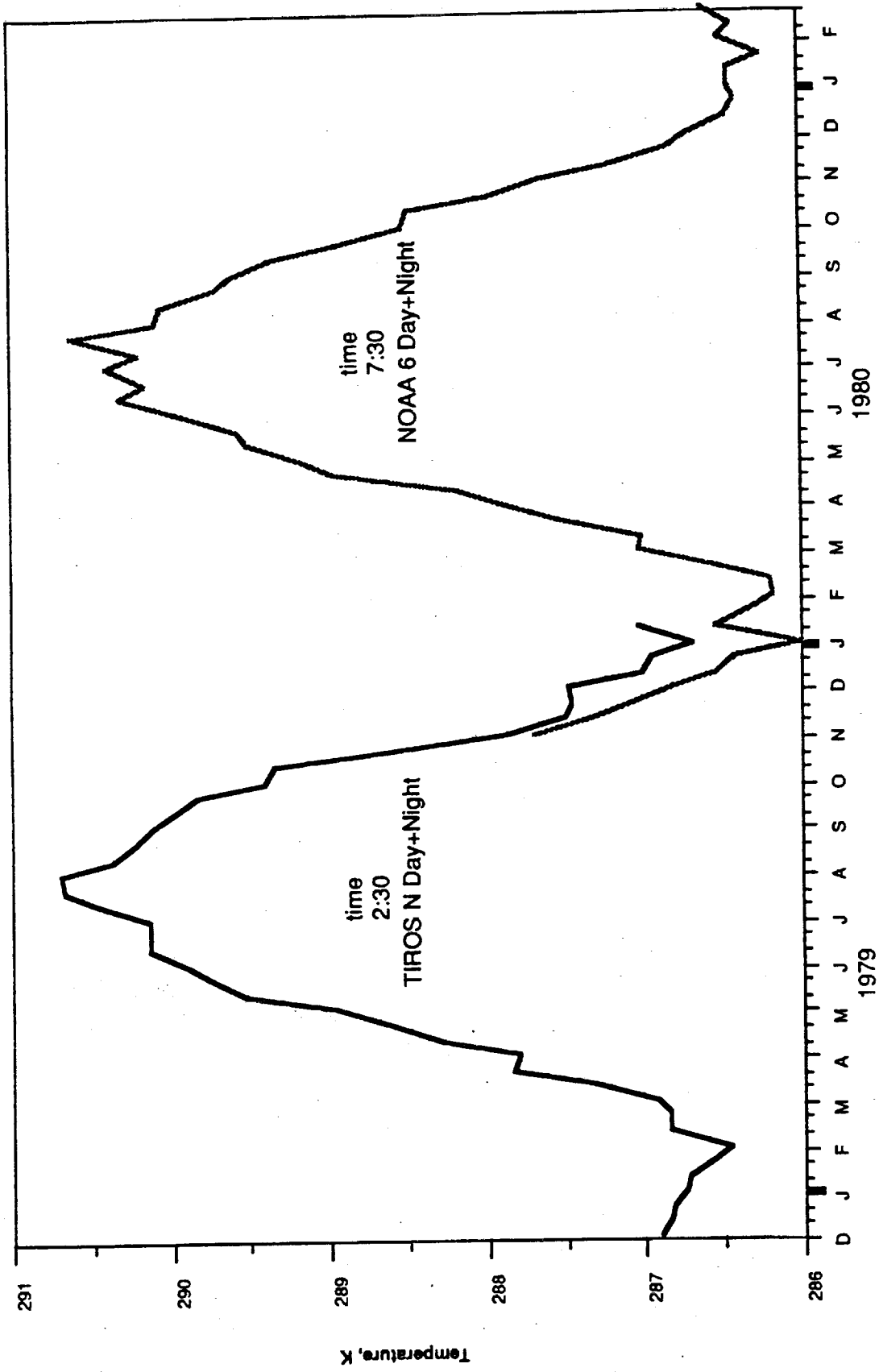
- **IS THE BASIS FOR UNDERSTANDING AND PREDICTING GLOBAL ENERGY AND WATER CYCLES**
- **SHORT-RANGE FORECASTS ARE A KEY TOOL**
 - **TO PRODUCE COHERENT DATA SETS FROM INCOMPLETE OBSERVATIONAL DATA**
 - **TO VALIDATE AND CONSTRAIN SURFACE FLUXES**

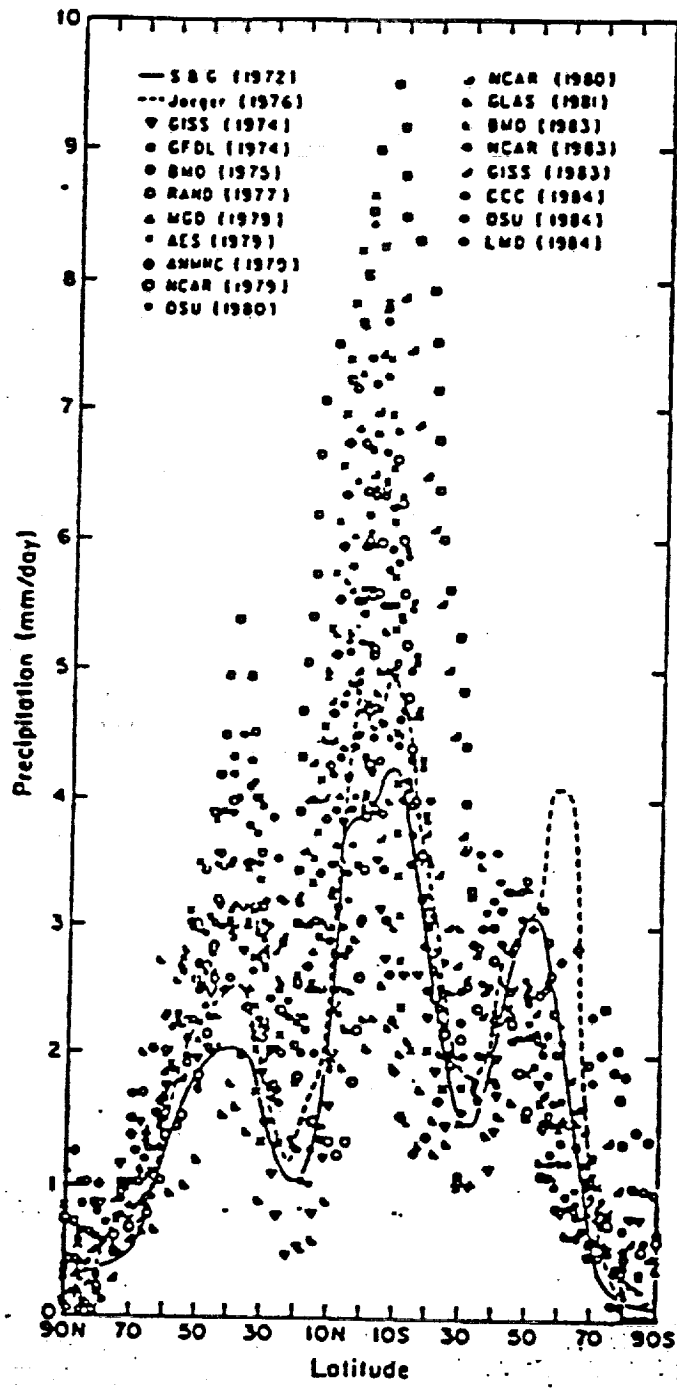
ACCURACY OF THE OPERATIONAL SATELLITE RETRIEVAL AND NMC MODEL 6h FORECAST (RAOB DIFFERENCES) CLEAR OCEAN CASES $\pm 60^\circ$ LAT

CASE STUDY - 02/08/91 (SAMPLE=44)
CLEAR OCEAN -60 TO +60 LAT



HIRS2/MSU Retrieved Day + Night Surface Temperature
December 1978 - February 1981





GCIP LOCATION: MISSISSIPPI RIVER BASIN



GCIP OBJECTIVES

- **DETERMINE THE TIME/SPACE VARIABILITY OF THE HYDROLOGIC AND ENERGY BUDGETS OVER A CONTINENTAL-SCALE REGION**
- **DEVELOP AND VALIDATE MACRO-SCALE HYDROLOGIC MODELS, RELATED HIGH RESOLUTION ATMOSPHERIC MODELS, AND COUPLED HYDROLOGIC/ATMOSPHERIC MODELS**
- **DEVELOP AND VALIDATE INFORMATION RETRIEVAL SCHEMES INCORPORATING EXISTING AND FUTURE SATELLITE OBSERVATIONS COUPLED WITH ENHANCED GROUND-BASED OBSERVATIONS**
- **PROVIDE A CAPABILITY TO TRANSLATE THE EFFECTS OF A FUTURE CLIMATE CHANGE INTO IMPACTS ON WATER RESOURCES AND TEMPERATURE ON A REGIONAL BASIS**

GCIP IMPLEMENTATION

- **MISSISSIPPI BASIN CHOSEN AS PRIMARY LOCATION, SUPPLEMENTED BY FIELD STUDIES IN OTHER REGIONS, AS REQUIRED**
- **MAKE FULL USE OF EXISTING AND PLANNED NETWORKS OF SURFACE OBSERVATIONS, AIRCRAFT DATA AND SATELLITE DATA**
- **SUBSTANTIAL INTERNATIONAL PARTICIPATION REQUIRED**
- **RELY ON AND COLLABORATE WITH EXISTING AND PLANNED PROGRAMS AS MUCH AS POSSIBLE, E.G.:**
 - STORM
 - ARM
 - INTERNATIONAL PROGRAMS, IGBP, ETC.
- **COLLECT A COMPREHENSIVE DATA SET OF HYDROMETEOROLOGICAL VARIABLES FOR AN EXTENDED PERIOD OF TIME TO TEST AND VALIDATE MODELS**

GCIP DATABASE

- REMOTELY SENSED

- RADAR PRECIPITATION (NEXRAD)
- SATELLITE RADIATION
 - - LONG AND SHORT-WAVE AT T.O.A.
 - - DERIVED FLUXES AT SURFACE
- SATELLITE AND AIRCRAFT VIS, IR, AND μ WAVE
- AVHRR NDVI
- CLOUD DISTRIBUTION/RADIATION
- CHARACTERISTICS ([ISCCP])
- WATER VAPOR

- GEOPHYSICAL DATA

- HYDROLOGIC BOUNDARIES
- STREAMS
- TOPOGRAPHY
- SOILS
- VEGETATION
- LAND USE
- SNOW COVER
- ALBEDO

- DERIVED DATA FIELDS

- NMC GRID POINT INITIALIZATIONS
- PRECIPITATION (MERGED
 - NEXRAD/SATELLITE/GROUND)
- OROGRAPHIC PRECIPITATION
- SOIL MOISTURE
- EVAPOTRANSPIRATION

- IN-SITU

- RADIOSONDE
- SURFACE METEOROLOGICAL
 - OBSERVATIONS (ASOS, ETC)
- SUPPLEMENTAL RAIN GAUGES
- WIND PROFILERS
- HYDROLOGIC OBSERVATIONS
 - (RIVER/RUNOFF, ETC)

POTENTIAL U.S. AGENCY INVOLVEMENT IN GCIP

	IN-SITU MEASUREMENTS	REMOTE MEASUREMENTS	MODELLING	DATA ARCHIVING
NASA	✓	✓	✓	✓
NOAA	✓	✓	✓	✓
NSF			✓	
USGS	✓		✓	✓
EPA	✓		✓	
DOE	✓		✓	
ARMY CORP OF ENG	✓			✓
BUREAU OF REC.	✓			✓
SOIL CONS. SERVICE	✓		✓	✓
U.S. FOREST SERVICE	✓			✓
USDA	✓		✓	✓

**GLOBAL ENERGY AND WATER CYCLE EXPERIMENT
(GEWEX)**

GCIP IMPLEMENTATION

FIVE MAJOR ACTIVITIES: / FY91 / FY92 / FY93 / FY94 / FY95 / FY96 / FY97 / FY98/

MODEL DEVELOPMENT

DATA COLLECTION

DATA ANALYSIS

PROCESS STUDIES

FIELD STUDIES
