

Korea's Icebreaker ARAON



17 March, 2010

KOPRI

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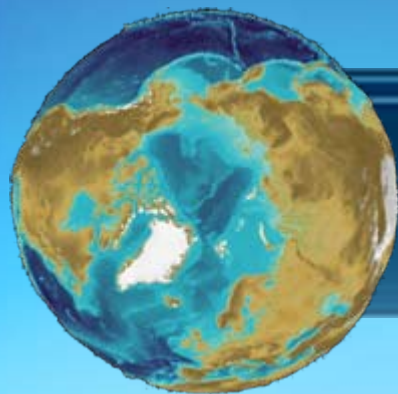
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3 *First Cruise and Ice Trial in Antarctica*

4 *Discussion*





Overview



- **Period : 2004~2009 (7 yrs)**
- **Budget : 100 mil USD**

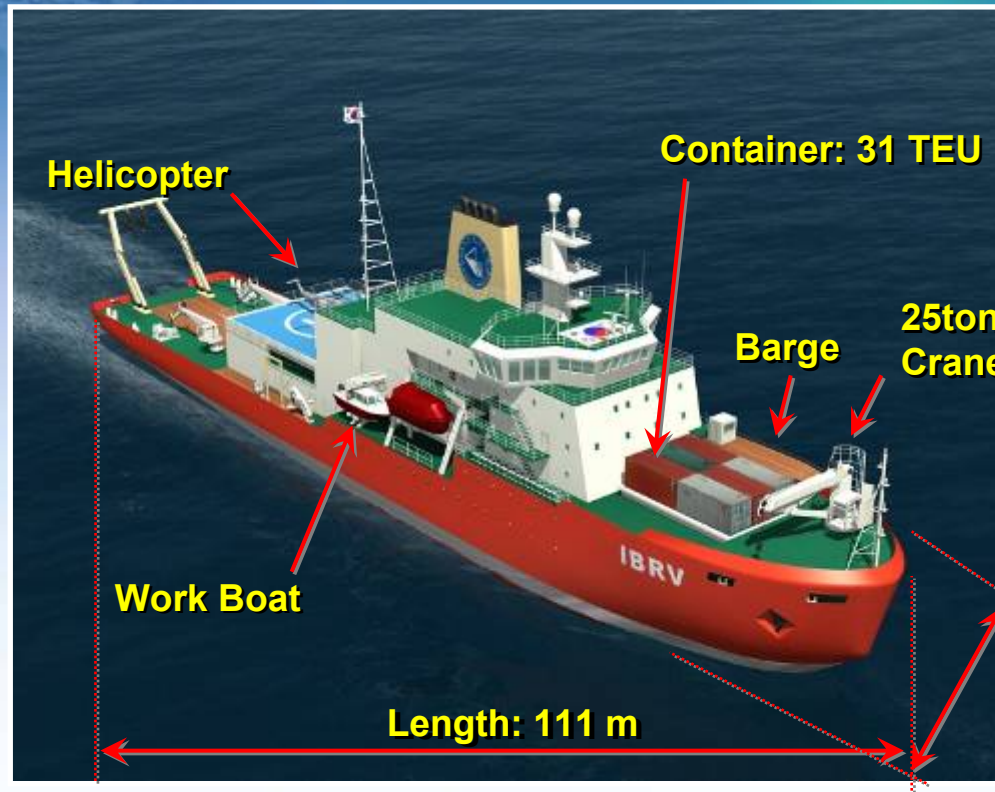
‘Ara’ (sea) + ‘On’ (all) = All the sea



• **Mission**

- To execute multidisciplinary research survey in worldwide oceans, including bi-polar areas
- Logistics support for the Arctic and Antarctic station

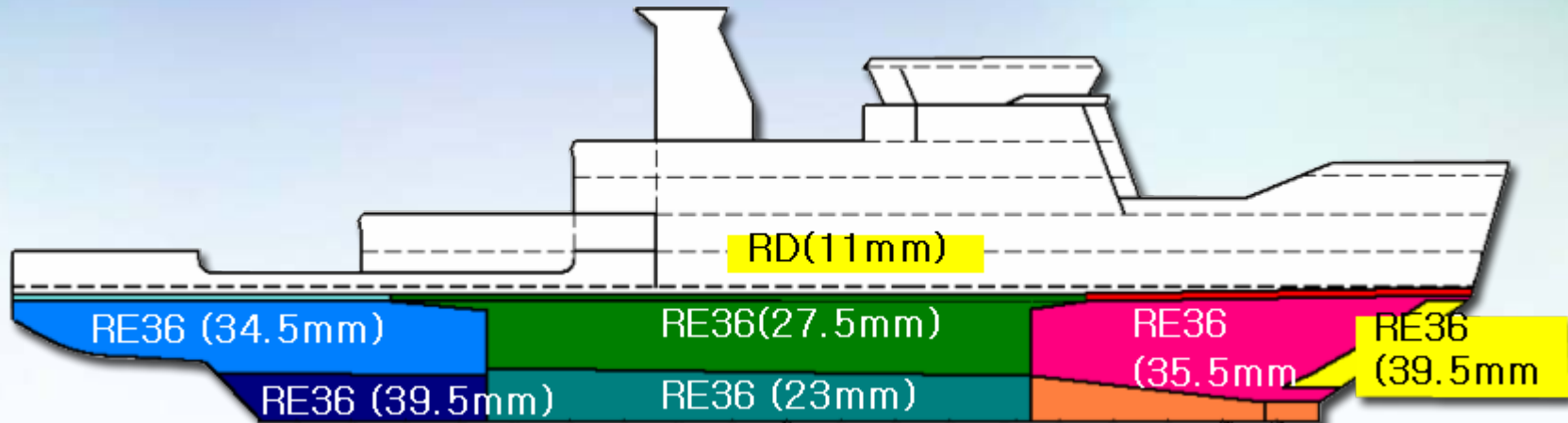
Overview



- **Tonnage** : 7,487 GRT
- **Manning** : 85 persons (25+60)
- **Service Speed** : 12 knot
- **Endurance** : 20,000 nm (70 days)
- **Classification** : KR PL-10
(1 m depth icebreaking in 3 knot, Dnv Polar 10)
- **Propulsion** : Azimuth Thruster
- Diesel electric plant : 10 MW (5 MW x 2)
- **DP-2 System**

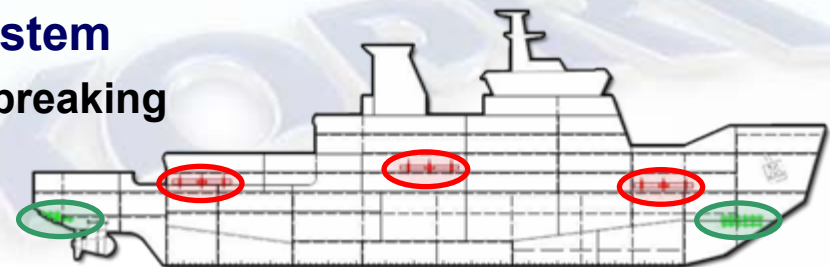
- **Higher Tensile Steel**

- Ice strengthening area and transverse structural members
- Thickness : 39.5 mm in max.
- Material (RE 36, - 40 □) : normalized steel or TMCP steel



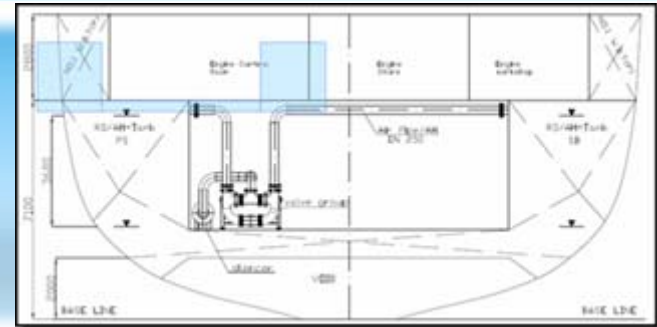
- **Hull Stress & Ice Load Monitoring System**

- Realtime monitoring and alert while ice breaking
- Keeping ice load data on cruising route



- **Heeling System**

- Air-blow type
- 7 °heeling from port to starboard during 3 minutes



- **Working Deck**

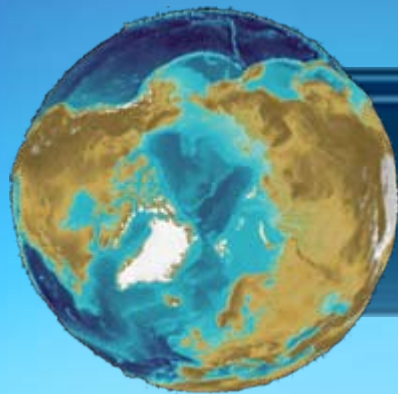
- Wooden deck
- Close for winches
- Room for controlling & monitoring



- **Sensors fitted on Hull Bottom**

- Compact and no interference
- Ice protection of bottom sensors from ice load





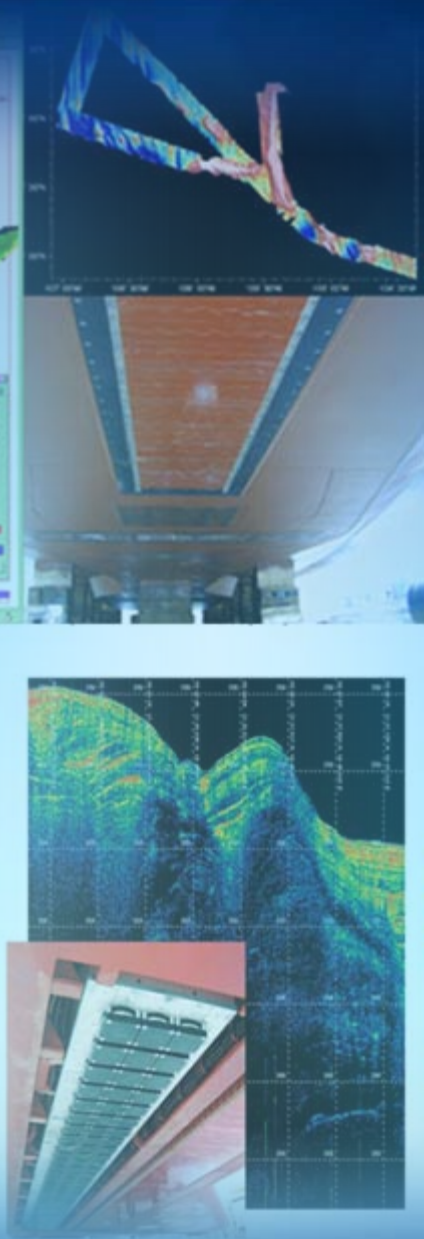
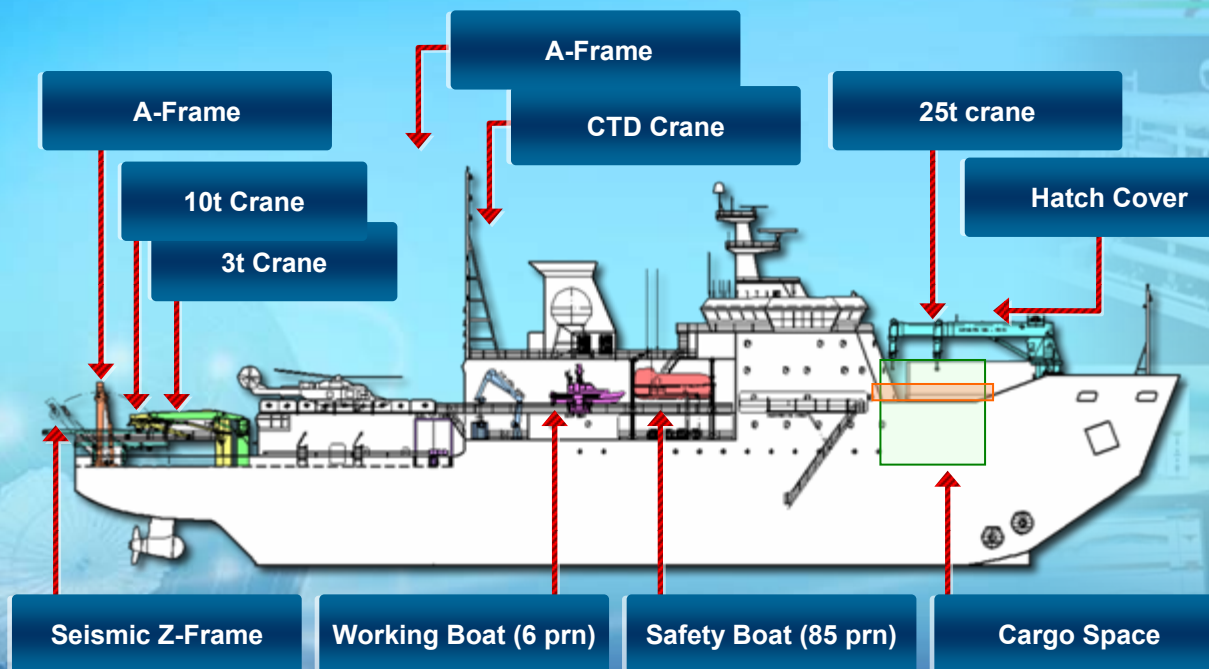
Research Equipment



Research Equipment - 1



- **Oceanography** : CTD with water sampler, etc.
- **Geophysics** : Multi-channel seismic system, etc.
- **Marine Geology** : Multi-beam echo sounder, etc.
- **Biology** : MOCNESS, Sea soar, etc.
- **Monitoring, Analyzing equipment** : Weather Station, etc.



Research Equipment - 2

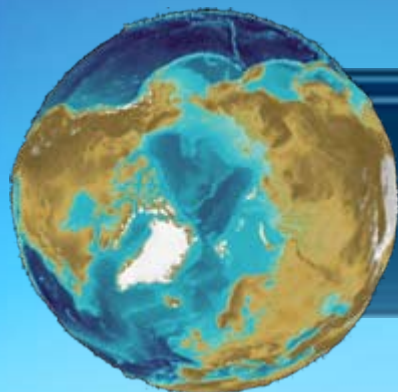


Equipment	Specification	Equipment	Specification
ADCP/LADCP	Freq:38kHz	Salinometer	Measurement Range: 0.0001:1.15 Conductivity Ratio 0.004 to 76mS/cm 0.005 to 42 Equivalent Practical PSU
Scientific Fish Finder	Freq:38,120,200kHz	Acoustic Synchronizer System	Synchronizing up to 12 acoustic system Better than 1 msec timing resolution
Low Fre. Omni-Directional Fishery Sonar	Freq:24/26/28kHz	Marine Gravity Meter	Resolution:0.01mGal Static Repeatability:0.05mGal Accuracy at Sea:1.00mGal
Multi-Beam Echo Sounder in cluding Sub-Bottom Profiler)	Freq:12kHz Freq:2.5kHz ~ 7kHz	Marine Magnetometer	Absolute accuracy:0.2nT Sensitivity:0.01nT Resolution:0.001nT
Precision Depth Recorder	Freq:12/38kHz	Wavemeter	Significant Wave Height - Range:0~5m, Accuracy:0.25~0.5m - Range:Above 5m, Accuracy:10%
Compressor System	GA90W / Air Receiver / CT	Underwater Undulating Instrument System	Towing speed:0.5 ~ 10knot Operating Depth:0 ~ 400m
Aerosol Sizing Instrument	Heating Control:0~300 □	Multi-Channel Seismic System	Streamer CH:120 Air Gun Vol:1200 cu in
LIDAR	Range:12km (Less than) wavelength:532nm	TV Grab	working depth: ~6000m Grab size:2 X 2ft

Research Equipment - 3



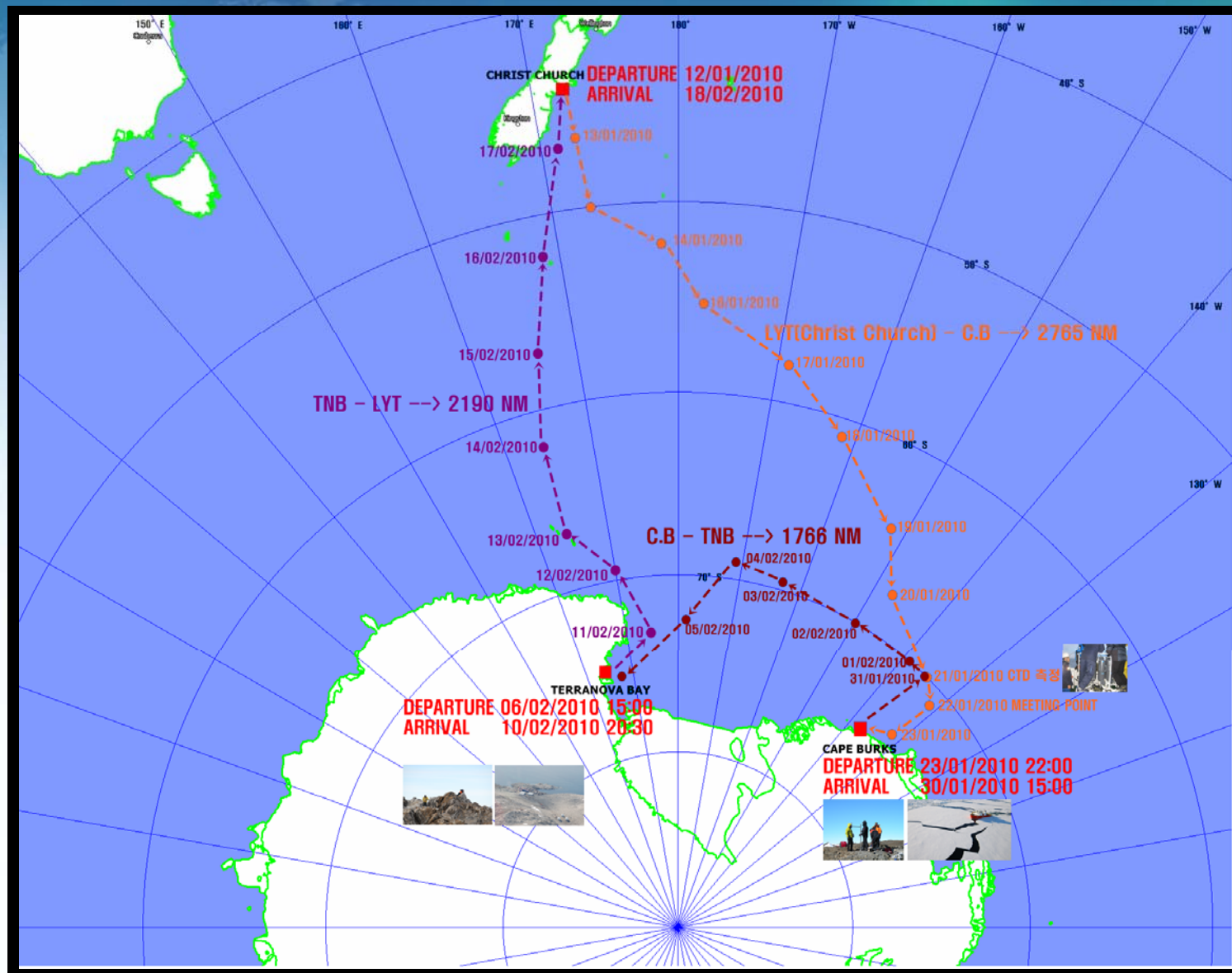
Equipment	Specification	Equipment	Specification
Attitude and Positioning System	Heading Accuracy:0.02 □ Roll/Pitch Accuracy:0.02 □ Heave Accuracy:5cm or 5%	MOCNESS	Net size:333 micron mesh No of Net:9 Length of Net:6.0m
LAN system	Master/Slave Server/Ship's Signal Interface Unit/	Satellite Receiver	Radome attenuation: ~0.15dB L-Band Input Freq:1680~1710Mhz S-Band Input Freq:2207~2267Mhz
CTD	Temperature:-5 ~ 35□ Conductivity:0 ~ 7 S/m Pressure:0 ~ 10500 meter	Sea Water Analyze	Take 120 sample cups up to 5mL Fiber optic detector for Nutrient
Weather station		Data cable	
Sub-bottom profiler		pCo2 System	
ITRAC Core Scanner(Second Generation)		Thermo-Salinograph	
Streamer Winch		Umbilical Winch	
Magnetometer Winch		Gun Array	
Deep Sea Winch		Electro-Optic Cable Winch	
Small Empty Winch		Small Coaxial Cable Winch	
CTD Winch		CTD Crane	
Stern A-Frame		CTD Handling System	
Winch Monitoring System		Uncontaminater Seawater System	



First Cruise and Ice Trial in Antarctica



First Cruise and Ice Trial - 2



First Cruise and Ice Trial - 3



First Cruise and Ice Trial - 4



Annual Operation Plan



NOVEMBER ~ APRIL

Antarctic Expedition

MAY

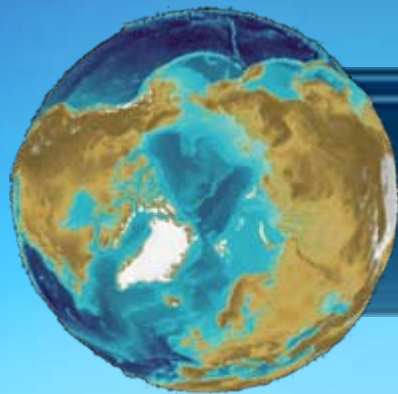
**Anchoring in Incheon, Korea
(Docking and Maintenance, cargo loading)**

JUNE ~ SEPTEMBER

Arctic Expedition

SEPTEMBER ~ OCTOBER

**Anchoring in Incheon, Korea
(Docking and Maintenance, cargo loading)**



Future Research Plan



Future Research Plan (draft) - 1



Long-term Arctic Ocean Monitoring Program

Past

Recovery of past environments;

- Structure of sediments
- Geochemical isotope analysis
- Paleo-phytoplankton in sediments

Current

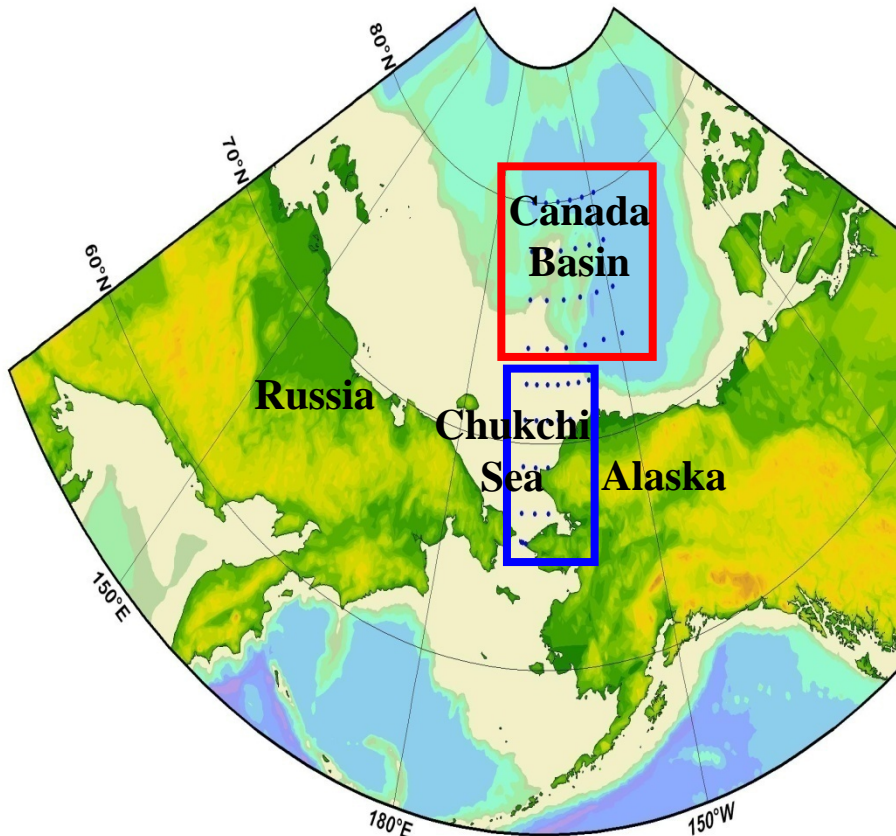
Monitoring current conditions;

- Monitoring sea ice
- Physical/Chemical characteristics of waters
- Distributions and characteristics of phytoplankton and zooplankton
- Benthic ecosystem studies
- Microorganism studies
- Sea ice ecosystem studies on sea ice

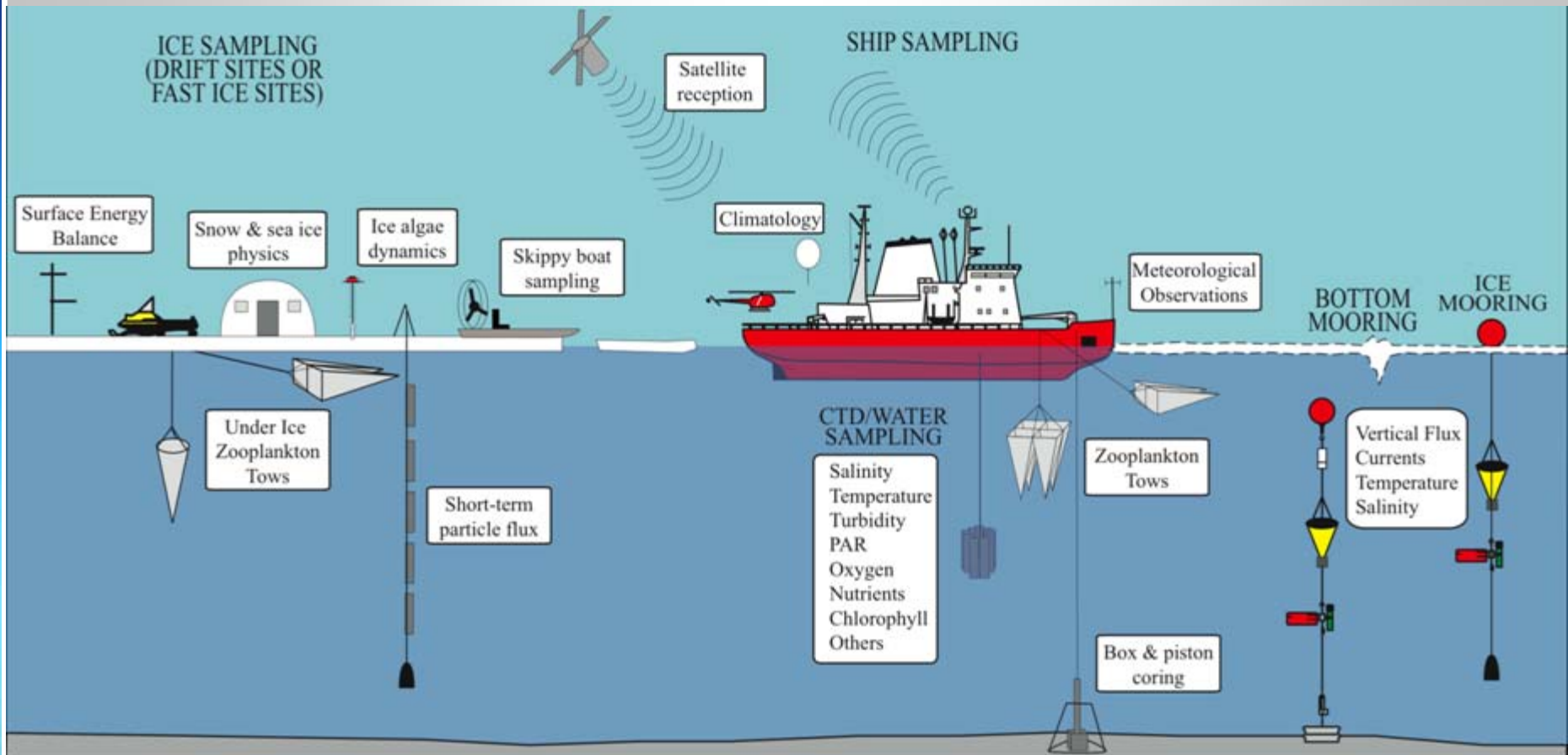
Future

Predicting future conditions;

- Developing ice-ocean-atmosphere model



Ideal Model for Korean Arctic Monitoring



From Calder et al. 2009. Community white paper

Schematic of the scientific equipment used on the Canadian icebreaker *Amundsen* and at ice camps near

Thank you

