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TECHNOLOGY POWER TO WIN

Transportable System for the Reception, Processing and Application of Multi-Satellite Integration Meteorological Data (TSMD)

CASC

Space Star Technology Co.,Ltd

Contents

Part One

Overview

International Corporation

ABE Agencia Boliviana Espacial

esa

jenaoptronik

SingTel

ASTRO RESEARCH

LAPAN

SUPARCO

agenzia spaziale italiana

EADS ASTRIUM

DLR

NARSS
National Authority for Remote Sensing & Space Sciences

TESAT SPACECOM

ThalesAlenia Space

ABAE
AGENCIA BOLIVARIANA PARA ACTIVIDADES ESPACIALES

Swedish Space Corporation

cnes
CENTRE NATIONAL D'ÉTUDES SPATIALES

1. Background

Meteorological problems are evident. A growing demand for systems to monitor environment changes has rose around world

China as a member of World Meteorological Organization and International Union for Conservation of Nature, has:

- Actively participated in international cooperation to solve global climate changes
- Continuously promoted meteorological satellite products and technical exchange among countries
- Made efforts to improve the monitoring capacities of environment changes around the world

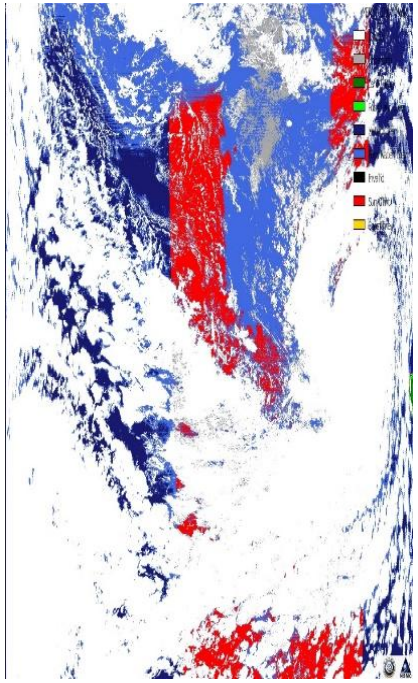
2. Application

TSMD is used in:

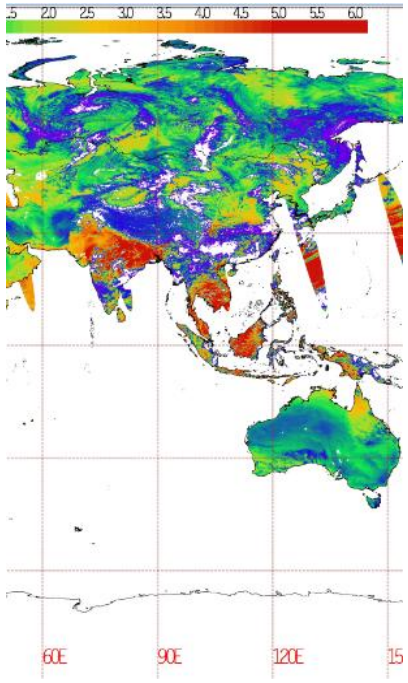
- ✓ Weather monitoring
- ✓ Climate forecast departments
- ✓ Agricultural production
- ✓ Environmental monitoring
- ✓ Emergency services
- ✓ Meteorological technology basic research
- ✓ Meteorological applications development research
- ✓ Climate change research departments

Benefits:

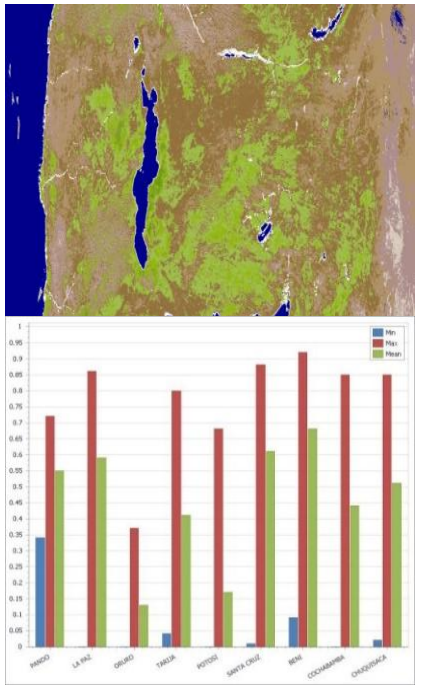
- ✓ Provide monitoring methods for daily meteorological changes.
- ✓ Detect natural disasters and environmental changes
- ✓ Long-term climate change monitoring analysis, such as precipitation changes, temperature changes and vegetation changes



Cloud Detection



Atmospheric Precipitation



Vegetation Detection Statistics

Part Two

System Specifications

2.1 Introduction

The meteorological satellite application system is based on a transportable vehicle platform. It is adaptable and modular. It is designed to bear high temperature and humidity conditions. It does not demands large infrastructure facilities.

The basic system consists in three operative vehicles:

- Antenna Vehicle
- Receiving Process Vehicle
- Power Supply Trailer

Antenna Vehicle

Receiving Process Vehicle

Power Supply Trailer

2.2 System Composition—Antenna vehicle

It is used for tracking and capturing L/X-band satellite's signals. It consists in antenna's feeder, antenna's structure, control sub-system, antenna's mounting platform

Characteristics

- X/L band receiving, capturing and tracking
- Automatic tracking and program tracking
- Automatic leveling
- Security protection capacity
- Able to be disassemble

Performance

- ✓ Receiving antenna aperture: 3.3m
- ✓ Working frequency: X band: 7700MHz ~ 8400MHz, L band： 1670MHz~1710MHz
- ✓ Demodulation method: BPSK/QPSK/UQPSK/DQPSK/OQPSK
- ✓ Demodulation rate: 0.5 ~ 40Mbps
- ✓ Antenna tracking mode: program tracking/ manual tracking/ step-by-step tracking
- ✓ Trace ability: Elevation of 5 ° began tracking, Elevation or received 7° stable tracking (keeping-precision).

2.2 System Composition—Receiving Process Vehicle

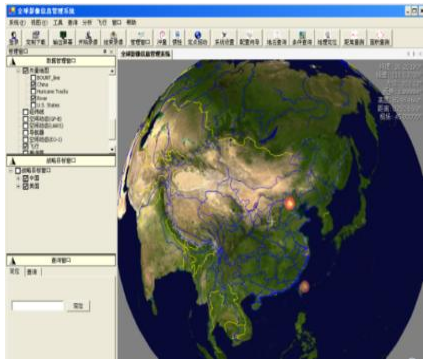
It is the operational room, where are received and processed meteorology satellite data, generated and managed the application products, including basic application and thematic products

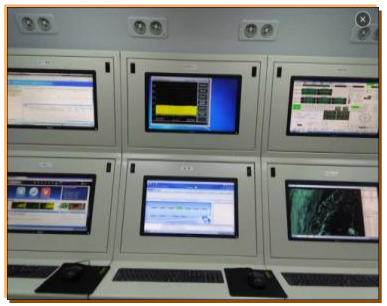
Characteristics

- ✓ Able to process data from different meteorology satellites: FY-3D, MODIS (Aqua/Terra), NOAA18
- ✓ Generate at least 19 kinds of basic meteorology product
- ✓ Generate at least 9 kinds of typical application products
- ✓ Support automatic and manual operations
- ✓ Able to perform mission management and monitoring
- ✓ 30 days data on-line storage

Receiving Process Vehicle


Processing Equipment


Data Management Software


Operation Room

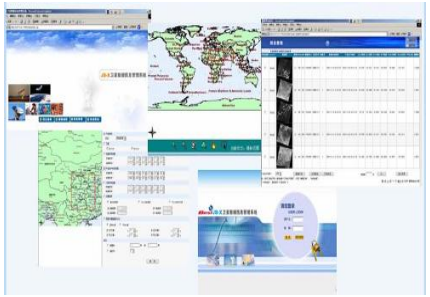


Image Processing Software

2.2 System Composition—Power Supply Trailer

Power Supply Trailer equips with an power generator and manageable trailer, it provides energy to the system when is not possible to be connected to the public power supply

Characteristics

- ✓ Windproof, waterproof, dustproof
- ✓ 3-phase, 4-wire power
- ✓ Dual power switching
- ✓ Emergency stop protect

Performance

- ✓ Environment conditions:
  - Altitude: up to 5000m
  - Ambient temperature: -40℃～55℃
  - Relative humidity: ≤95±3% (25℃)
- ✓ Supply 30kW, 50Hz, 380/220V
- ✓ Weight: ≤3500kg
- ✓ Noise: ≤72dB
- Voltage regulated range with no load: 95%～105%

Power Supply Trailer

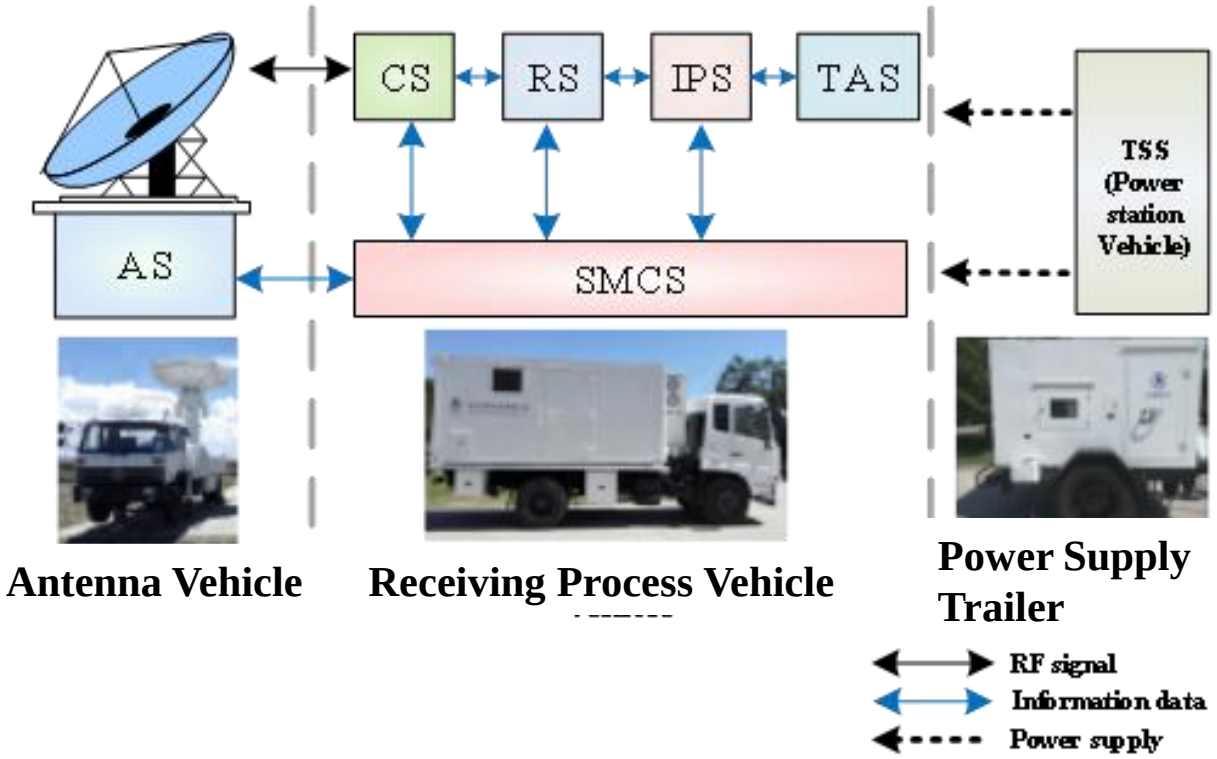
Diesel Generator

2.3 System Composition-subsystem

TSMD systems are usually divided into 7 subsystems

7 subsystems:

- Antenna Subsystem (AS)
- Channel Subsystem (CS)
- Recording Subsystem (RS)
- Image Processing Subsystem (IPS)
- Typical Application Subsystem(TAS)
- Station Monitoring and Control Subsystem (SMCS)
- Technical Support Subsystem(TSS)



2.3 System Composition-subsystem

Antenna Subsystem is used for capturing, tracking, and receiving X-band remote sensing satellite signal.

2.3 System Composition-subsystem

Channel Subsystem consists of frequency converter, optical transmitter and receiver, matrix switch, modulator and demodulator. It is used for channel switch, channel backup, frequency convert and demodulating satellite signal.

Demodulator

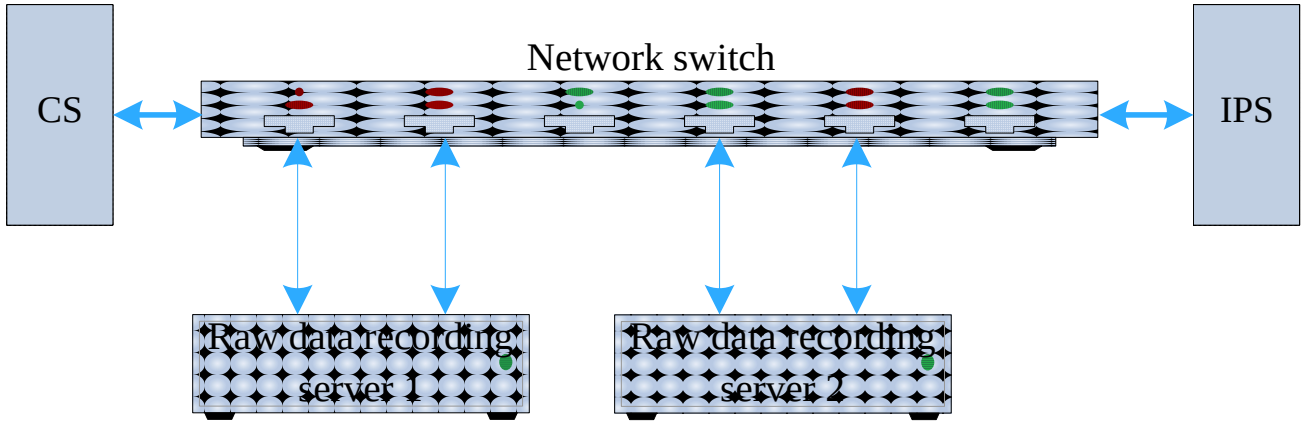
Frequency converter

Switch matrix

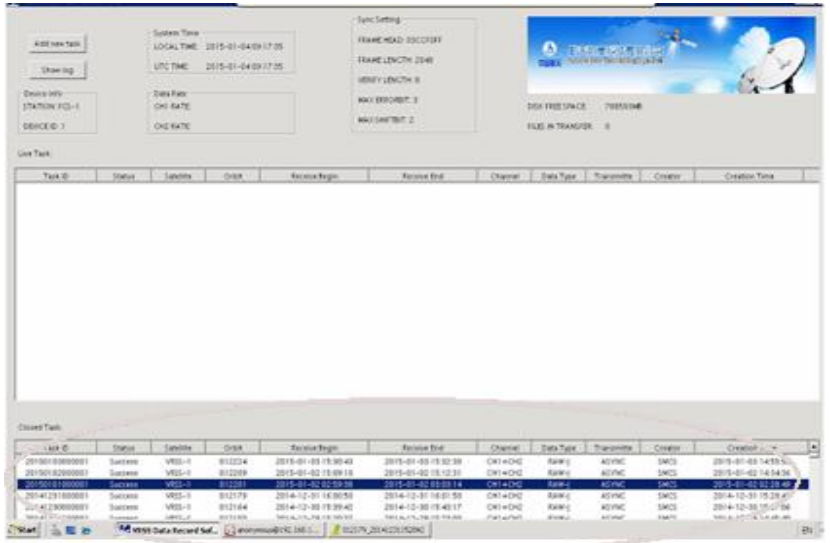
Channel Subsystem Equipment (for reference)

2.3 System Composition-subsystem

Recording Subsystem consists of raw data recording servers, network switch and recording software. It is used for processing bit information stream to raw data file. In order to ensure whole station work normally, raw data recording servers adopt hot backup.



Recording Subsystem structure



Recording software interface

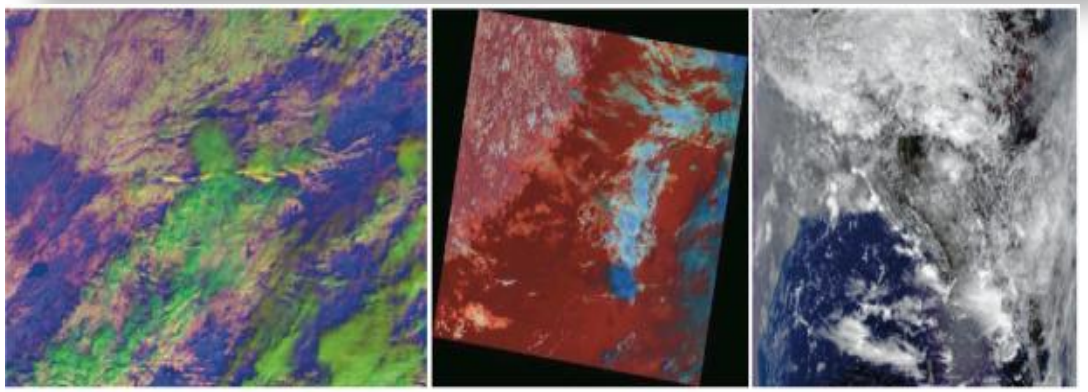
2.3 System Composition-subsystem

IPS consists of decompression device, formatting data recorder, moving window display device, fiber switch, storage area network array disk, IPS server and image processing software. It is used for synchronizing, decompressing, formatting, recording and preprocessing raw data. And it is used to process L1 ~ L3 meteorological products.

Functions

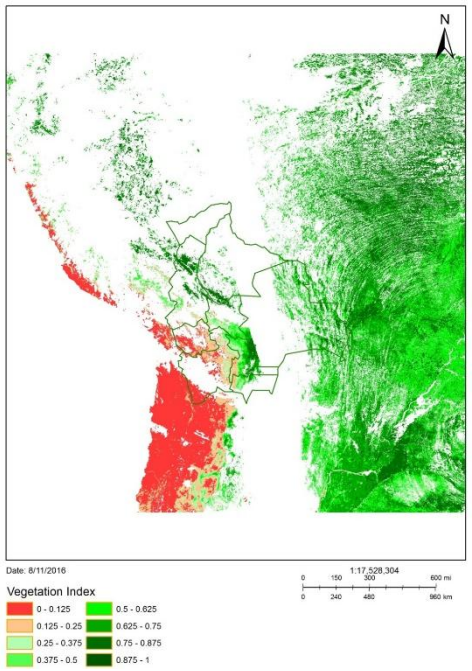
- Receive raw data from transportable Station;
- Process and generate Level-0 strip data , Level-0~Level-2 product;
- Support FY-3D、MODIS、NOAA18 satellite data processing;
- Catalog and archive of the Level-0 strip data, GCP and DEM management;
- Data push: pushing products and corresponding meta-information.

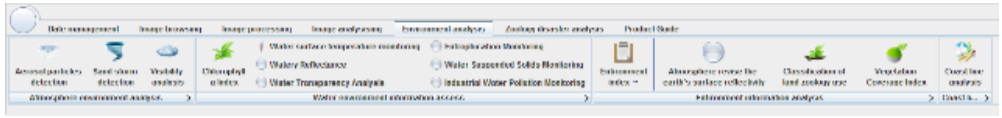
➢ Standard Image Production Software Package

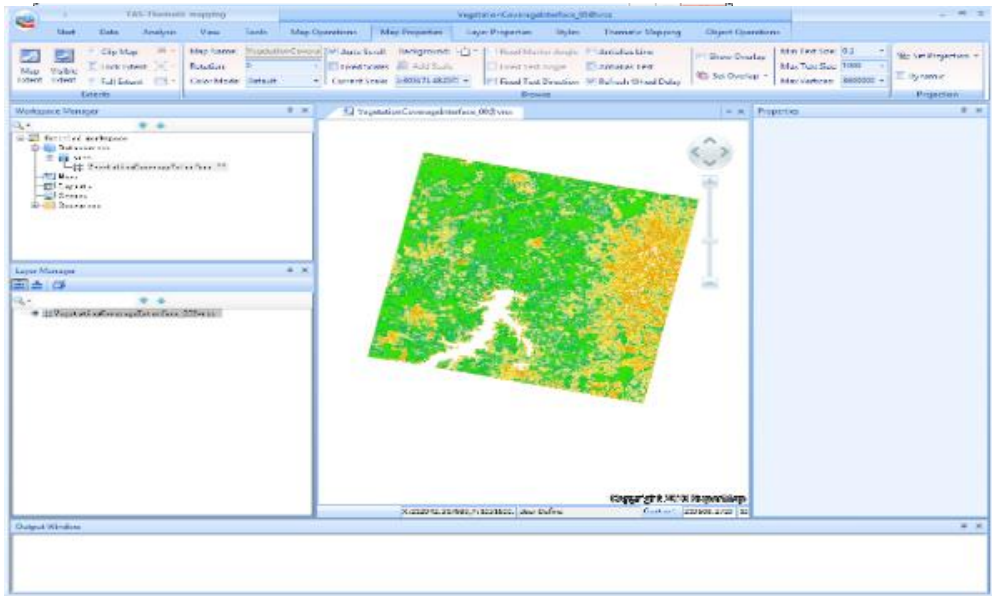


2.3 System Composition-subsystem

TAS is a professional Remote Sensing Application System, which is designed to do remote sensing imageries processing, thematic product producing and thematic product mapping.

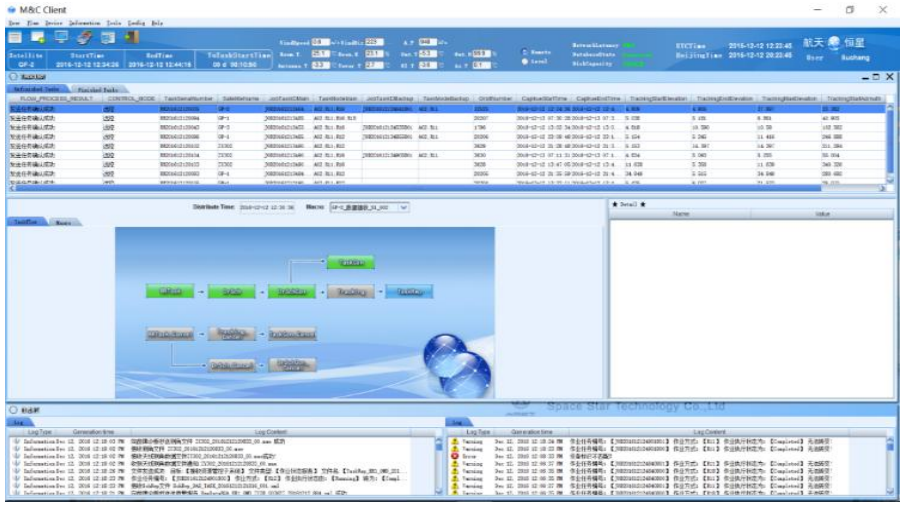






2.3 System Composition-subsystem

SMCS consists of SMCS server, network switch and SMCS software. It is responsible for receiving remote reception plan or generate local reception plan, and controls related subsystem receiving and processing satellite data. SMCS is also used for monitoring, controlling and managing whole station status, and generating related report.



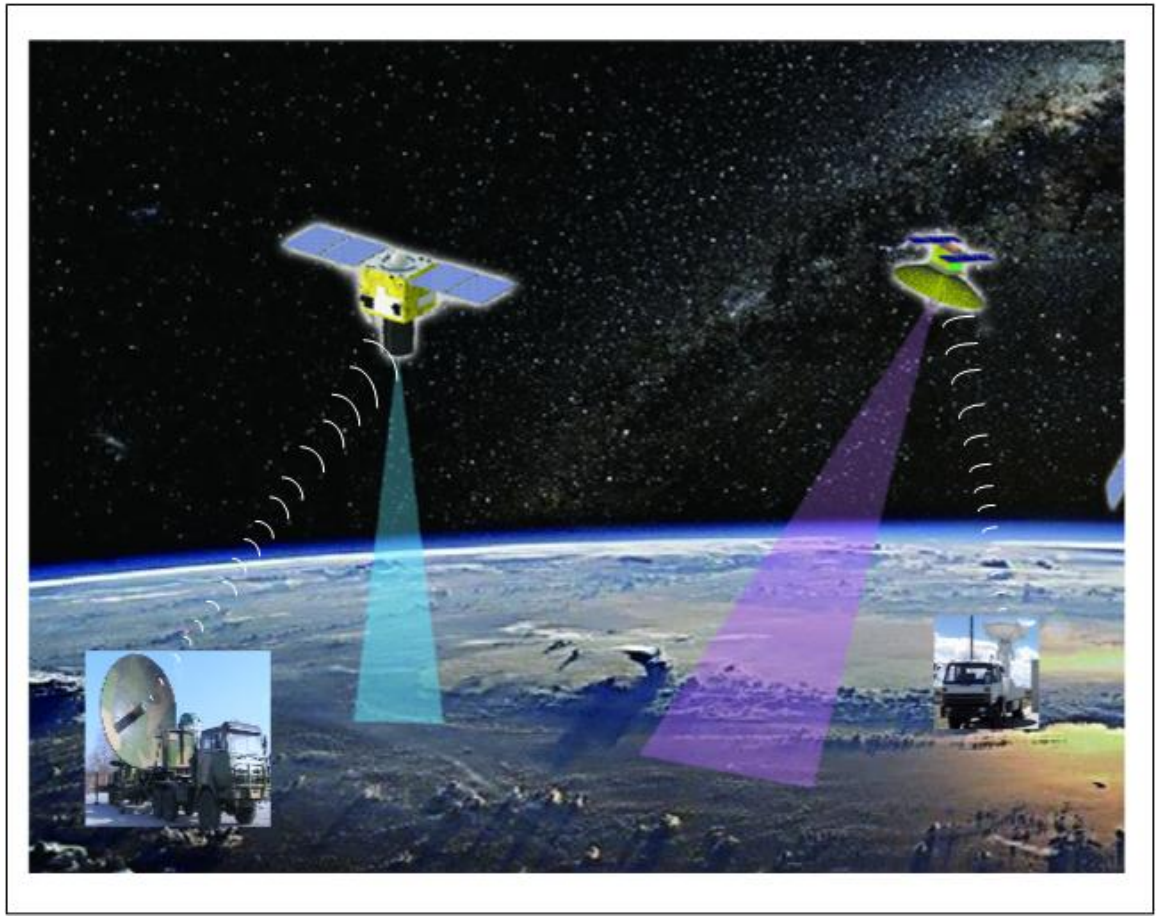
SMCS software

2.3 System Composition-subsystem

TSS consists of timing and frequency equipment, Power distribution vehicle, spectrum analyzer, signal generator, air conditioner, cables, cabinet, receiving and processing shelter, etc.

2.4 Main Function

- Capturing and tracking Meteorological Satellite
- Preprocess L0 data to generate L1 ~ L2 meteorological products
- Centralized monitoring and control devices
- One-click unfolding/collecting antenna and vehicle leveling
- City electricity and UPS power supply



2.5 Performance

➢ Receptive capacity

- ✓ Receiving antenna aperture: 3.3m
- ✓ Working frequency: X band: 7700MHz ~ 8400MHz, L band： 1670MHz~1710MHz
- ✓ Demodulation method: BPSK/QPSK/UQPSK/DQPSK/OQPSK
- ✓ Demodulation rate: 0.5 ~ 40Mbps
- ✓ Antenna tracking mode: program tracking/ manual tracking/ step-by-step tracking
- ✓ Trace ability: Elevation of 5 ° began tracking, Elevation or received 7° stable tracking (keeping-precision).

➢ Mobility capacity

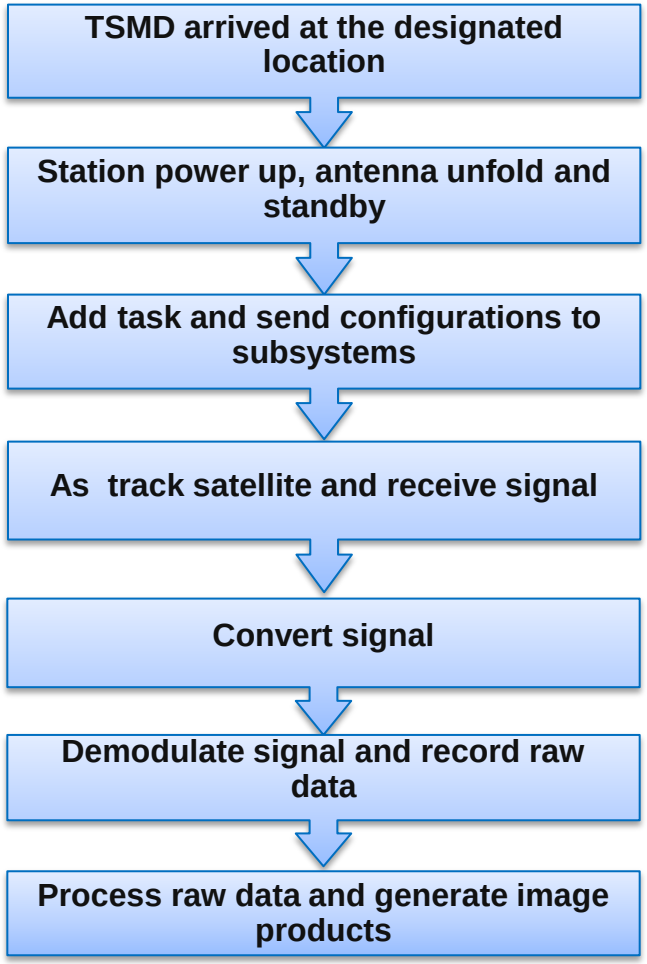
- ✓ Support road, mountain road mobility
- ✓ Support 4 people for 2 hours in full operation, normal work

2.5 Performance

- **Processing capacity**
  - ✓ Data preprocessing type : FY-3D, NOAA18, MODIS(Terra, Aqua),
  - ✓ Data preprocessing time : 10minutes
  - ✓ Data storage capacity : Store 30 days of data online.

- **Technique support capacity**
  - ✓ Provide one antenna vehicle, one Data Receiving and Processing vehicle and one power trailer
  - ✓ UPS power supply time is not less than 15 minutes
  - ✓ Diesel generators can generate electricity for 8 hours

2.5 System Worklow



Part Three

Meteorology Application

Introduce

IPS support the satellite data processing for FY-3D、MODIS(Aqua、Terra) and NOAA 18.

IPS support to generate standard level 0-1 data, and can generate the level 2 application product by retrieving processing, which supports the atmosphere, environment, forest and soil management.

Product level instruction shows bellow:

Level	Data/Product description
Raw data	Refer to raw code stream data file received from satellite downlink
Level 0	Refer to standard scene data product obtained after processing of frame synchronization, decompression, formatting and framing of Level-0 stripe data.
Level 1	radiometric correction, Refer to the product after radiometric correction
Level 2	Image or data application typical application product which generated from level 1.

Thematic Application

Meteorological data was used for some meteorological application monitoring, and then produce some meteorological products, such as:

Field	Meteorological Products
Weather	Snow Cover, Atmospheric Dynamic Precipitation,etc
Vegetation	Vegetation Index, Leaf Area Index, growth condition of vegetation,etc
Disaster	Forest Fire, Drought Index, Scope of ice and snow,etc
Atmosphere	Fog monitoring, Aerosol monitoring, Land Surface Temperature, Cloud Classification and Cloud Phase, Cloud Top Temperature and Cloud Top Height, Cloud optical Depth ,etc

Meteorological Products

➢ Land Surface Temperature

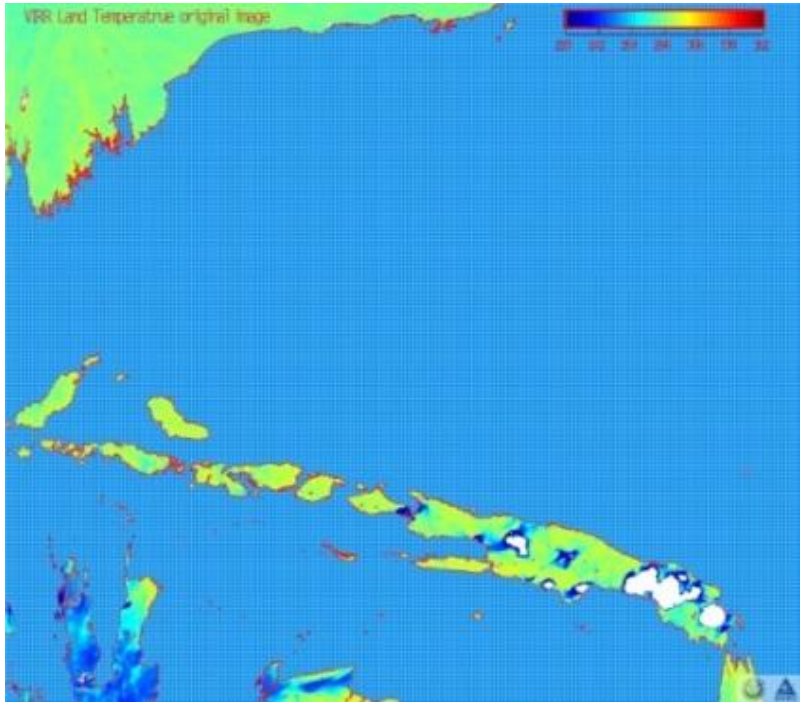
Split-window algorithm retrieves surface temperature and characterizes surface temperature.

Application field：

a) As the important parameters to other meteorological models

b) Drought monitoring, environmental monitoring and other climate monitoring data sources

c) Climate and eco-model input parameters



South Indonesia Sea

Meteorological Products

➢ Vegetation Index

The visible and near-infrared channels are used to characterize the growth of vegetation due to different spectral characteristics of vegetation and soil.

Application field：

a) As the important parameters to the global climate model that can be used to analyze vegetation growth processes, net primary productivity and evapotranspiration

b) Ecological environment monitoring

c) Agricultural assessment

West coast of Africa

Meteorological Products

➢ Leaf Area Index

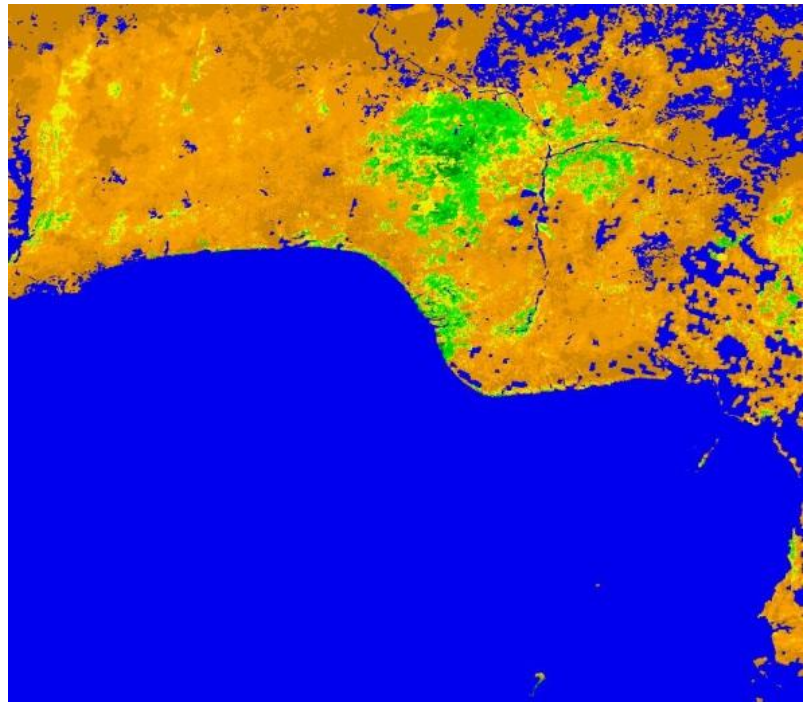
The unit area of the plant leaves the total area of land area multiples.

Application field:

a) As the important parameters to the global climate model can be used to analyze the vegetation growth process, net primary productivity

b) Can be used for agricultural assessment

c) Ecological environment monitoring



North West coast of Africa

Meteorological Products

➢ Land Aerosol

Aerosol optical depth of the land atmosphere, indicating the aerosol attenuation of light.

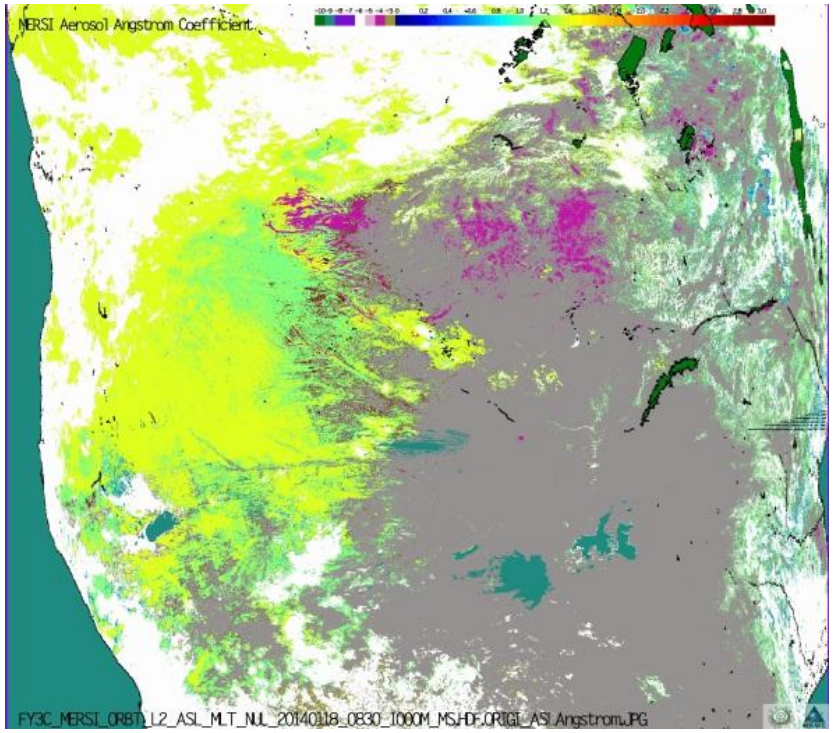
Application field：

a) Radiative Forcing and Climate Change Studies

b) Provide visibility information

c) Air pollution monitoring

d) Provide visibility information



West coast of Africa

Meteorological Products

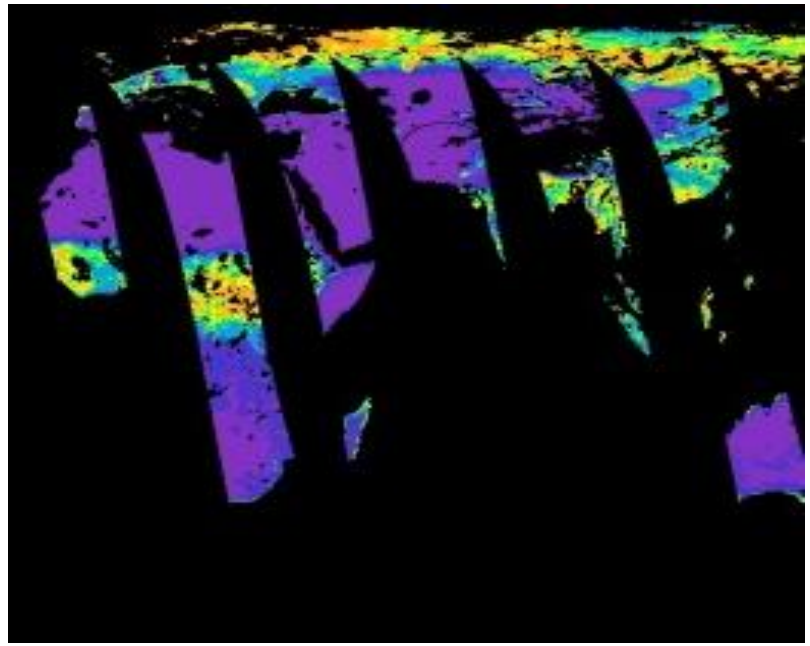
➢ Drought Index

Through the establishment of the relationship between the surface vegetation and soil moisture, the quantitative index reflects the degree of soil wetting and drying.

Application field：

a) Monitoring of arid conditions on land

b) For the farming, forestry, animal husbandry department to provide soil moisture reference



Europe and Asian and Afican continent

Part Four

Services and Application Cases

4.1 Services

➢ **Technical Support:**

- Technical proposal based on user's requirements and on-site survey
- Delivery operation
- On-side installation
- Operators training
- Maintenance manuals

➢ **After Sale:**

- Two years free warranty
- 15 days of on-site inspection per year.
- on-line technical support
- 24 hours failure recovery
- Long term technical support on demand

➢ **Delivery cycle:**

- A standard cycle is shown in the table a side

No.	Time（month）	Phase
1	T0	Project start
2	T0+8	System development and production
3	T0+10	System test
4	T0+12	Factory acceptance test
5	T0+15	Packing and transportation
6	T0+16	Deployment and Installation
7	T0+17	On-site Test
8	T0+18	Final acceptance

System delivery cycle

4.1 Services

➢ **Training:**

Provide theory, operation and maintenance trainings

- **Duration**

  Two (2) months.

  ✓ Twenty days in-factory

  ✓ Forty days on-site

- **Language**

  English.

Operation Training

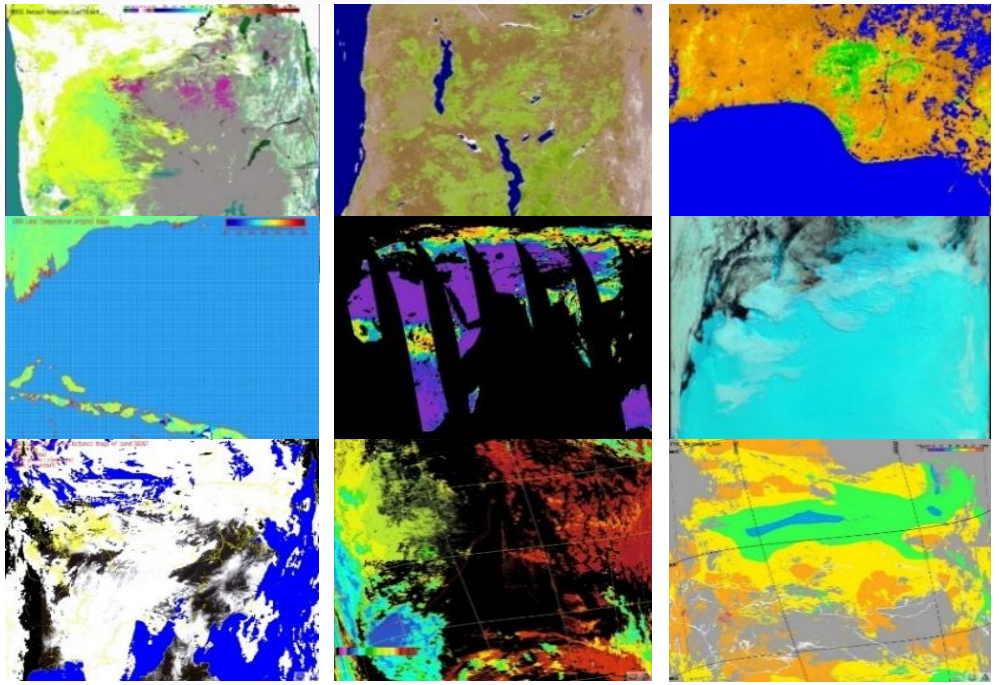
Theory Training

4.2 Application Cases

➢ Bolivian TSMD

- The system is a project for China to strengthen international cooperation on global climate change.
- The National Development and Reform Commission of China is responsible for the donation of materials to Bolivia.
- The project was completed in August 20, 2016 and was formally delivered in January 20, 2017 to the user.
- The project effectively enhanced the monitoring capacity of Bolivia in dealing with climate change and trained professionals in the field of meteorological satellite applications.
- In order to enhance the application capacity of the system, the second phase of project will carry out the system upgrading work, with the ability to receive, process and generate the meteorological products of FY-3D, and to add 17 kinds of meteorological products.

System Deployed in Amachuma Station, La Paz, Bolivia



Thanks for your attention!