CEOS WGCV Plenary Meeting 30

Christopher Buck

Microwave Sensor Subgroup Report

26-29 May 2009

Ilhabela

Brazil

Overview of Recent Developments

- Task of coordinating subgroup very large so decision taken to appoint a vice-chairman of the group
- Xiaolong Dong of CSSAR has agreed to take on the responsibility of vice-chair
- Attempt made to hold a meeting of the SG in Beijing earlier this month
- Cancelled due to lack of participation from outside of China. Reasons given:
  - Other commitments -> somewhat disaparate nature of the group, but also increasingly
  - In view of financial crisis, problems getting funding for international travel
- In the short term the subgroup will therefore hold a web-based conference, possibly focused on a small number of sensors
- If successful this maybe repeated regularly

Enhanced Structure

- With so many different types of instrument covered by the sub-group, a more hierarchical structure is required
- The formation of “focal areas” will provide more focus for the individual sensor types whilst retaining the possibility for interdisciplinary discussion and cross-fertilization of ideas
- At the same time this avoids the problem of domination of the sub-group by problems faced by only one sensor type
- Each focus area to be headed by an appointed coordinator – typically a PI or other similar person who is heavily involved in cal/val activities for a particular (type of) instrument

Focal Areas

- Identified focal areas are:
  - Altimeters (e.g. Jason-1/-2, RA-2 etc. but also Cryosat-2, future WSOA)
  - Scatterometers (e.g. Quikscat, ASCAT)
  - Cloud and Precipitation Radars (e.g. TRMM, CPR)
  - Radiometers, although this may require two SSGs since the cal/val requirements for lower frequency sensors such as SMOS (1.4GHz) and higher frequency ones such as HSB (150GHz and 183GHz) are quite different
  - Ice sounders and GPR
  - Signals of opportunity instruments, again, possibly two SSGs as requirements for GPS occultation instruments are very different to those for reflectometry instruments

Coordination and Cooperation with other Groups

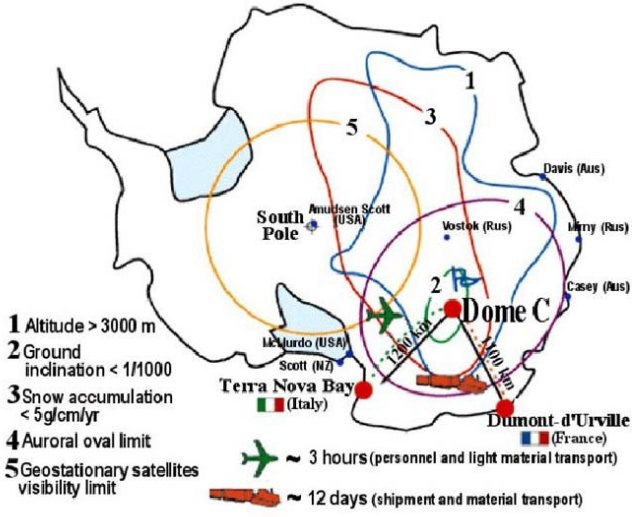
- It is important that we maintain good contact with other groups with which there is a degree of overlap or common interest
- Some notable groups with which some level of contact has already been established are:
  - GSICS
  - X-CAL
  - IEEE GRSS IFT-TC

Calibration Sites

- Dome-C
- EGIG and other lines on Greenland
- Salar de Uyuni, Bolivia
- Tropical Rainforest
- Takelimgan Desert
- Requirement for flat, high mw reflectivity site
  - E.g. a lake but without wind (!)

DOMEX-2

- Objectives
  - Extension of sampling time (Annual cycle spanning summer/winter)
- Experiment details
  - Radiometer modified to improve thermal behaviour, and prepared for Acquisition in Winter
  - Cooperation between IFAC and ESTEC Thermal experts



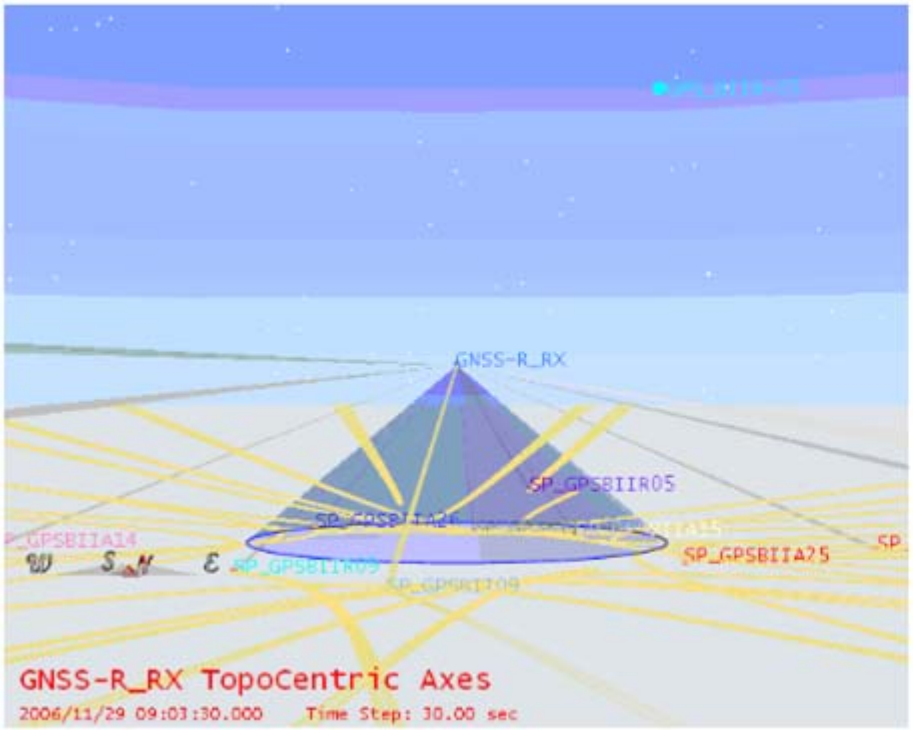
Tower at Concordia Station

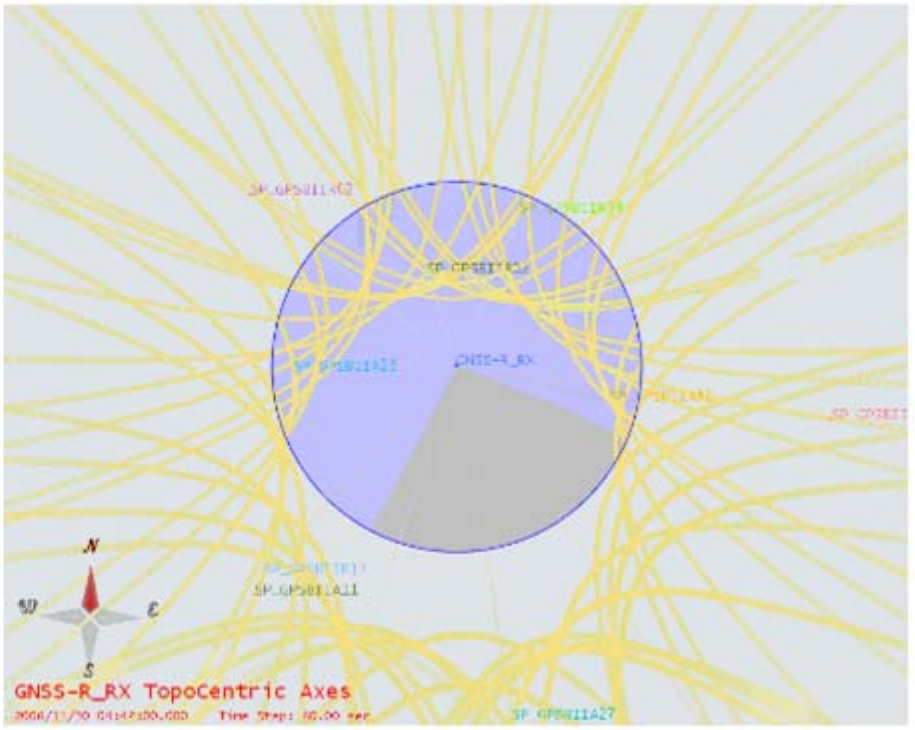
Photos courtesy G. Macelloni, IFAC-CNR" - DOMEX-1 Experiment

GNSS Reflectometry over Sea-Ice and Dry Snow

- Experiments based at
  - Godhavn, Greenland
    - Mast on top of cliff overlooking sea-ice
    - Collect time series data from fixed position through winter season
  - Dome-C
    - Position GPS-R receiver high on mast (30m)
    - Collect data during one week
    - Dry snow tomography
    - Potential support for SMOS e.g. TEC

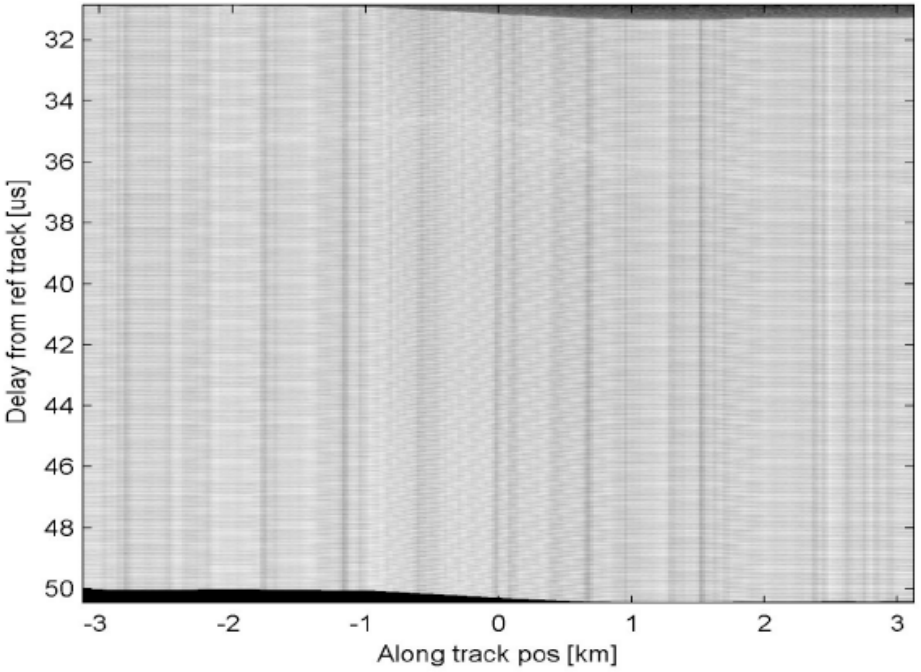
GPS-R Visibility at Dome-C

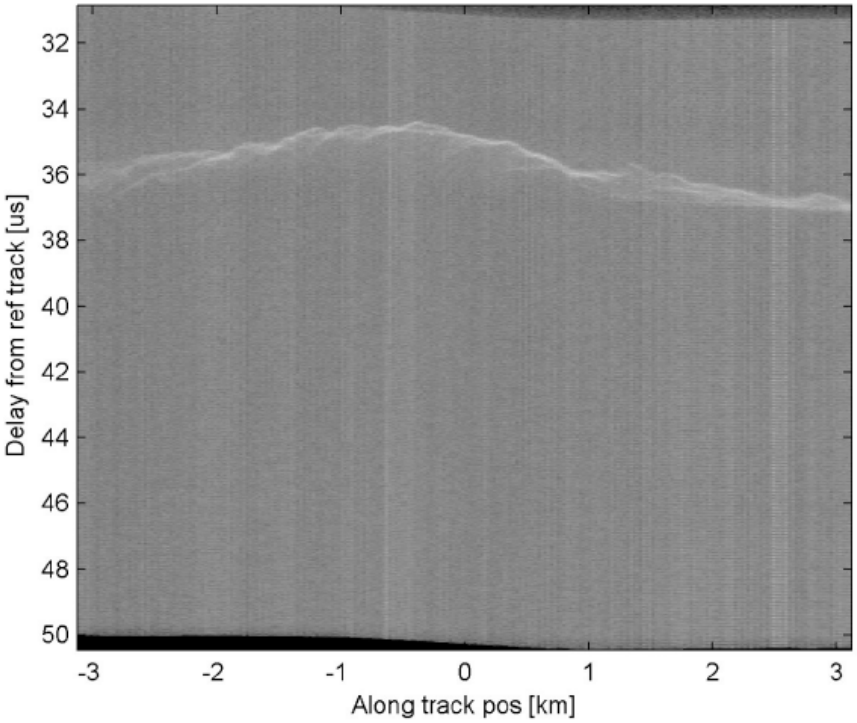




POLARIS – P-band Ice Sounder

POLARIS – Test Flight and First Results





POLARIS – Proof-of-Concept Flight

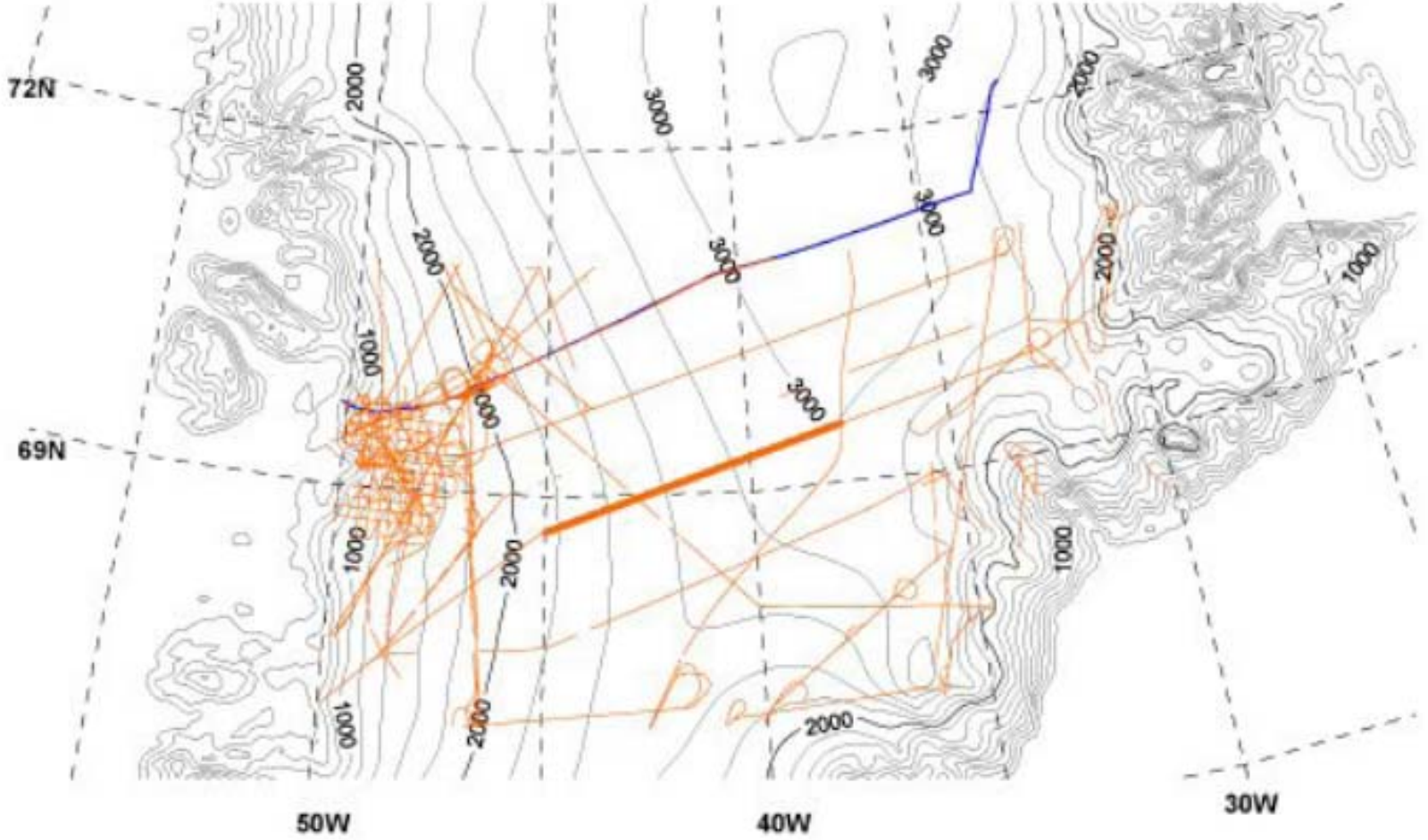


Figure 3.3 Flight lines used by University of Kansas (thin line) and DTU (thick line).

POLARIS – Proof of Concept Flight

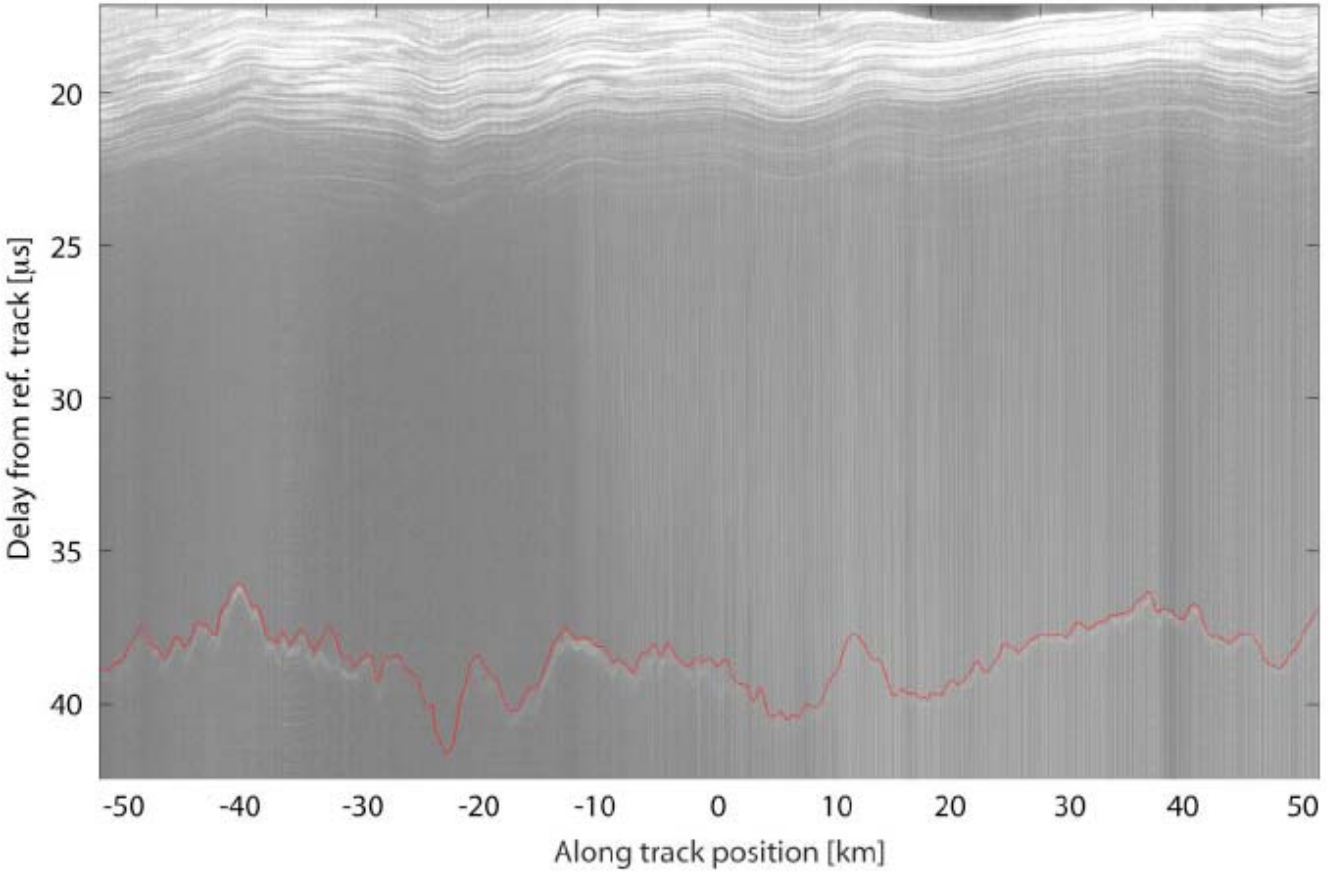


Figure 3.9 Comparison of the bedrock profile measured by DTU (white) and the University of Kansas (red).

POLARIS – Internal Layers

- Instrument had two modes of operation – deep and shallow
- Due to very high dynamic range of signal
- Enables fine internal structure to be analysed
- Instrument has high bandwidth of 85MHz (20%)

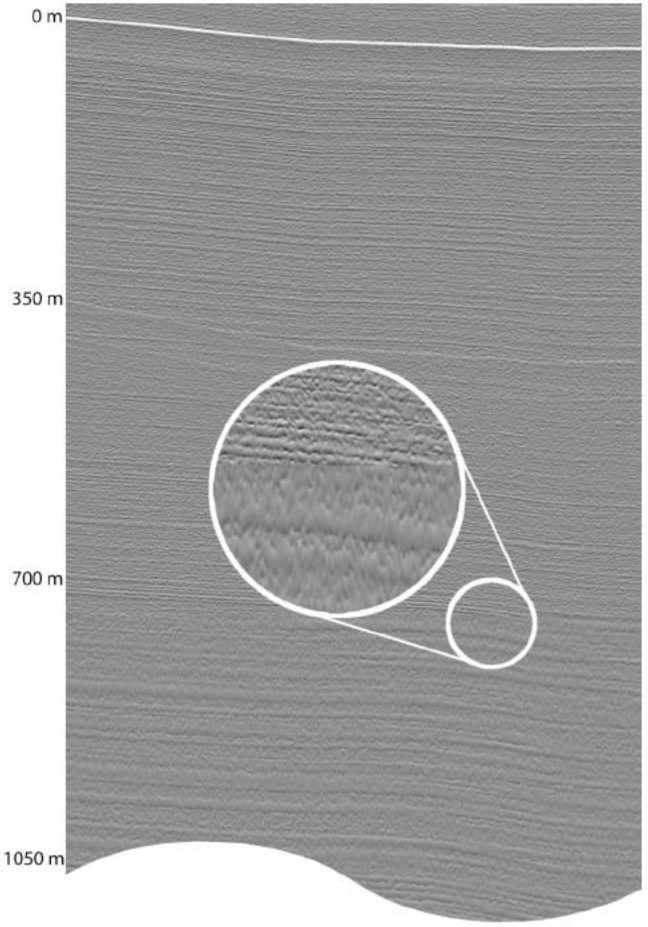
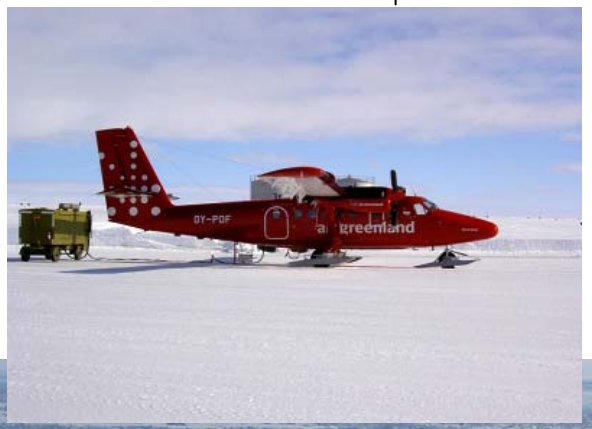
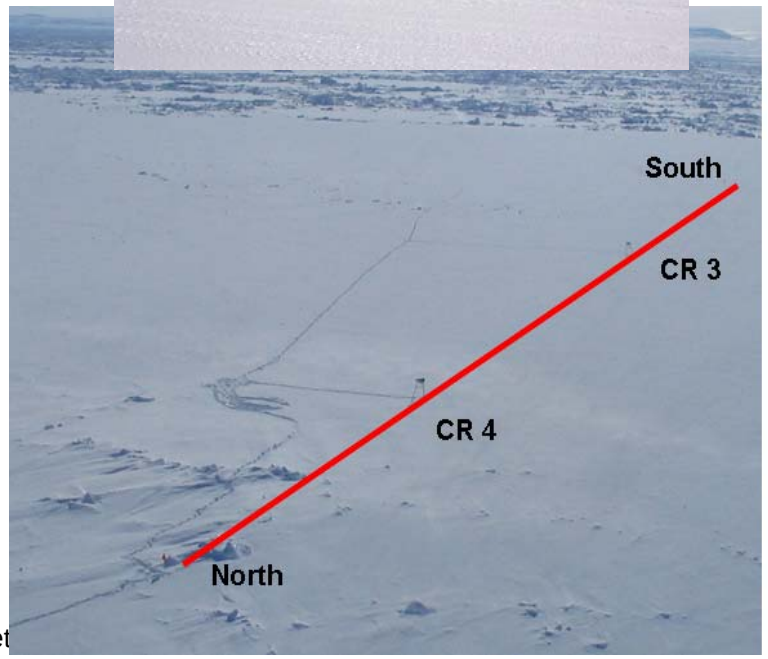


Figure 3.10 Internal ice layers mapped in SDS mode.

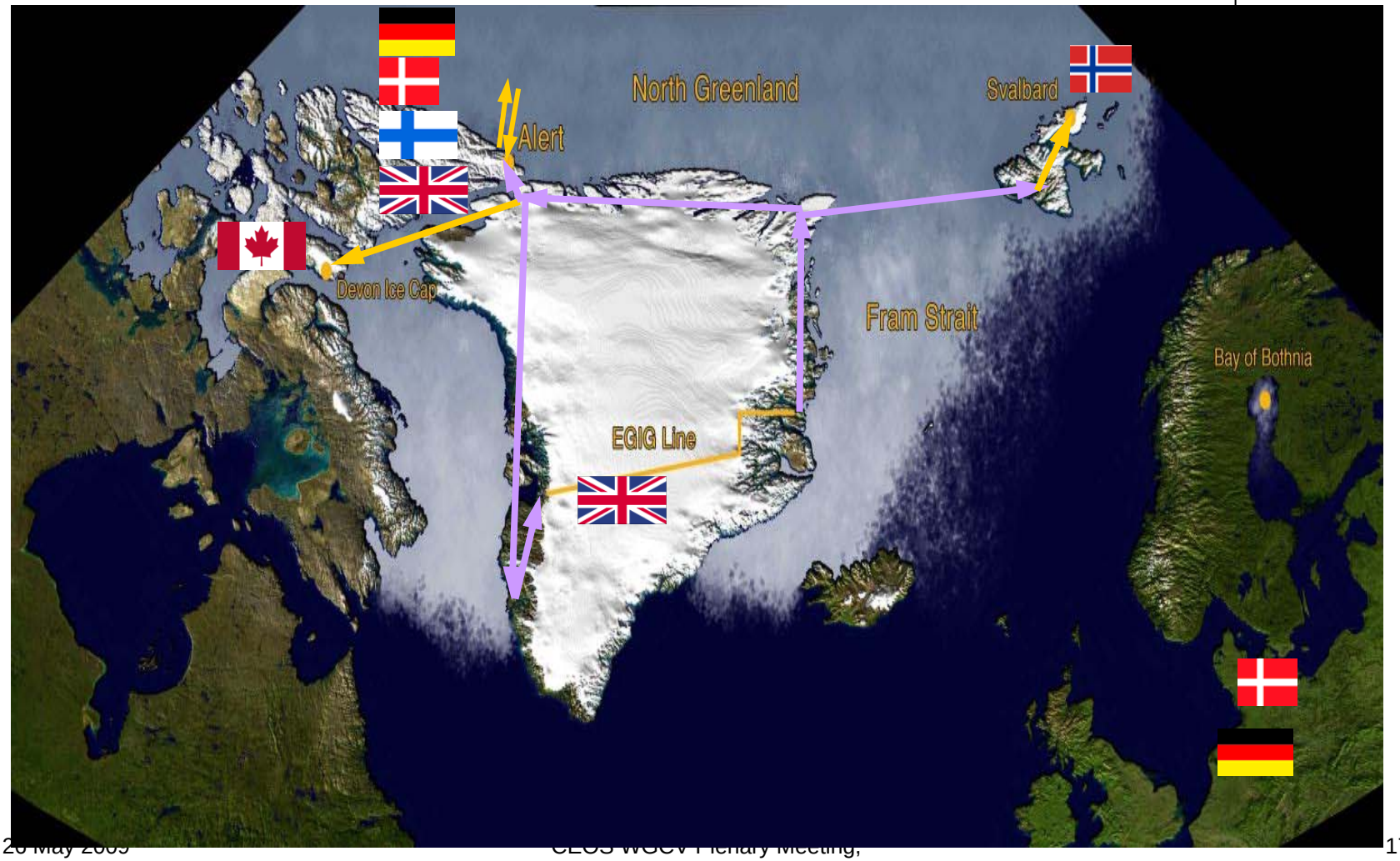
CryoVEx 2006

- Aims
  - Verify validation concept for sea ice
  - Address sea ice error sources (snow loading, signal penetration)
  - Repeat measurements of CryoSat land validation sites for characterisation of temporal behaviour (year-to-year, season-to-season)
  - Validated LAM (SAR) mode for ASIRAS
- Experiment details
  - Multiple test sites
  - 18 April -24 May 2006
  - Airborne measurements by DNSC using Air Greenland's Twin Otter



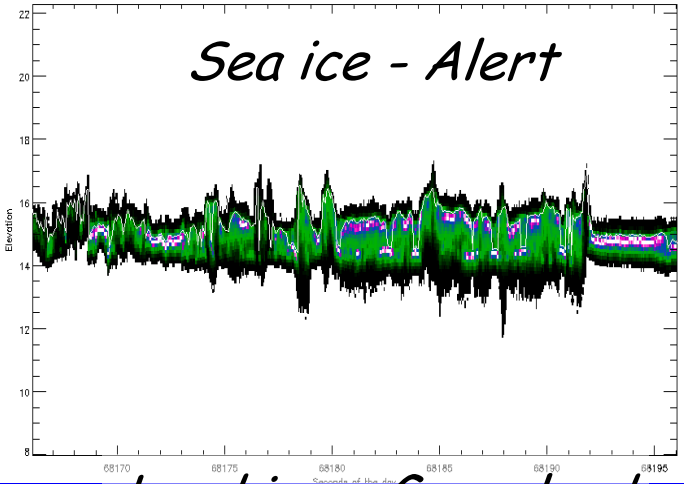


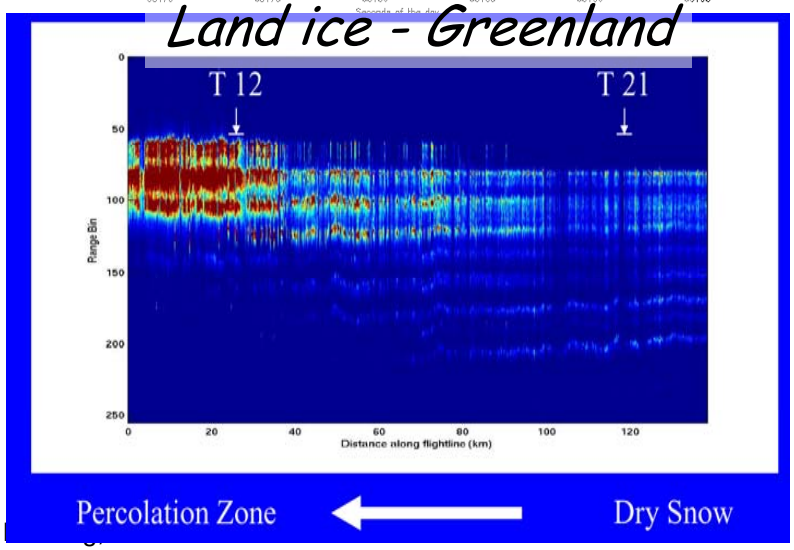
Test sites and airborne coverage



CryoVEx 2006

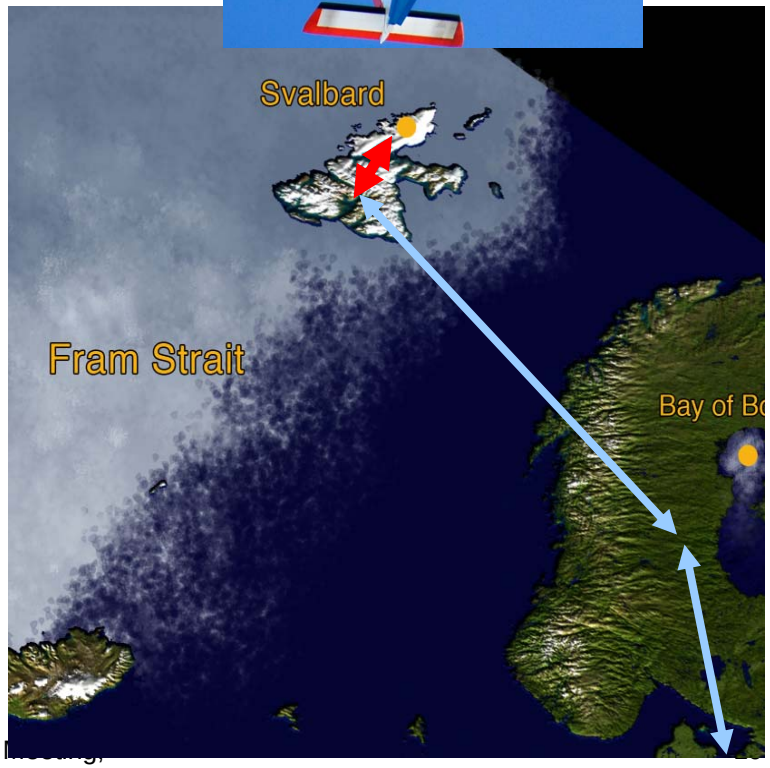
- Main Results
  - First feedback on **sea ice** snow loading, signal penetration and waveforms achieved
  - Verification of sea ice validation concept not achieved!
  - Signal variation over **land ice** as a function of snow conditions characterised => allows impact of volume component on CryoSat retracking to be estimated
  - ASIRAS Low Altitude Mode validated => problem with high data rates identified





CryoVEx 2007

- **Aims**
  - High and low altitude acquisition flights over Austfonna glacier to address CryoSat validation needs (e.g. signal penetration, waveform)
  - Augmented ground activities to address data gaps (e.g. exploitation of neutron probe data through UK collaboration)
  - Technical assessment of upgraded ASIRAS instrument
- **Experiment details:**
  - AWI Dornier 228 plane with ASIRAS and Laser altimeter to be used
  - Longyearbyen, Svalbard (Norway) used as base for acquisitions over land ice shelves



Microwave Sensor CAL/VAL Activities

Xiaolong Dong

Microwave Sensor Subgroup Report

26-29 May 2009

Ilhabela

Brazil

Contents

- CAL/VAL of Microwave Sensors of FY-3 Satellite
- Research on Calibration Site in the Takelimgan Desert
- Preparation of Ocean CAL/VAL Site

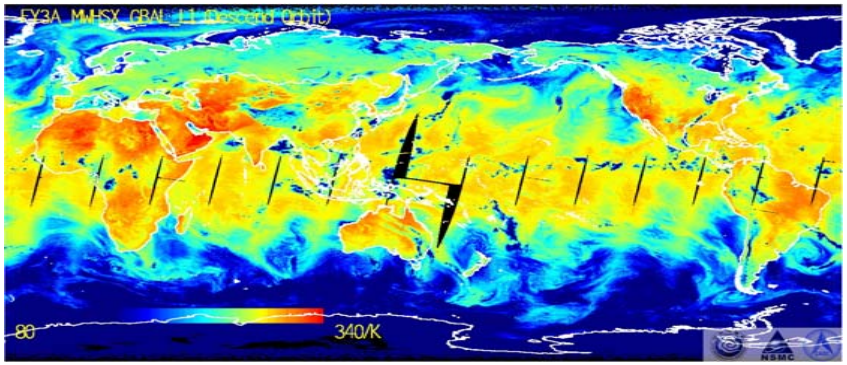
CAL/VAL of Microwave Sensors of FY-3

- Microwave Sensors of FY-3
- Cross calibration of MWHS of FY-3

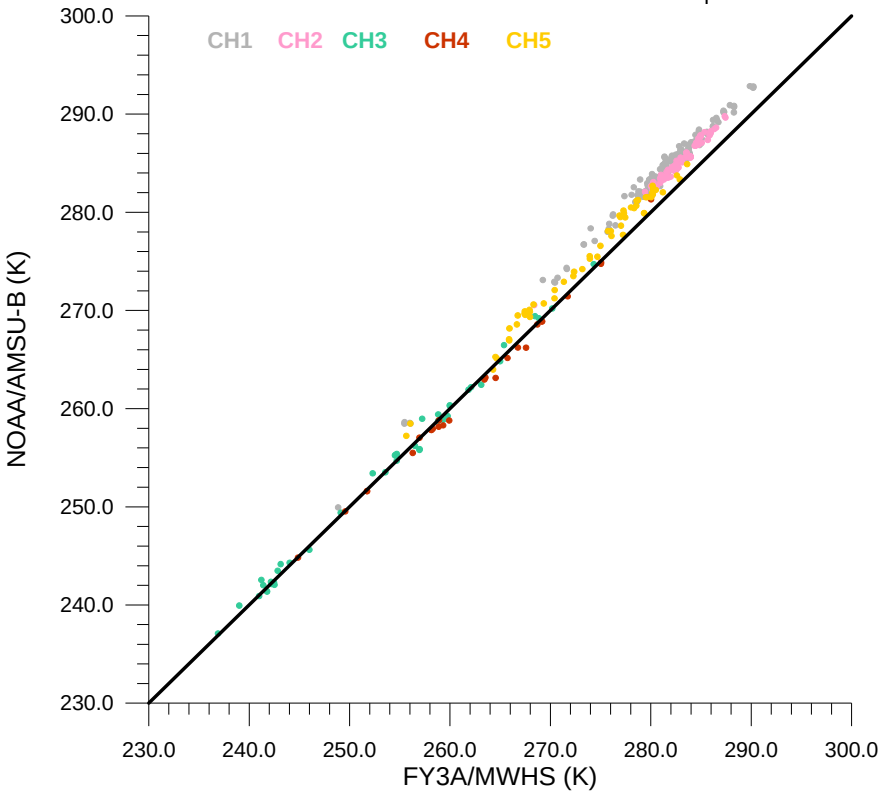
Microwave Sensors of FY-3

Instrument	No of Channels	Frequency Range	Pixels per scan	Nadir Resolution (km)	Purpose
MWTS	4	50 – 57 GHz	15	50-75	Atmospheric Temperature Contour
MWHS	5	150 – 183 GHz	98	15	Vapor contour, surface properties
MWRI	10	10.65 – 89GHz	240	15-70	Rain rate, cloud water content, vapor volume, etc

Cross Cal of MWHS



Global BT image of Channel #1
Of MWHS (2008.11.22)



Cross cal of MWHS/FY3 with AMSU-B/NOAA

Cross Cal of MWHS over the polar region

		FY3A/MWHS	NOAA17/AMSU-B	Tb(FY3A)-Tb(N17)
CH1	Tb(K)	178.3683	177.2133	-1.155
	σ(K)	1.687562	2.038363	
CH2	Tb(K)	177.3058		
	σ(K)	2.033599		
CH3	Tb(K)	208.3236	208.7155	0.3919
	σ(K)	1.640585	2.256896	
CH4	Tb(K)	192.6522	193.4067	0.7545
	σ(K)	2.550857	2.330858	
CH5	Tb(K)	183.0644	181.3400	-1.7244
	σ(K)	2.212211	2.108169	

Research on Calibration Site in the Takelimgan Desert

- Review of the project
- Background information about the site
- Microwave radiometry characteristics of the site and its simulation
- preparation, consideration and design for commissioning phase experiment

Contents

- Review of the project
- Background information about the site
- Microwave radiometry characteristics of the site and its simulation
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Purpose and requirement

- The project aims to provide the scientific community a reliable site to evaluate status of SMOS-like mission and its L1 level data product.
- It requires the site be uniform, of large areas (compatible with the sensor's spatial resolution), stable, if changes then need to be predictable.

- Based on

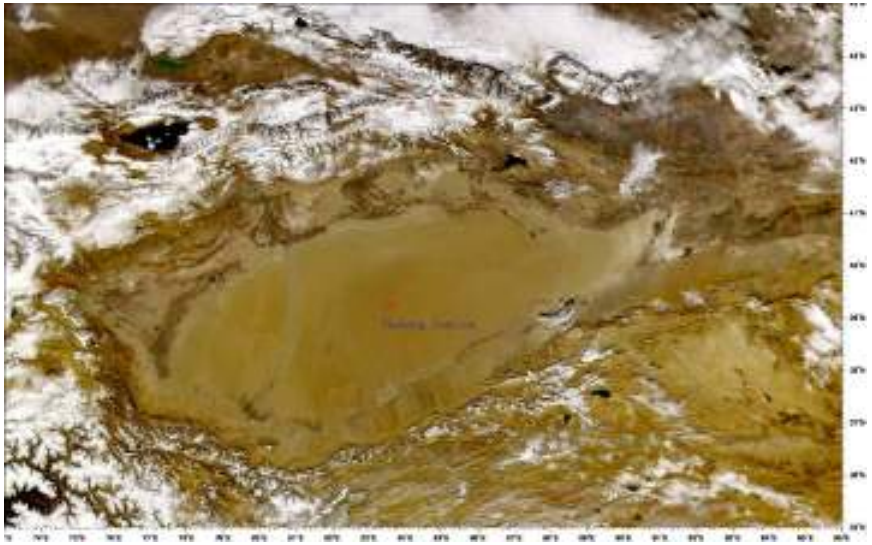
  1. proposal in response to SMOS AO-1

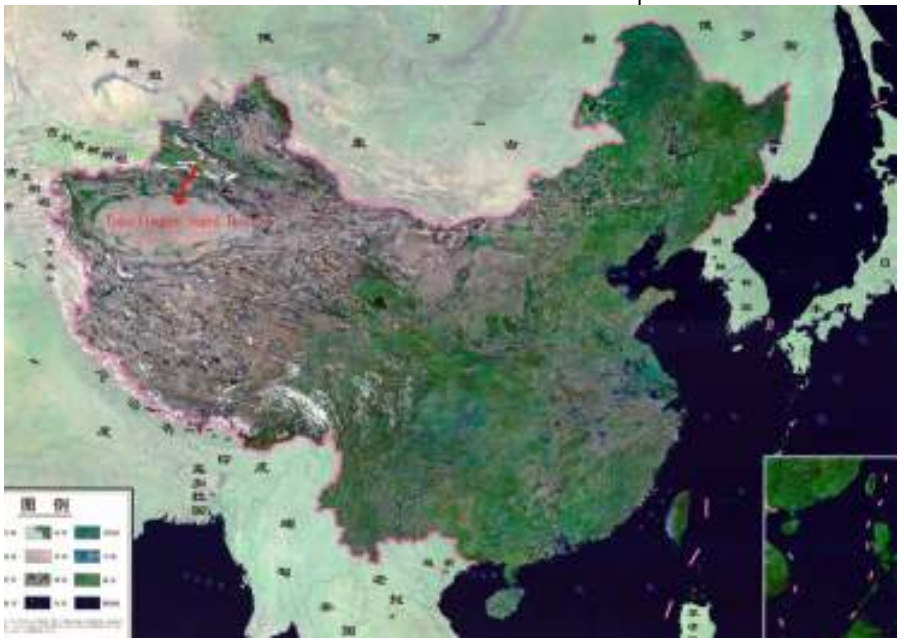
  2. discussion on SMOS 1st SVRT meeting (11.2005)

     and 6th SMOS workshop (5. 2006)

  3. agreement between CSSAR and ESA

Background information about the site



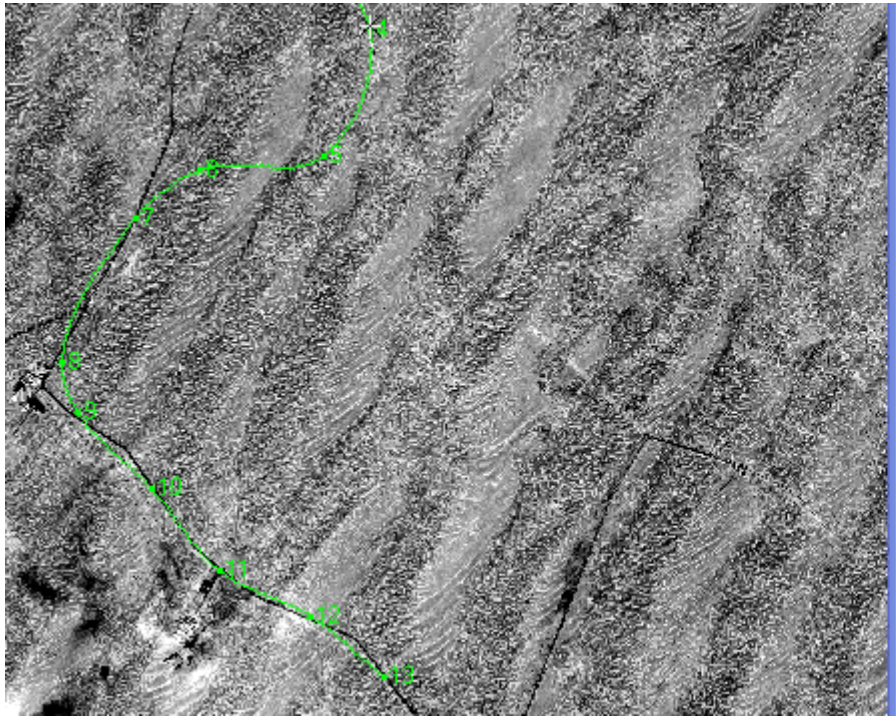


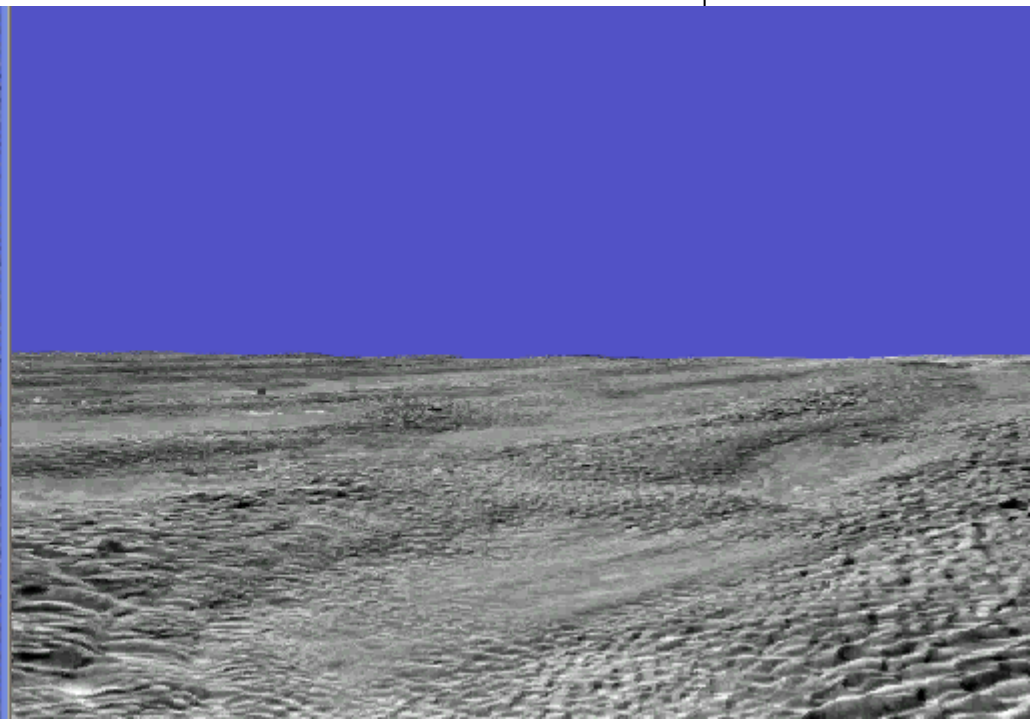
Large area: the 2nd largest desert in the world. Across 12 degrees of longitudes, 4 degrees of latitudes

Extremely arid: annual precipitation 25~45mm, concentrated on May-Aug. most of the precipitation are tiny rain (0.0~2.0mm). annual evaporation 2100~3400mm,

Single land type: 85% is covered with sand dunes. Other places are mixed with sand and shrubs, mainly distributed on brim of the desert.

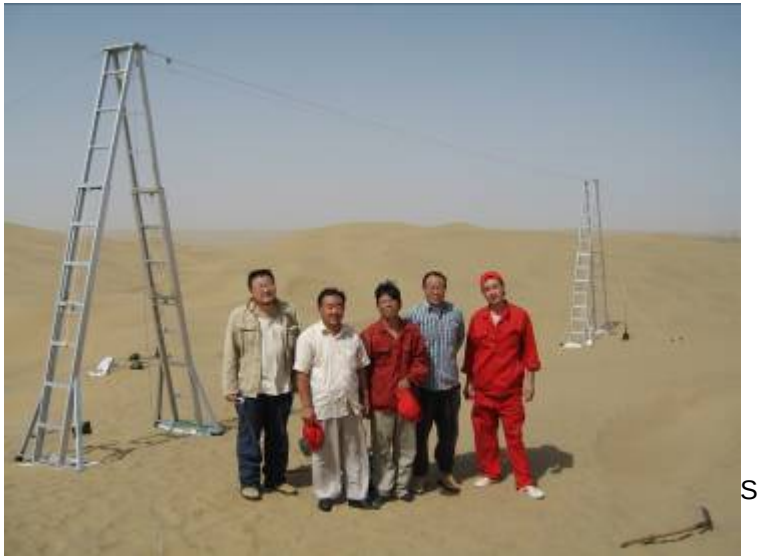
Surface View

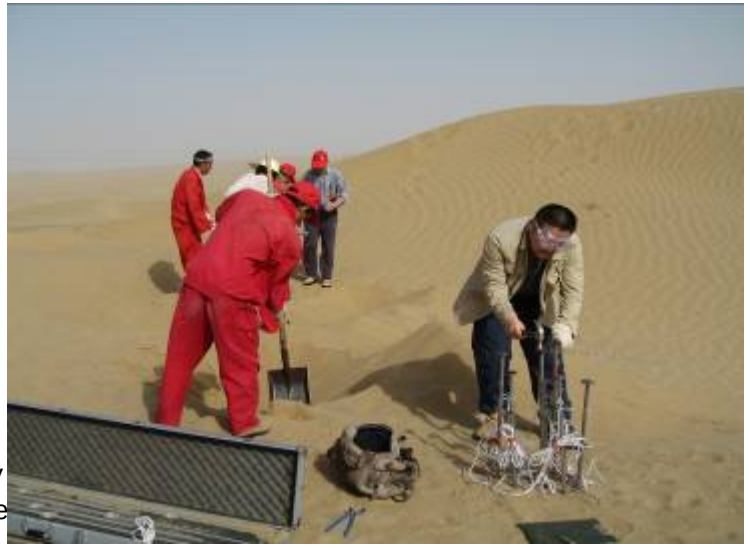




Dem extracted from ALOS PRISM data (Dragon2 TPM)
Vertically exaggreted

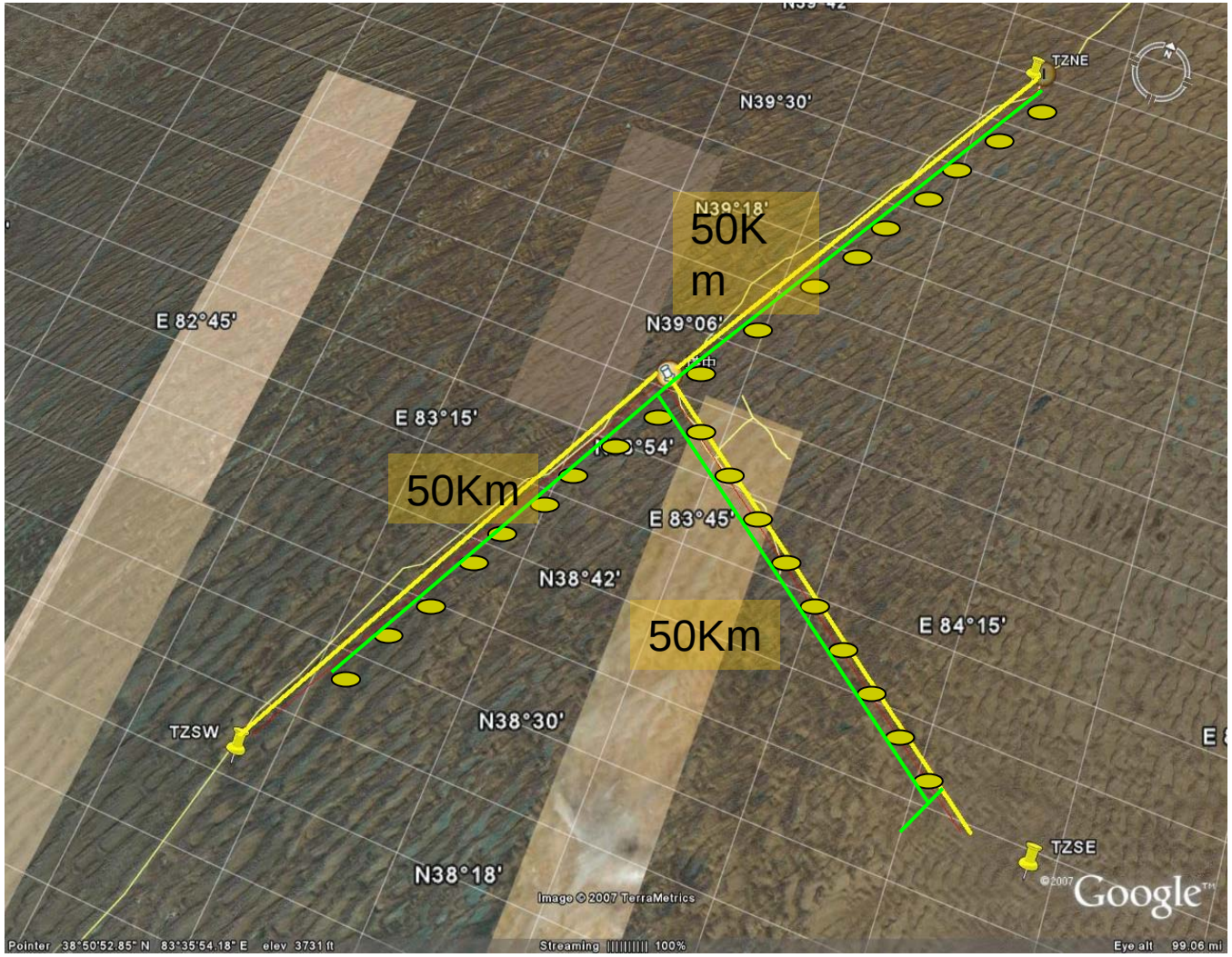
The first Takelimgan field experiment





Commissioning phase campaign

Commissioning phase campaign



Three sets of Soil temperature profile sensors at every points. (100 sets in all, 10 for backup) Equipped before radiometer Operation. Data should be Recorded by automatic recorder. Wire based data recorder is preferred.

Soil moisture profile beyond 2 m Should be investigated.

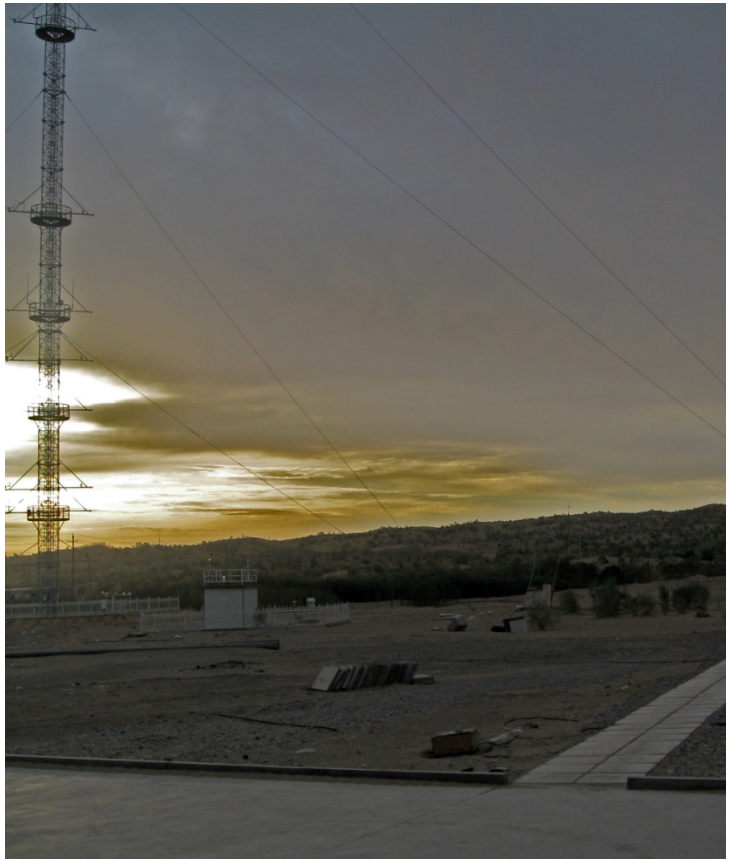
Truck mounted radiometer needs to continuously observe sand dunes with different observation angle, azimuth angle and position at every points for two days.

All 90 points may take 2 months to complete. Then tower observation.

After that, soil temperature profile data should be collected from the data recorder once a week until commissioning phase finished.

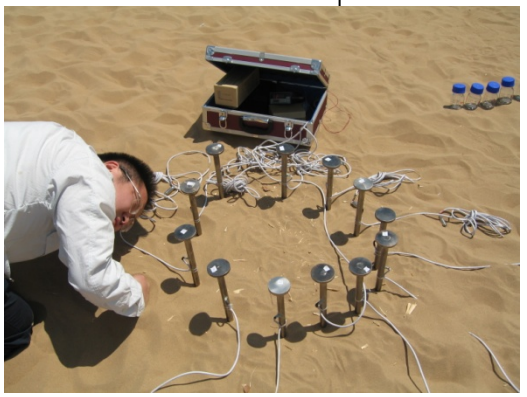
The scale may not be exact.

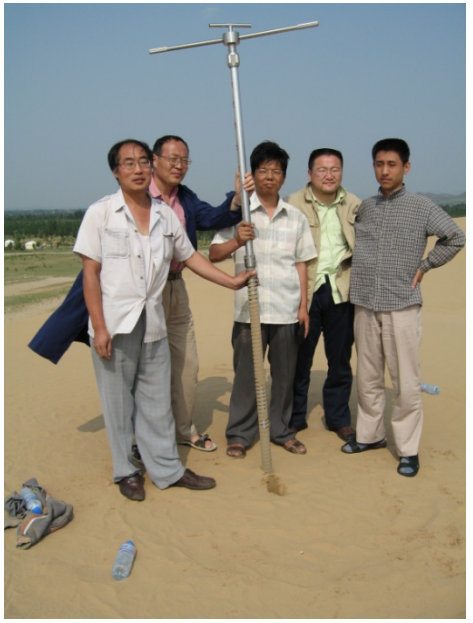
Commissioning phase experiment



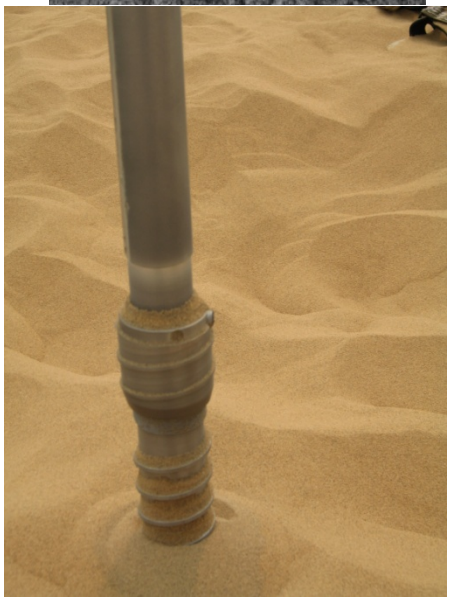
Sampling tools

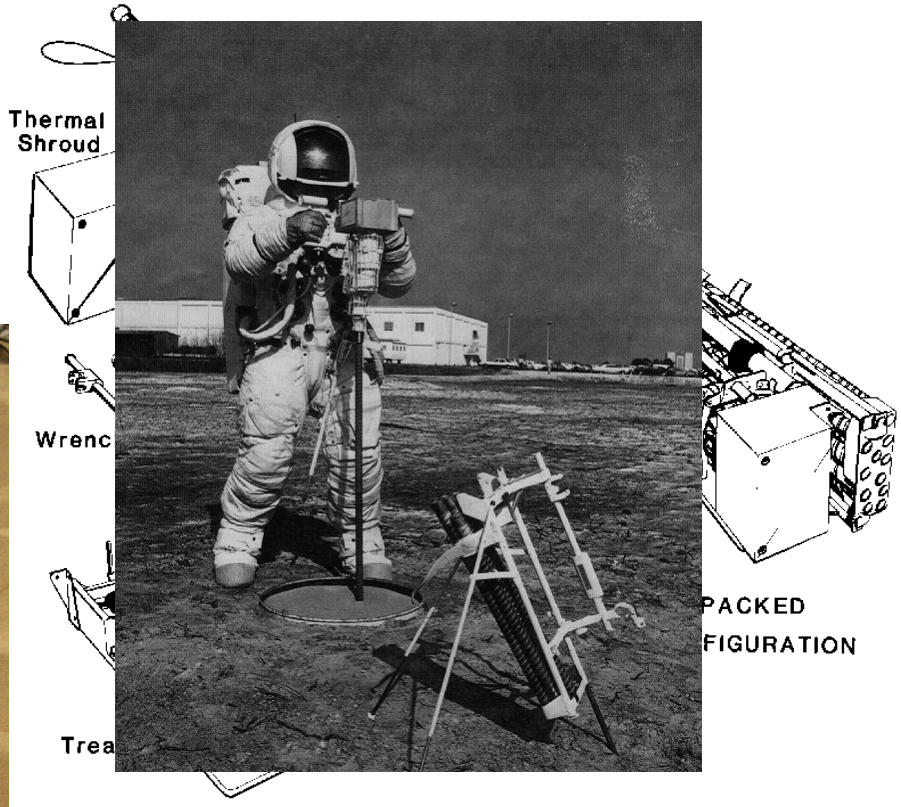
Sand auger sampling wind blown beach sand. Ocean is behind the dune.





Sampling





Summary

- Our purpose is to use this site to evaluate status of spaceborne L band radiometers since it is uniform, stable and predictable.
- Brightness temperature of this site is not a constant, but changing according to some law we have not completely understood. We can use three levels of experiment to find it.
- Preliminary research had been done, more work is undergoing.

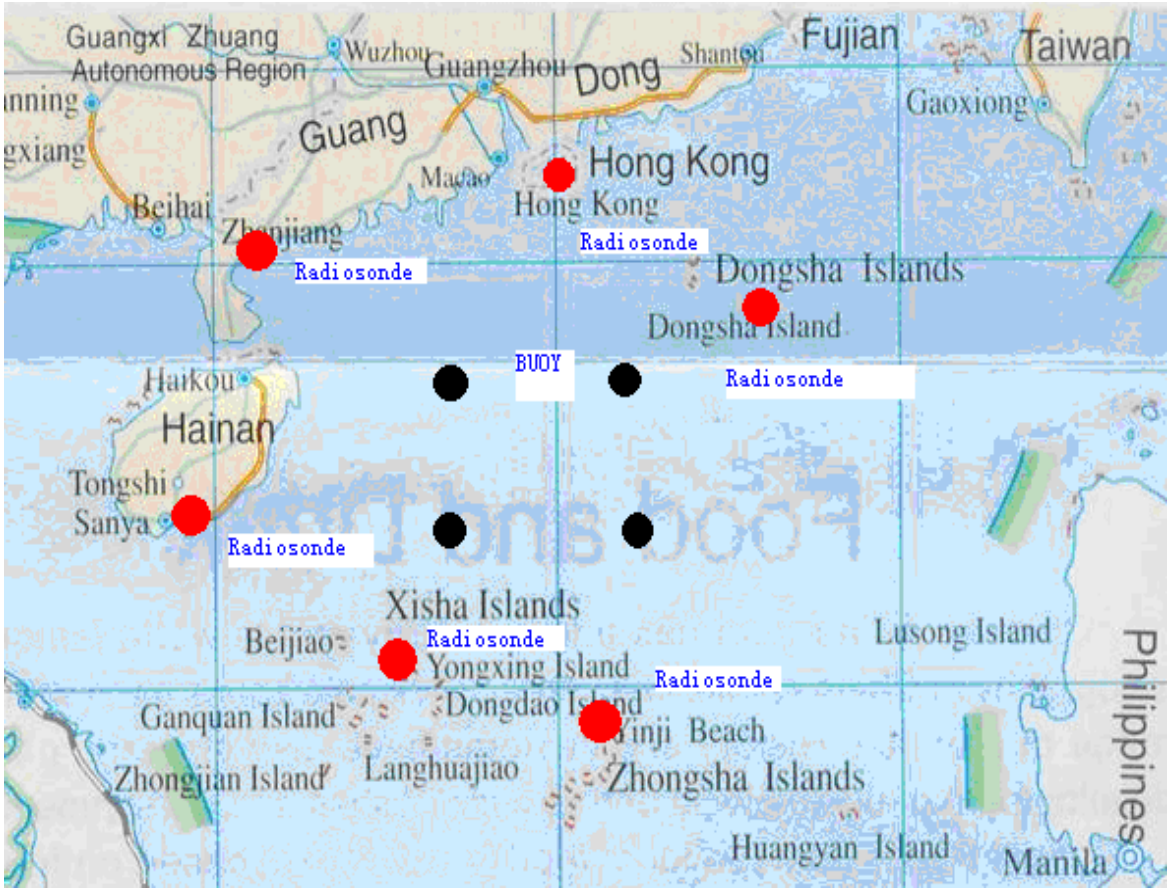
Preparation of Ocean CAL/VAL Site

- Background
- Location
- On-site instrument
- Experiment plan

Background

- Preparing CAL/VAL for HY-2 Satellite
  - ALT (13.58GHz, 5.25GHz)
  - MWR (18.7GHz, 23.8GHz, 37GHz)
  - SCAT (13.256GHz)
  - MWI (6.6GHz, 10.7GHz, 18.7GHz, 23.8GHz, 37GHz)
- Based on a Oil-Production platform out of the Pearl River Bayou of South China

Location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Autonomous Region
Wuzhou
Guangzhou
Dong
Shantou
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Beihai
Zhanjiang
Radiosonde
Radiosonde
Dongsha Islands
Dongsha Island
BUOY
Radiosonde
Haikou
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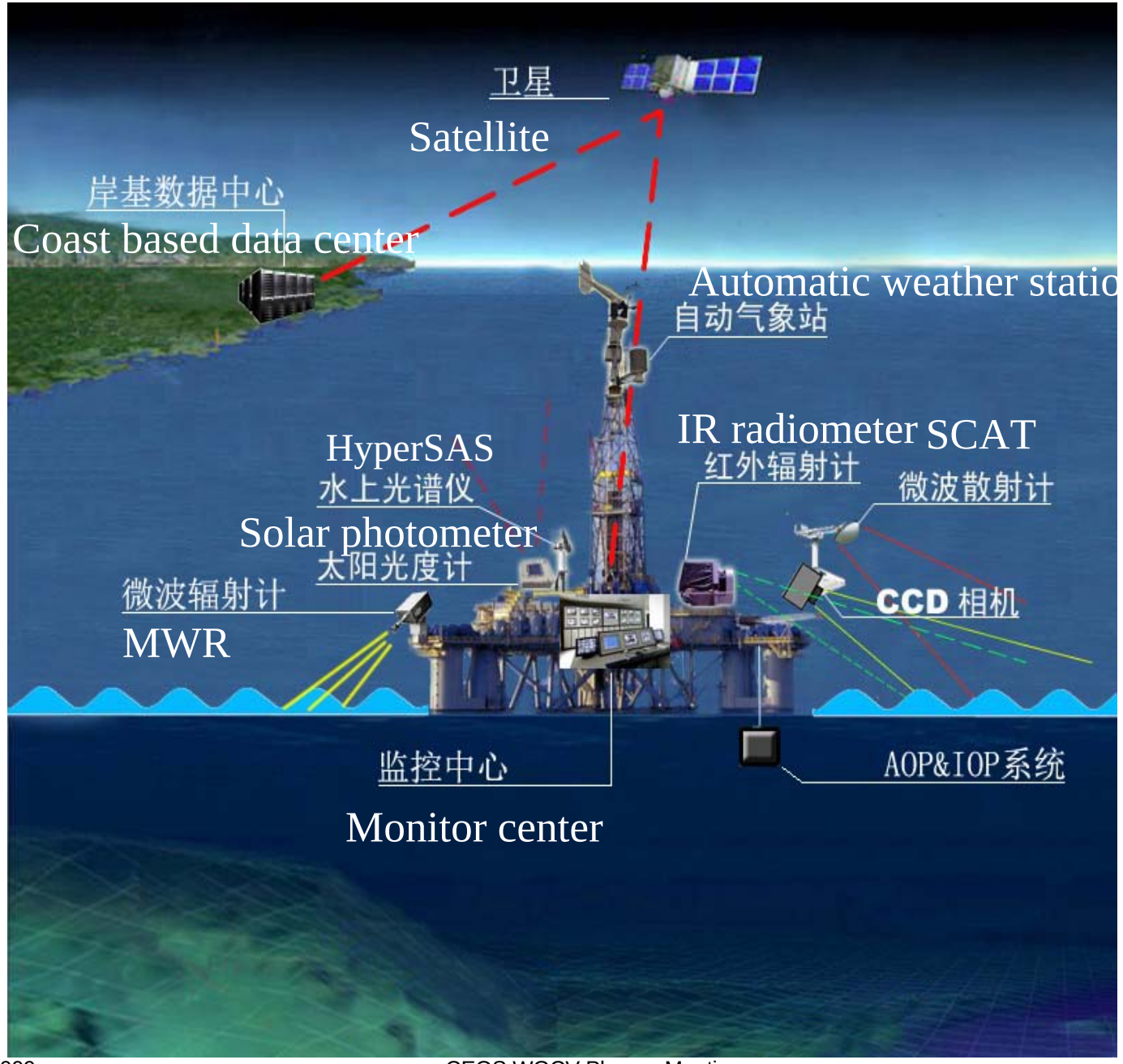
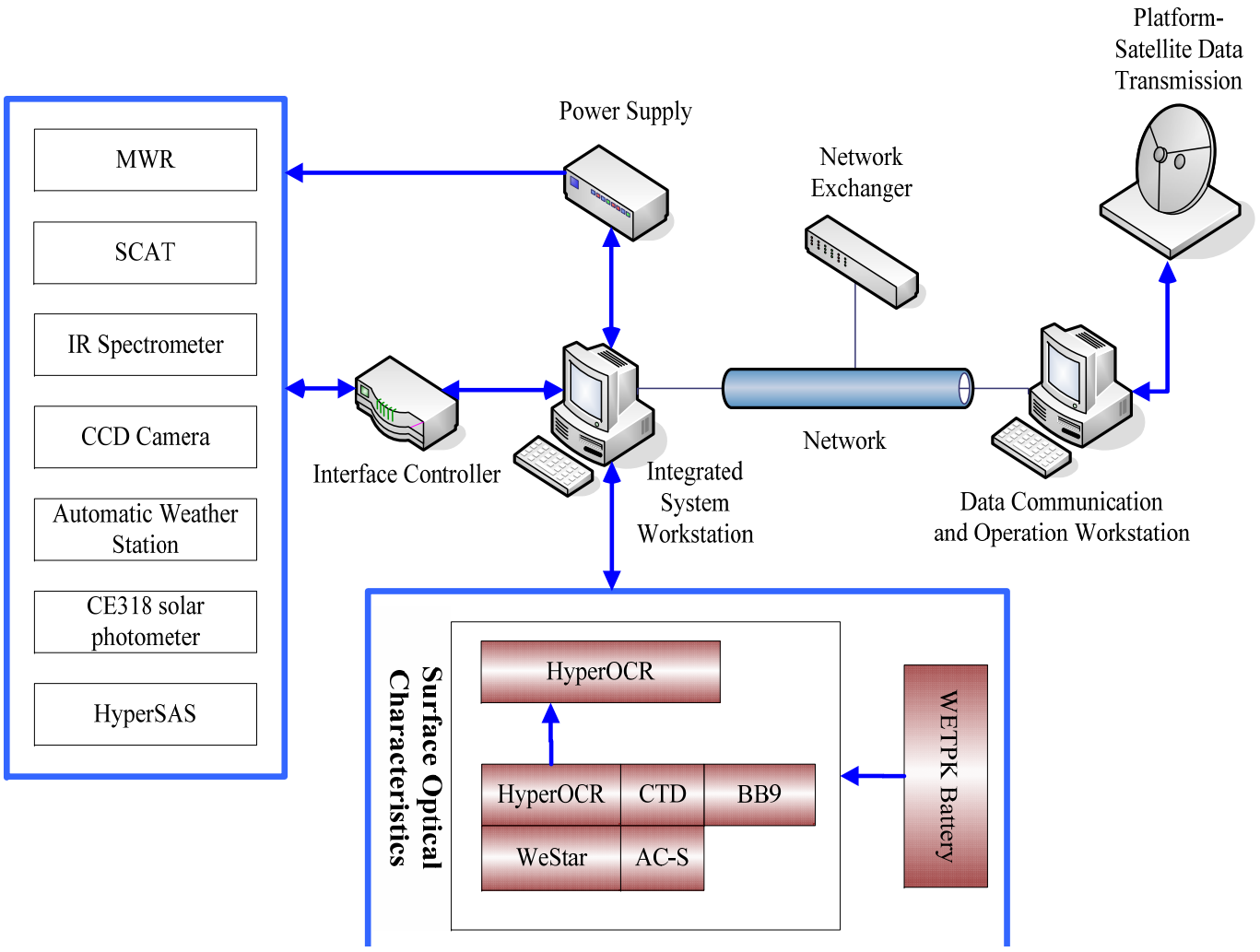

卫星
Satellite
岸基数据中心
Coast based data center
Automatic weather statio
自动气象站
IR radiometer SCAT
红外辐射计
微波散射计
HyperSAS
水上光谱仪
Solar photometer
太阳光度计
微波辐射计
MWR
CCD 相机
监控中心
Monitor center
AOP&IOP系统


Platform-
Satellite Data
Transmission
Power Supply
Network
Exchanger
MWR
SCAT
IR Spectrometer
CCD Camera
Automatic Weather
Station
CE318 solar
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HyperSAS
Interface Controller
Integrated
System
Workstation
Network
Data Communication
and Operation Workstation
Surface Optical
Characteristics
HyperOCR
HyperOCR
CTD
BB9
WeStar
AC-S
WETPK Battery

THANK YOU