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BRAZILIAN SPACE-BASED ENVIRONMENTAL DATA COLLECTION SYSTEM

GEO Capacity Building Workshop

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System Description

Main applications:

- **Hydrological basins monitoring**
- **Weather and climate forecast**
- **Chemistry of the atmosphere**
- **Oceanography**

Data Collection Platforms (DCP):

- **More than 700 DCPs installed**

Satellites:

- **SCD-1 (Operational since 1993),**
- **SCD-2 (Operational since 1998),**
- **CBERS-2 (DCS turned off, 2005)**

System Users:

- **More than 100 organizations**

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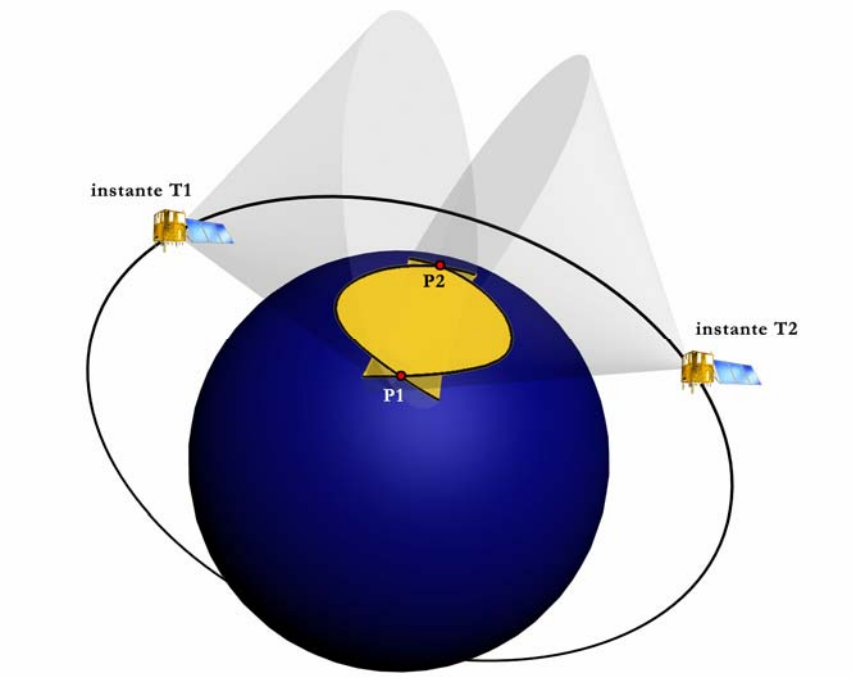
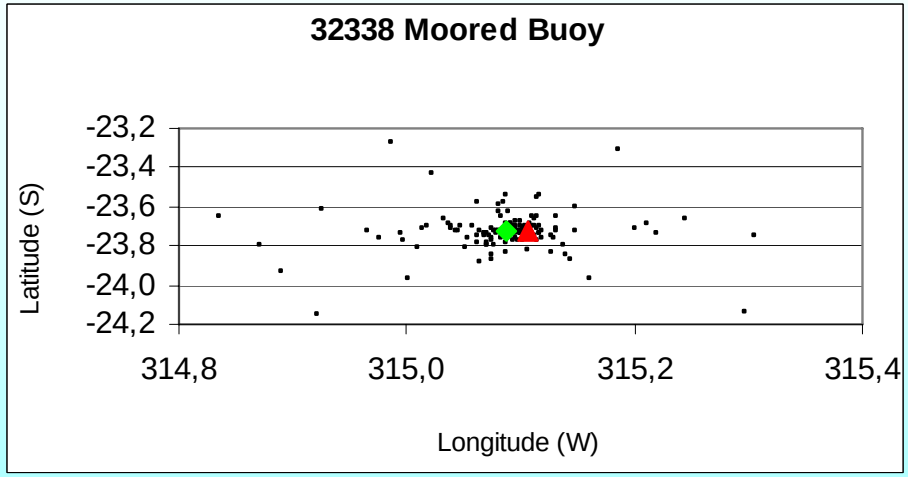
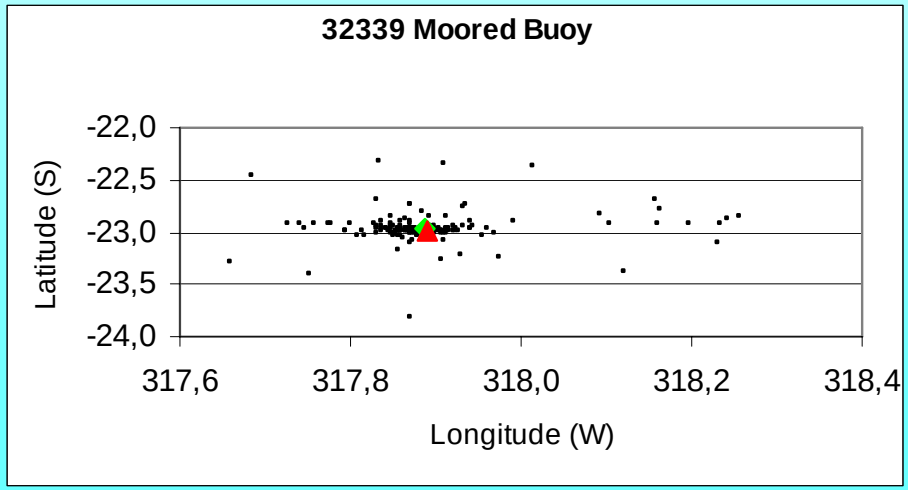
Data Collection System characteristics

- **Capacity of the System:**
  - **500 DCPs/Channel in the satellite foot print**
  - **2 channels(401.62MHz and 401.65 MHz)**
- **DCS transponder retransmits the received DCP messages in S Band or UHF (CBERS-2)**
- **DCP message acquisition is done at the Receiving Stations using a Data Collection Processor**
- **DCP message processing and storage are done at Data Collection Mission Center located in Cachoeira Paulista.**
- **Users can access the data at most 30 min after the satellite pass over a receiving station by Internet (ftp)**
- **DCP location capability using Doppler shift measurements at receiving station**

DOPPLER SHIFT DCP LOCATION CAPABILITY







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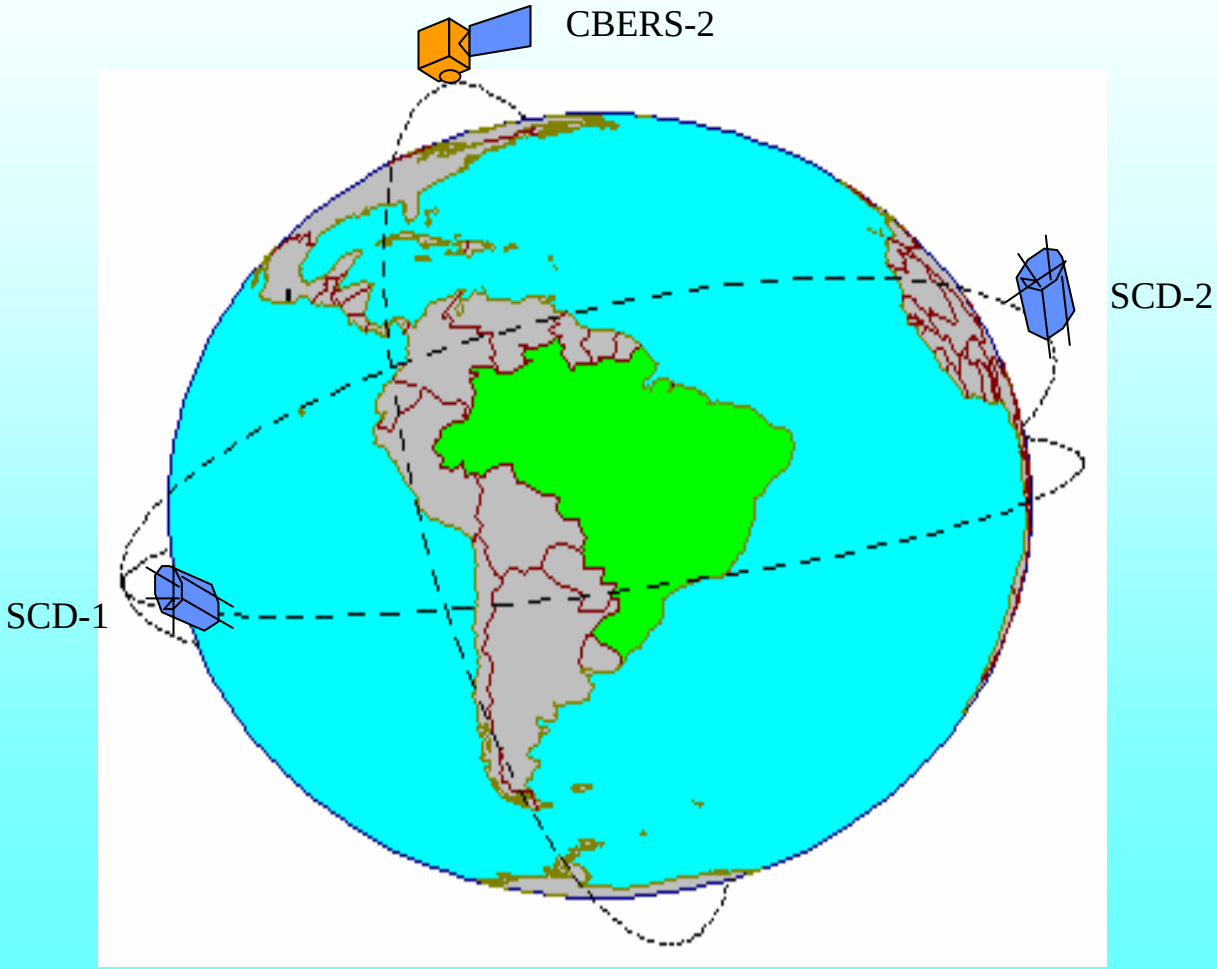
Space Segment

SCD-1, SCD-2 e CBERS-2



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Data Collection Ground Segment

DATA COLLECTION MISSION CENTER

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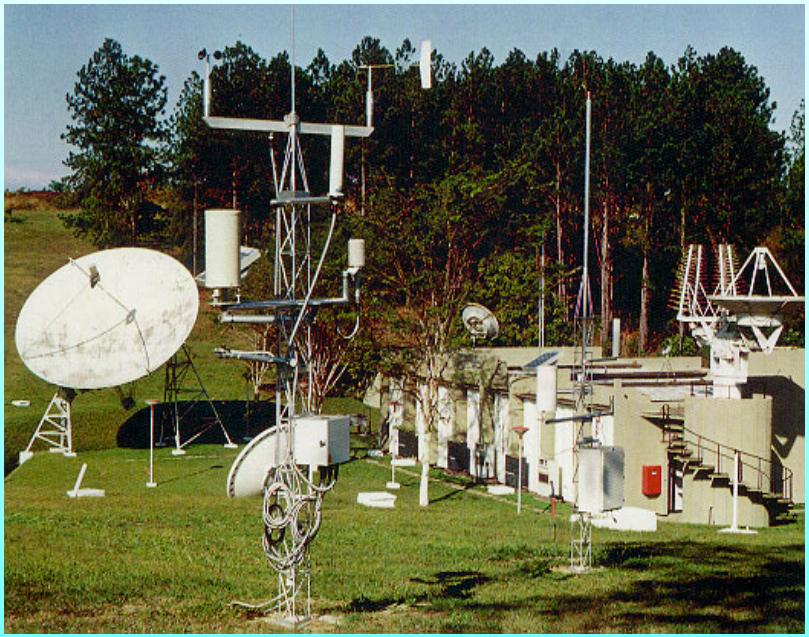
DATA COLLECTION MISSION CENTER
SCD/CPTEC - Cachoeira Paulista



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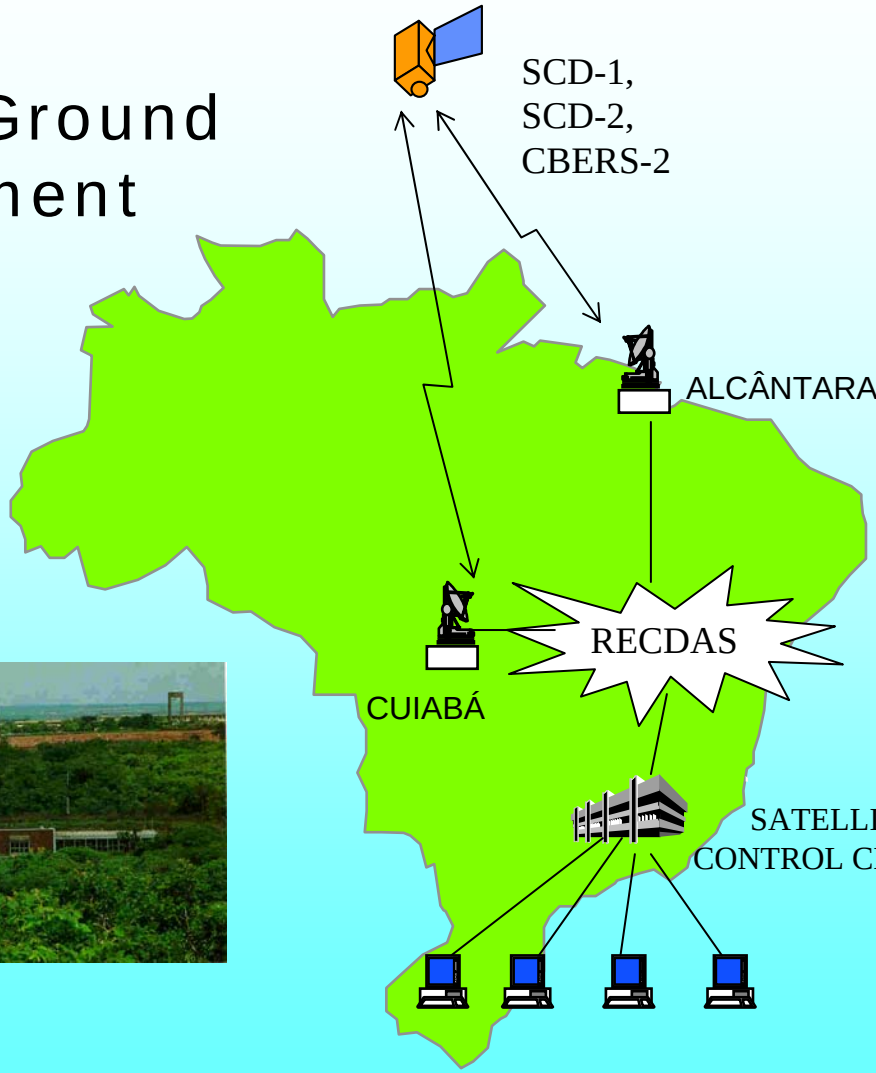
TT&C Ground Segment



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SATELLITE CONTROL CENTER
CCS/CRC

CCS Building – Säo José dos Campos

Main Control Room

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CUIABÁ GROUND STATION

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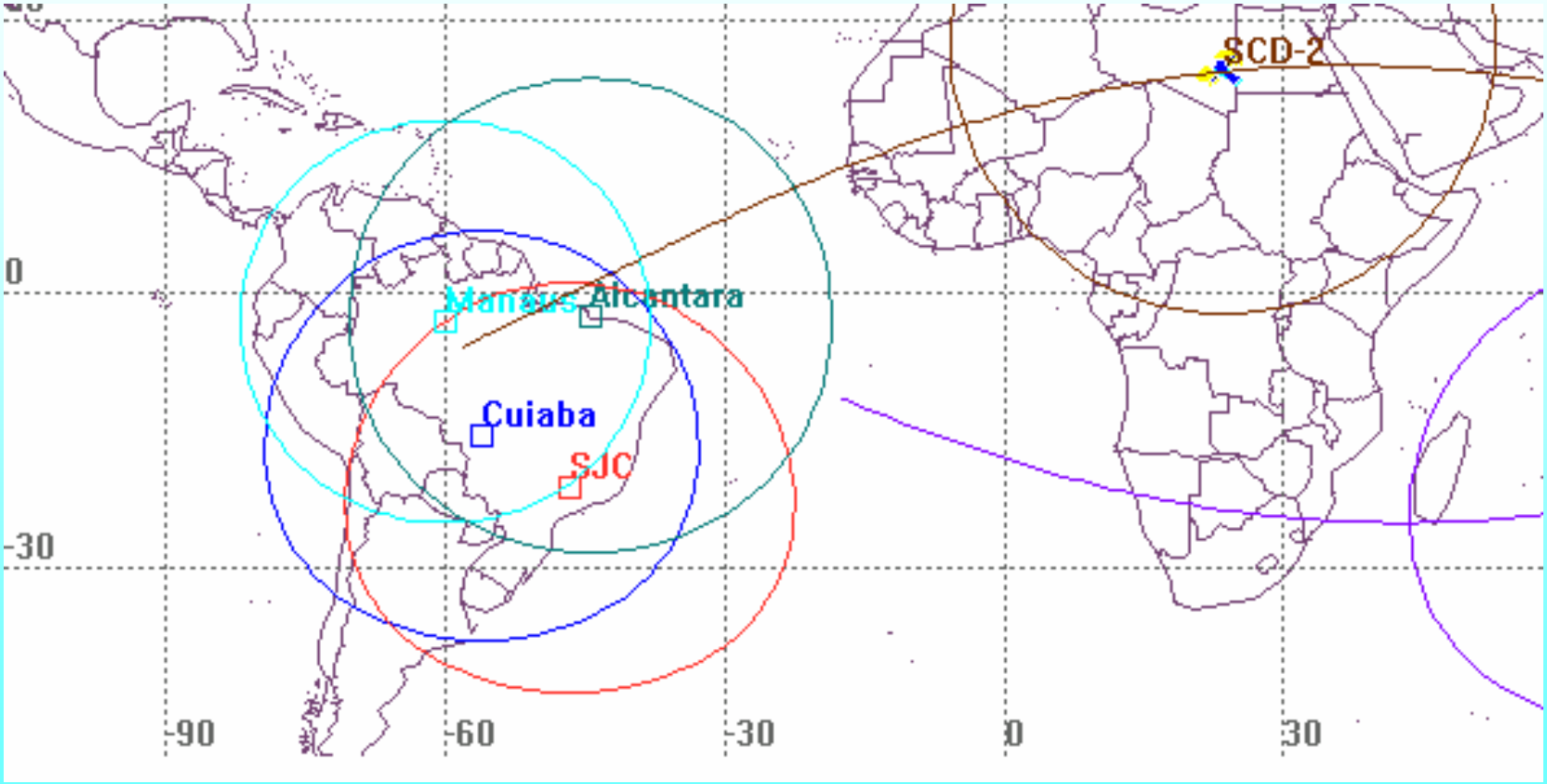
DCS Receiving Station in Brazil



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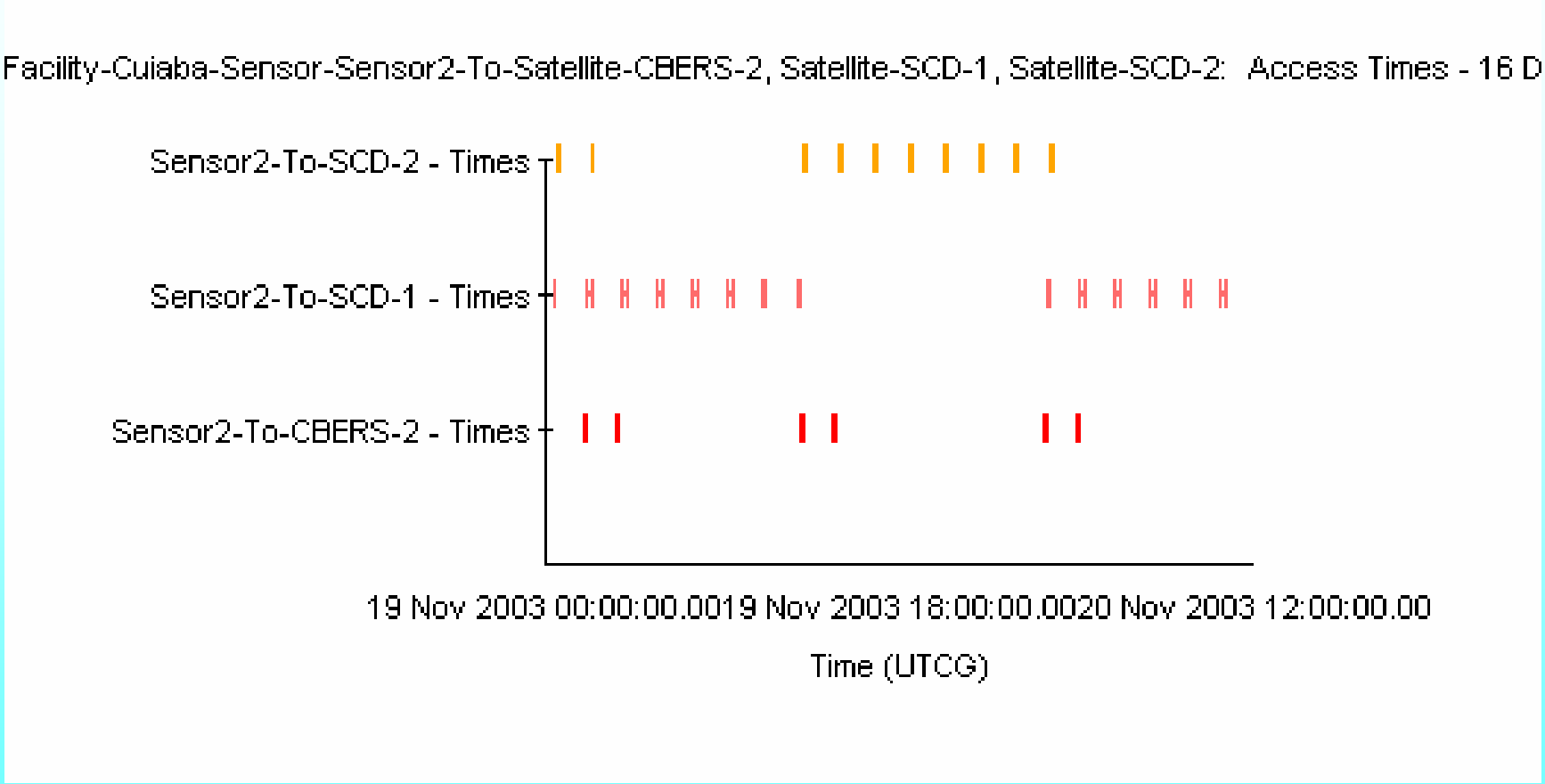

Satellite passes over Cuiabá Station

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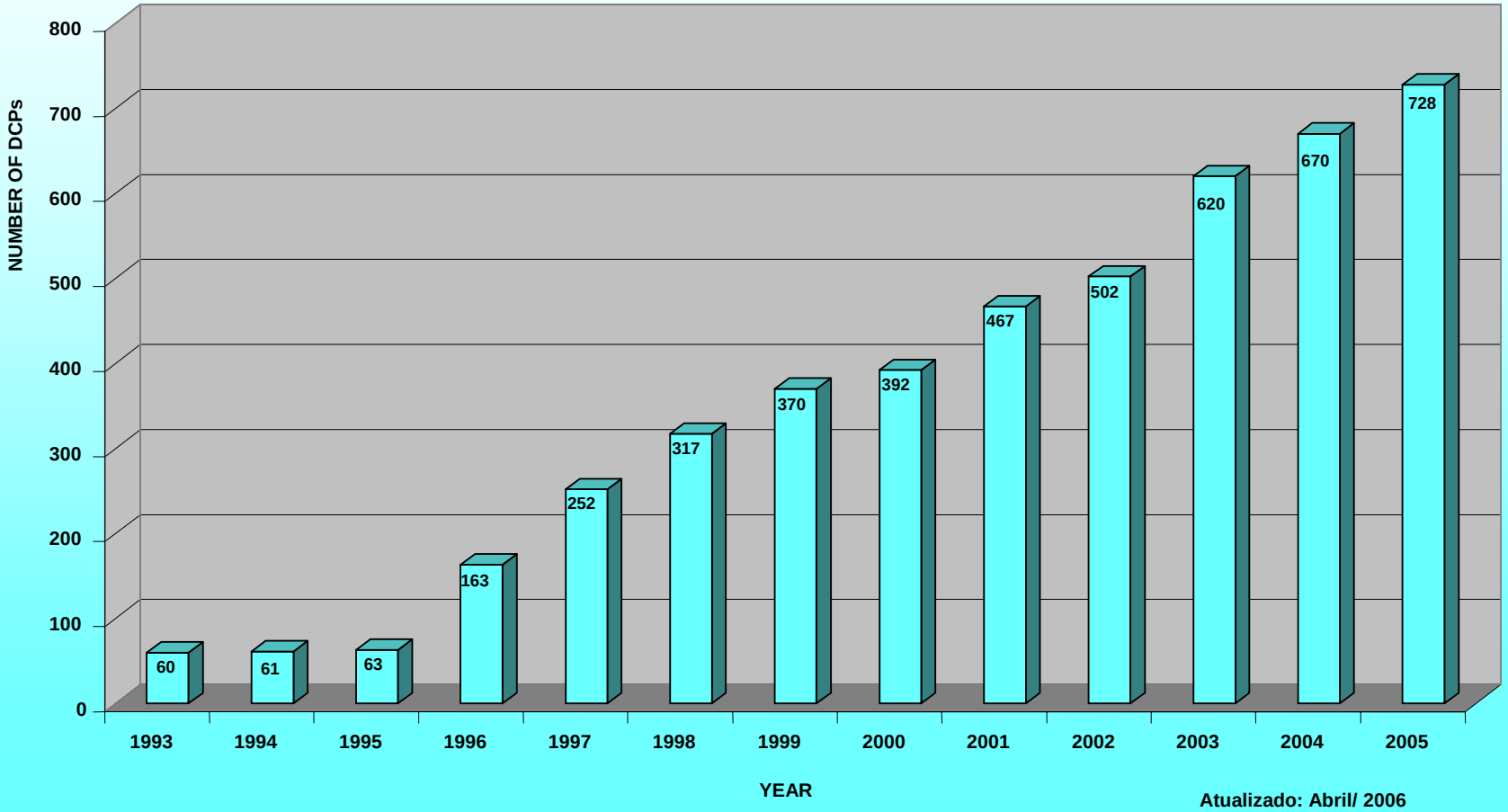
DCP NETWORK IN THE SYSTEM



Atualizado: Abril/ 2006

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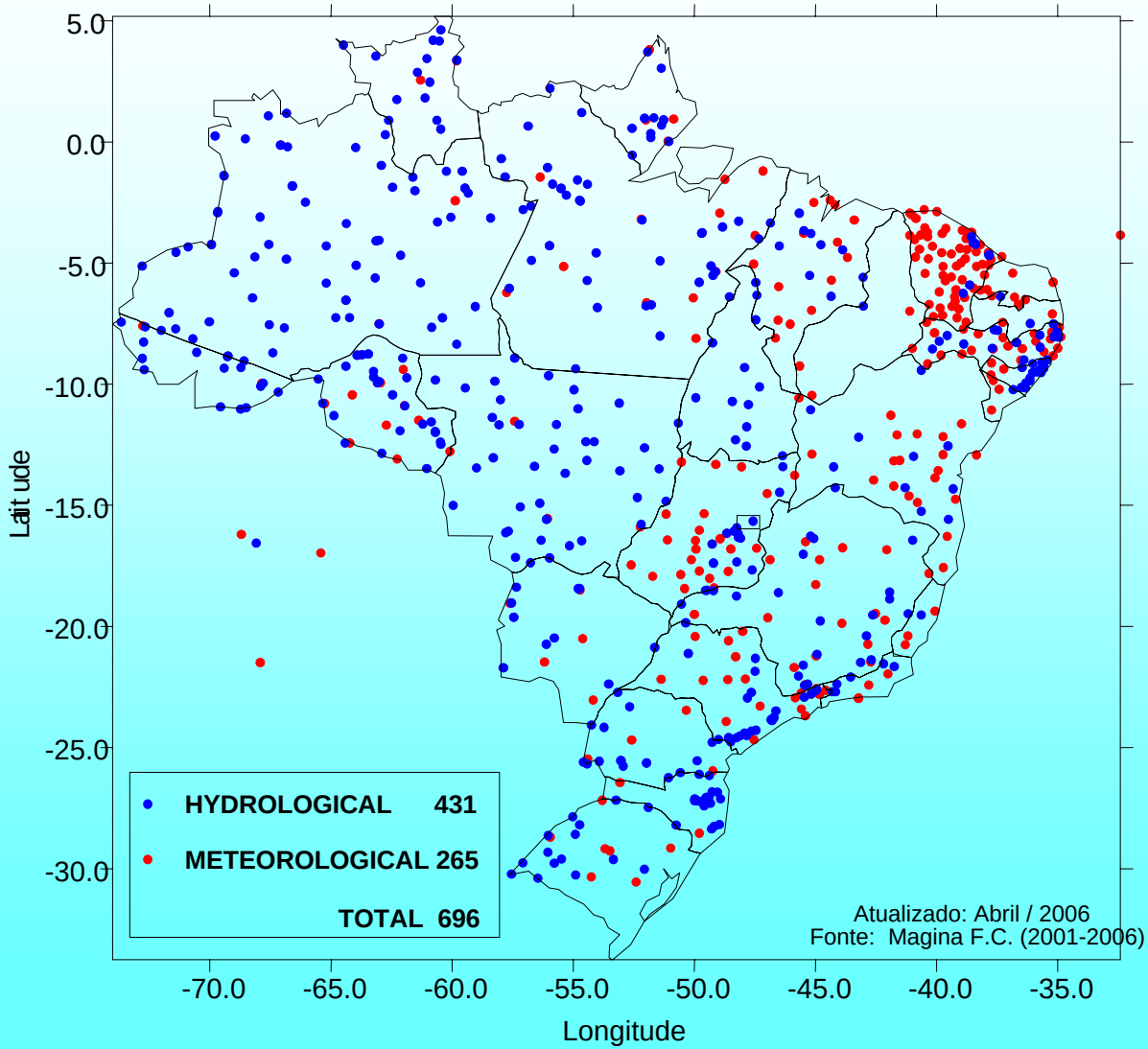
DCP DISTRIBUTION - April / 2006



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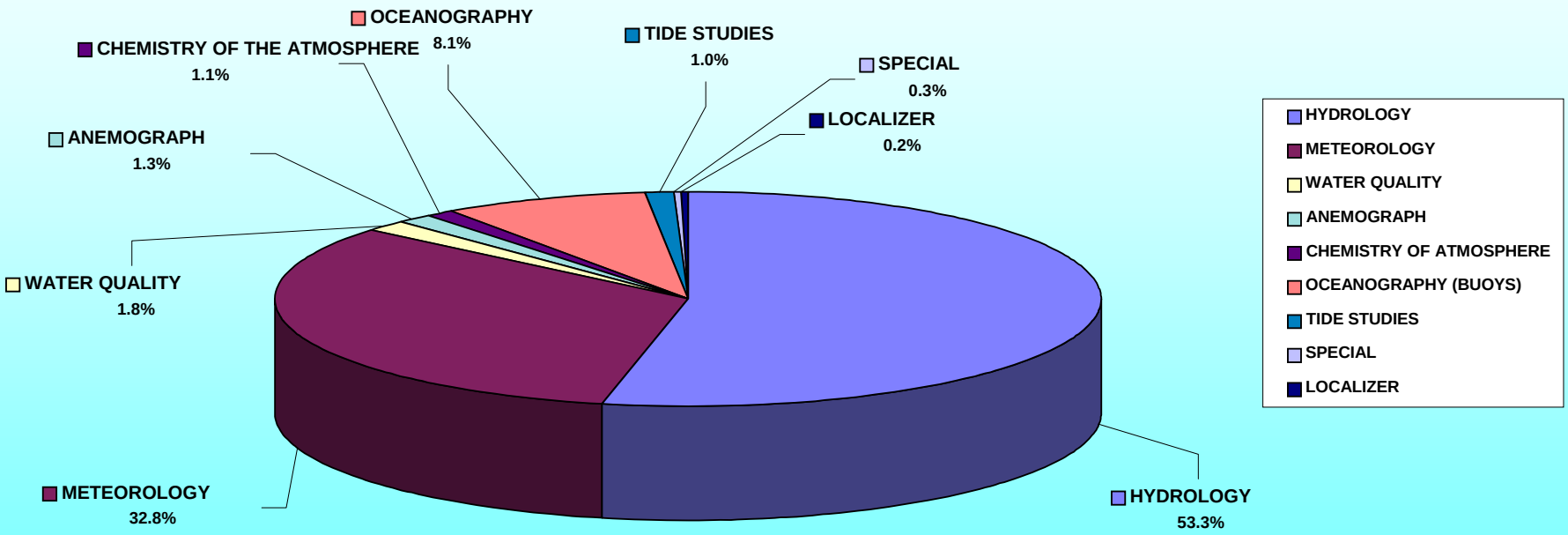
DCP APPLICATION PERCENT DISTRIBUTION



TOTAL INSTALLED DCP SINCE 1993: 728

Atualizado: Abril / 2006

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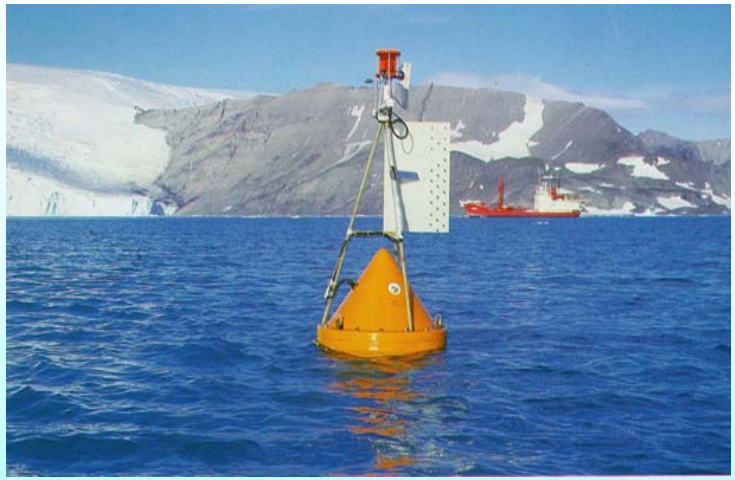
DCP APPLICATIONS



AWS Ilha Joinville, WMO 89253, Source: Alberto Setzer

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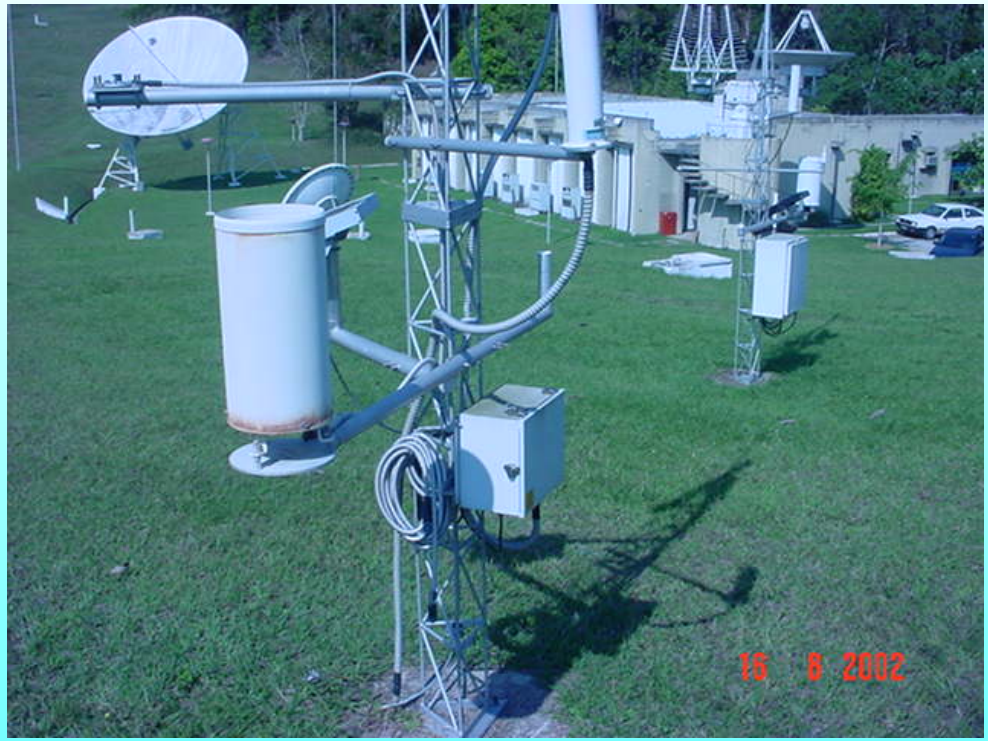
DATA COLLECTION PLATFORM (DCP)

HYDROLOGICAL DCP INSTALLED AT XAVANTINA [SIVAM]



DCP UNDER EVALUATION AT CACHOEIRA PAULISTA

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METEOROLOGY

- **Accumulated precipitation (rain gauge)**
- **Relative Humidity**
- **Accumulated Solar radiation**
- **Air Temperature (maximum and minimum)**
- **Wind Direction and Velocity**
- **Maximum Wind Intensity and direction**
- **Barometric pressure**

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HYDROLOGY

- **Precipitation (Rain gauge)**
- **Atmospheric pressure**
- **Submersible pressure transducer**

HIDROLOGY: Example of a portable station

- ➔ Water level from pressure sensor
- ➔ Air intake (pressure compensation)
- ➔ LR20 batteries - Autonomy >1 year
- ➔ Installed in >2 hours

Evolution: water quality multi-sensor probe, T-S, pH, turbidity

Source: CLS presentation

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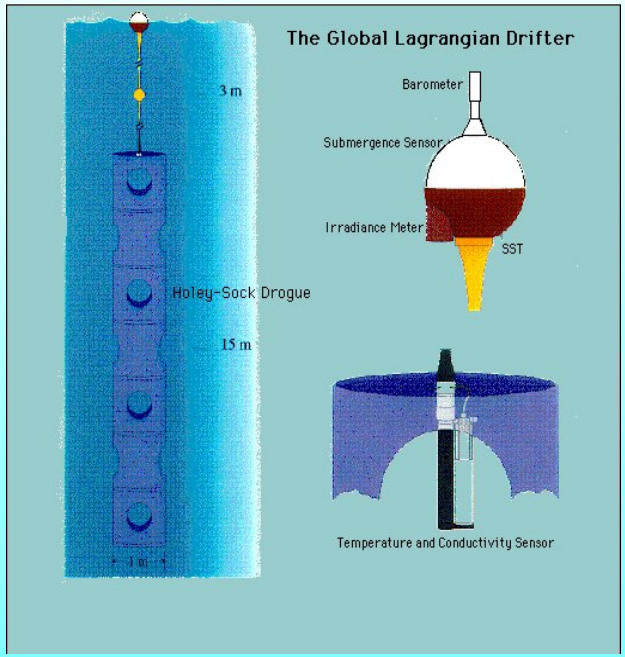
WATER QUALITY APPLICATION

- **pH**
- **Turbidity**
- **Dissolved Oxygen**
- **Salinity/Conductivity**
- **Solids**
- **Water temperature**

Oceanography applications



Moored Buoys

Drifters

Source: CLS presentation

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PIRATA PROJECT
(Pilot Research Moored Array in the Tropical Atlantic)

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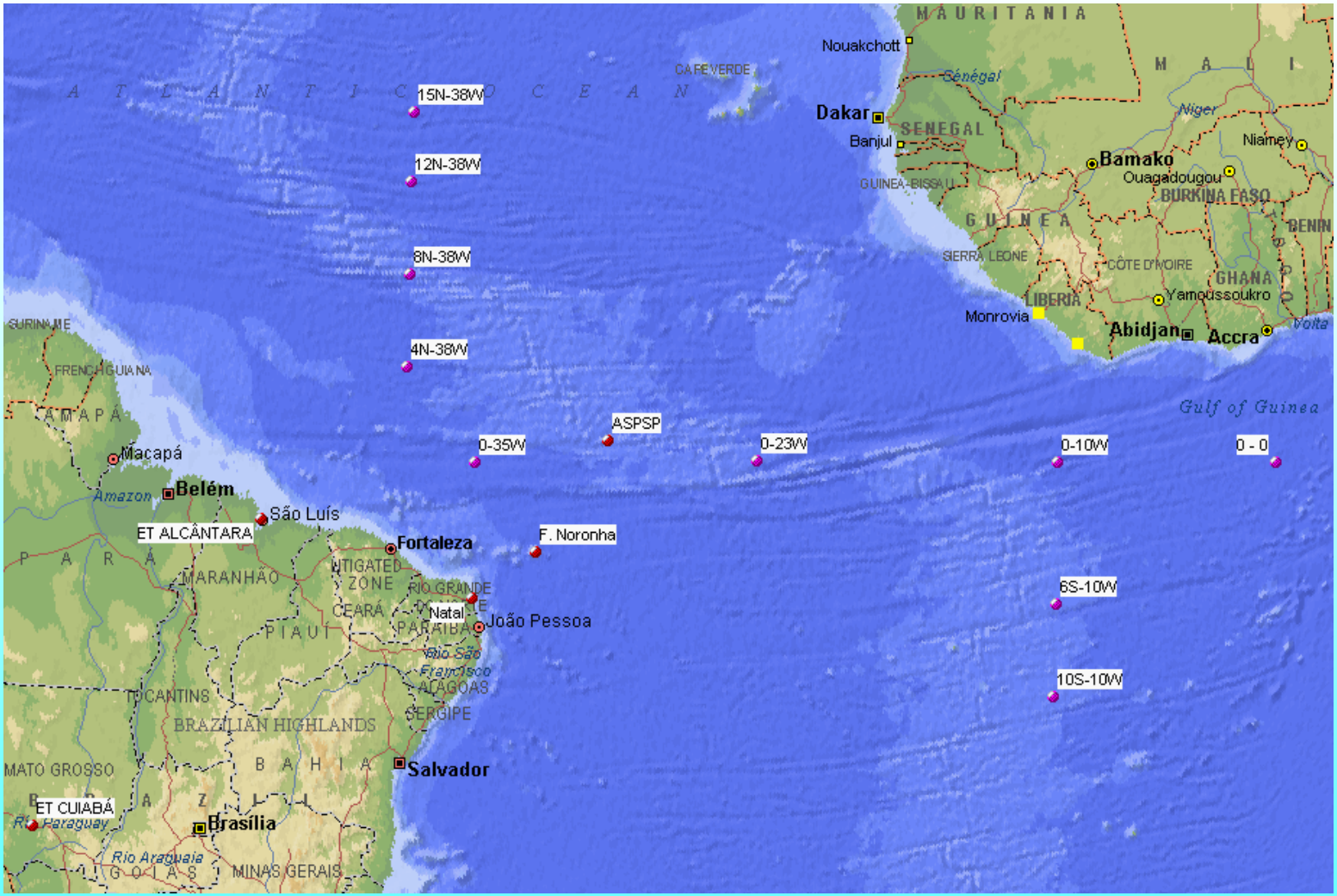
PIRATA BUOY DCP NETWORK



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Other applications

Tide studies

Anemograph

Chemistry of the atmosphere (CO2)

Environmental Monitoring

Localizer

Engineering tests

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POTENTIAL APPLICATIONS IN BRAZIL USING THE BRAZILIAN ENVIRONMENTAL DATA COLLECTION SYSTEM

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Wildlife tracking

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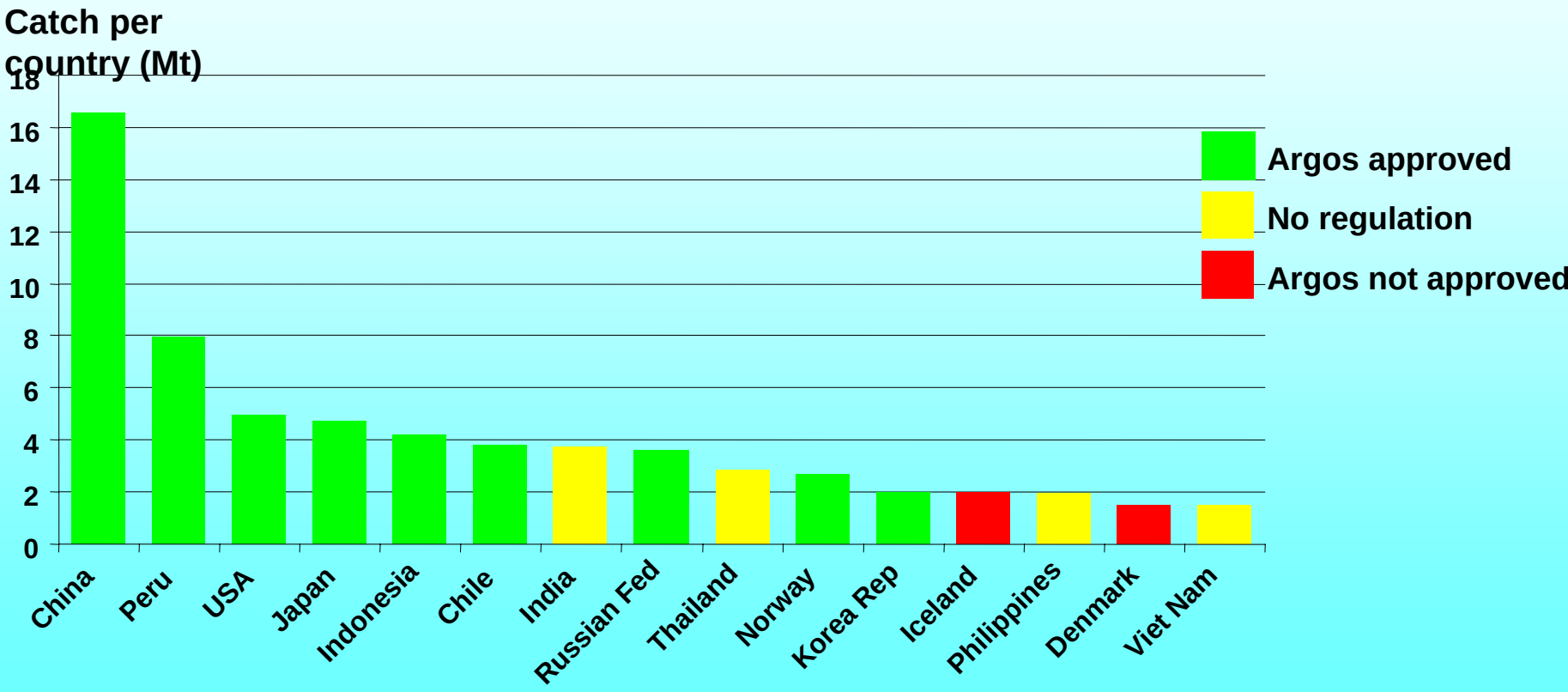
Vessel Monitoring System using Argos

Source:CLS presentation



Vessel Monitoring System

Several countries in the world is using the ARGOS System (Russia, Peru, Japan, USA, Panama, Mexico, Venezuela, Honduras, Chile, Guatemala)

In Brazil, SEAP (Fishing and Aquiculture Special Secretary) is establishing fishing rules to monitor for 2000 to 3000 fishing vessels (initial phase) and in following phase additional 5000 vessels.

Source: NOAA presentation

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Other ongoing activities to improve Brazilian Environmental Data Collection System

- Improvements in the RF chains of Cuiaba and Alcântara stations.
- 2 new data processing equipment (PROCOD-2) delivered to Cuiabá and Alcântara Ground Stations. One Procod-2 will be installed in Natal.
- Improvements in Data Collection Mission Center processing facilities to reduce data delivery time to the users.
- Development of a new data processing equipment (PROCOD-3).
- Low cost S band receiving station.
- Studies and implementations of the localization algorithms using Doppler effect considering several satellites and several receiving stations as well as signal delay propagation due to troposphere and ionosphere.
- Testing new system applications such as animal tracking using low power transmitters.

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Data Exchange with CNES/CLS

- Brazilian DCPs are compatible with the Argos System (NOAA-CNES)
- Argos DCP messages retransmitted by Brazilian DCS and received at Cuiabá Station are being transferred to CLS Argos since 2001
- The Data Exchange agreement is under discussion.

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Hydrological and Environmental Data Collection System for Mozambique based on Brazilian Satellites

- **Brazil and Mozambique cooperation (MOU signed end of 2002) resulted from discussions with the Community of Portuguese Language Countries (CPLP) and UNESCO.**
- **Participating institutions: MCT/Brazil, MCT/Mozambique, INPE, MRE, UNESCO, DNA, INAM, UEM**
- **Implementation in two phases:**

First phase: Installation of 4 Hydrological DCPs in Zambeze river basin and a Receiving Station in Beira

Second phase: Installation of an additional 12 DCPs (Meteorological and Hydrological DCP), including water quality sensors and a buoy for oceanography studies

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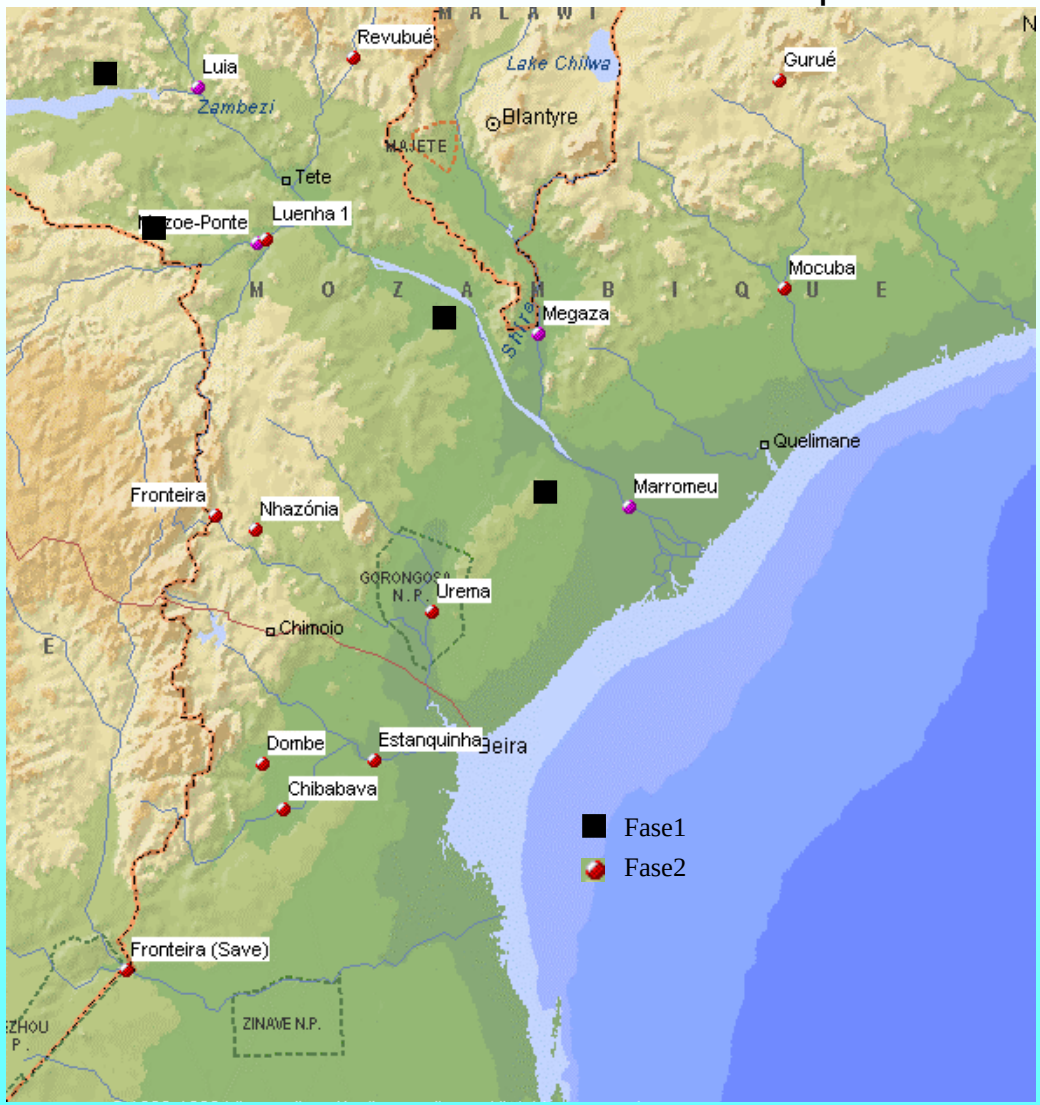
DCP Network in Mozambique



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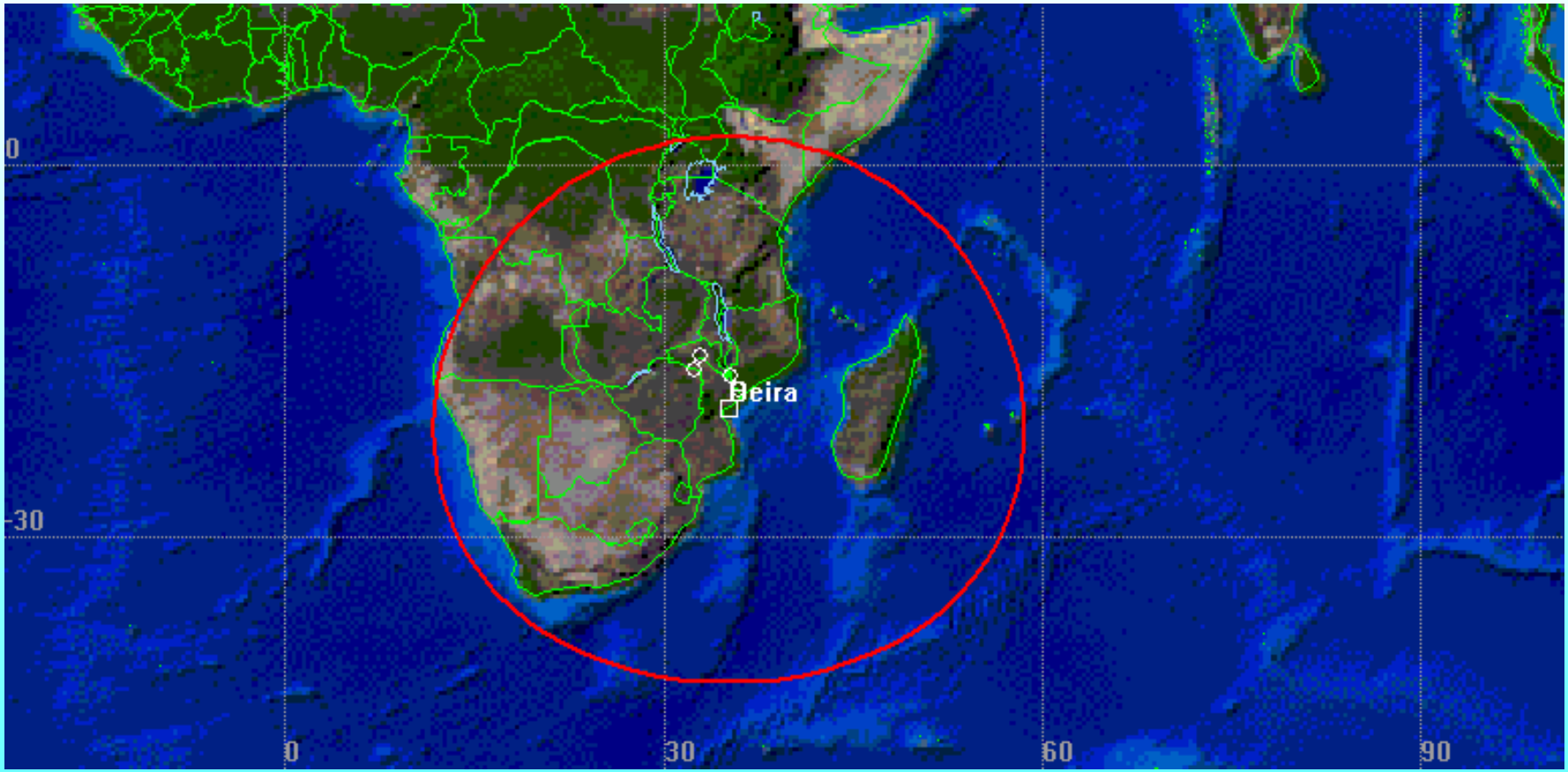
Receiving Station coverage at Beira, Mozambique



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FUTURE PLANS

- **TO ASSURE THE SYSTEM CONTINUITY BY:**
  - **DCS PAYLOADS ON CBERS-2B, CBERS-3 AND 4 SATELLITES**
  - **SMALL DCS SATELLITES FOR SCD-1 AND 2 REPLACEMENT**
  - **USE OF SCIENTIFIC SATELLITES TO CARRY DCS TRANSPONDERS.**
- **INCREASE SYSTEM PERFORMANCE AND COVERAGE BY:**
  - **ADDING NEW RECEIVING STATIONS**
  - **DEVELOP NEW EQUIPMENTS AND FUNCTIONALITIES**
- **INCREASE NUMBER OF USERS AND APPLICATIONS**
- **INCREASE COOPERATION WITH OTHER SPACE AGENCIES**

BRAZILIAN DATA COLLECTION SYSTEM CONTINUITY

- **EQUARS (20º inclination, 750 km, 2007).**
- **Preliminary proposal for SCD replacement, TBD).**
- **SSR-1 (TBD).**
- **CBERS-2B (Polar Orbit, 778 km, 2007).**
- **CBERS-3 (Polar Orbit, 778 km, 2008).**
- **CBERS-4 (Polar Orbit, 778 km, 2010) .**
- **SSR-2 (MAPSAR) (Polar Orbit, 606 km, 2011).**