

# PolarQuEEEst

Extreme Energy Events

@

Extreme Weather Conditions !



# POLARQUEST

1928  
2018

EXTREME....

EXPLORATION

A complete circumnavigation of the Svalbard islands investigating on heroes of the past

SCIENCE

An international team of researchers looking for great enigmas, from climate changes and human footprint, paleoclimate and cosmic rays

A MESSAGE FOR THE PLANET

A Voyage to the last wilderness on the Earth, looking for our Planet fate



## PolarQuEEEst

3 portable  
CR detectors,  
1 onboard + other 2  
in italian and  
norwegian schools  
Studying Cosmic Rays  
at extreme Latitudes  
and their connection  
with climate  
and environment,  
EEE extends  
to POLE!



## Nanuq Mantanet

The first study of  
Microplastics  
pollution  
above 78°  
to understand  
The effects and size  
of plastic  
accumulating  
at Poles  
harming  
Earth environment

## ARARAT Arctic Research Aerial Reconnaissance and Transport

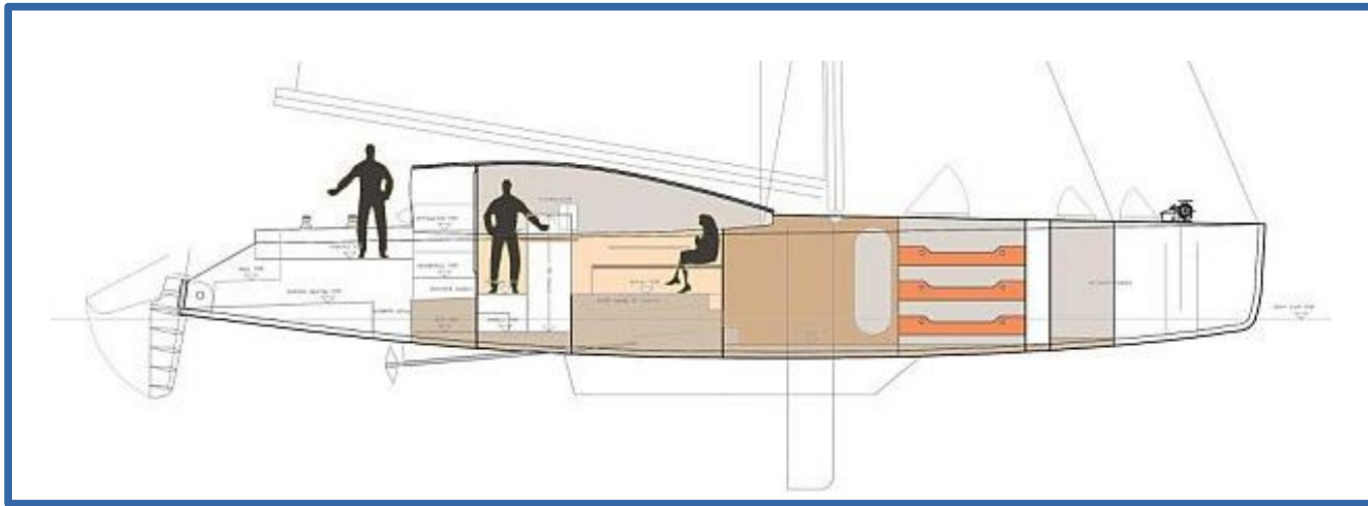
The first test of the use of drones  
for gathering samples of waters, ice, air and pollution  
for climate related scientific research





The  
BOAT  
and the  
IGLOO





2 double cabins with  
bunk for extra crew  
plus cabin with 6  
berths

Engine: inboard  
Diesel 85cv

Fresh water tank: 800l

Diesel tank: 1200l

Type: Integral 60

Launched 2014

Length: 17.80 m

Beam: 4m70

Sail area: 165m<sup>2</sup> jib,  
main and mizzen

Displacement: 18t





## The IGLOO

sandwich technique: lightweight shaped high performance **polystyrene blocks** assembled to make the sandwich core

**thermal conductivity 0.029 W/(mK)**

Fiberglass and epoxy resin skins provide strength, impact resistance and weatherproofing. The completed "Igloo" weighs **only 1300 kg**.

A robust **metal frame** is necessary for dealing with ice and extreme temperature conditions





High performance thermal insulation

High performance glazing

Heat recovery from exhaust air

Cockpit heating system (hot air from engine)

3 watertight compartments

Onboard composting unit

Emergency beacon (EPIRB)

Radar, AIS, GPS

HF receiver, weather-FAX / NAVTEX

Handheld, station VHF radio

Two 1.5kW wind generators

200Wp solar panels

Two ice poles

Ice drill, saw, pick



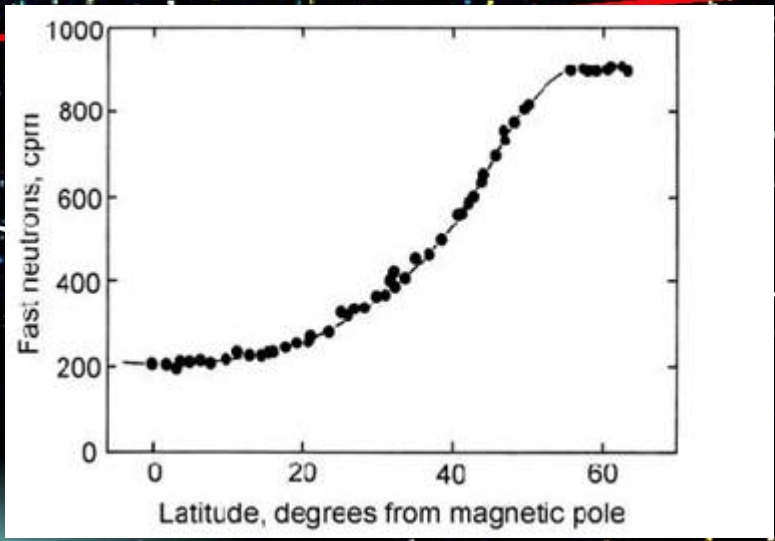
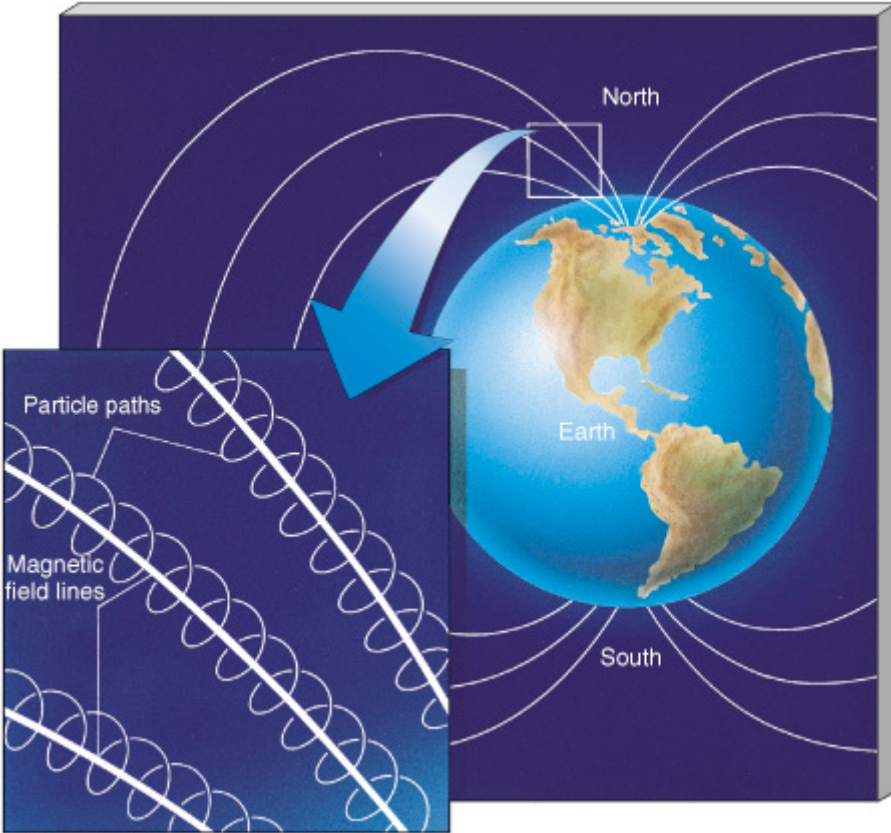
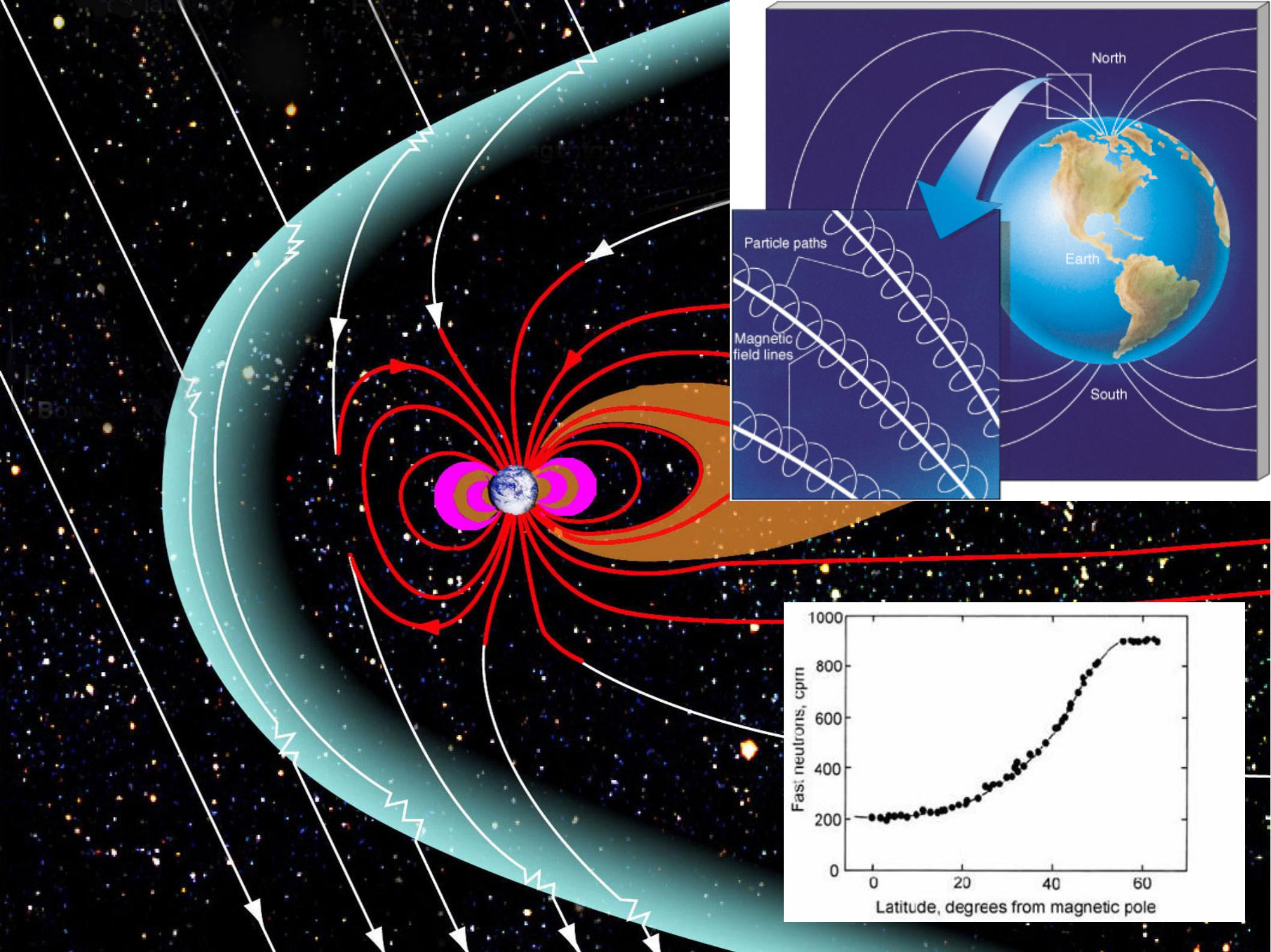
# The PolarQuEEEst mission

... Cosmic Rays, the Geomagnetic Field ...

... and the Earth Climate ...











Earth Magnetosphere is modified by solar wind

Earth Magnetic field lines

and

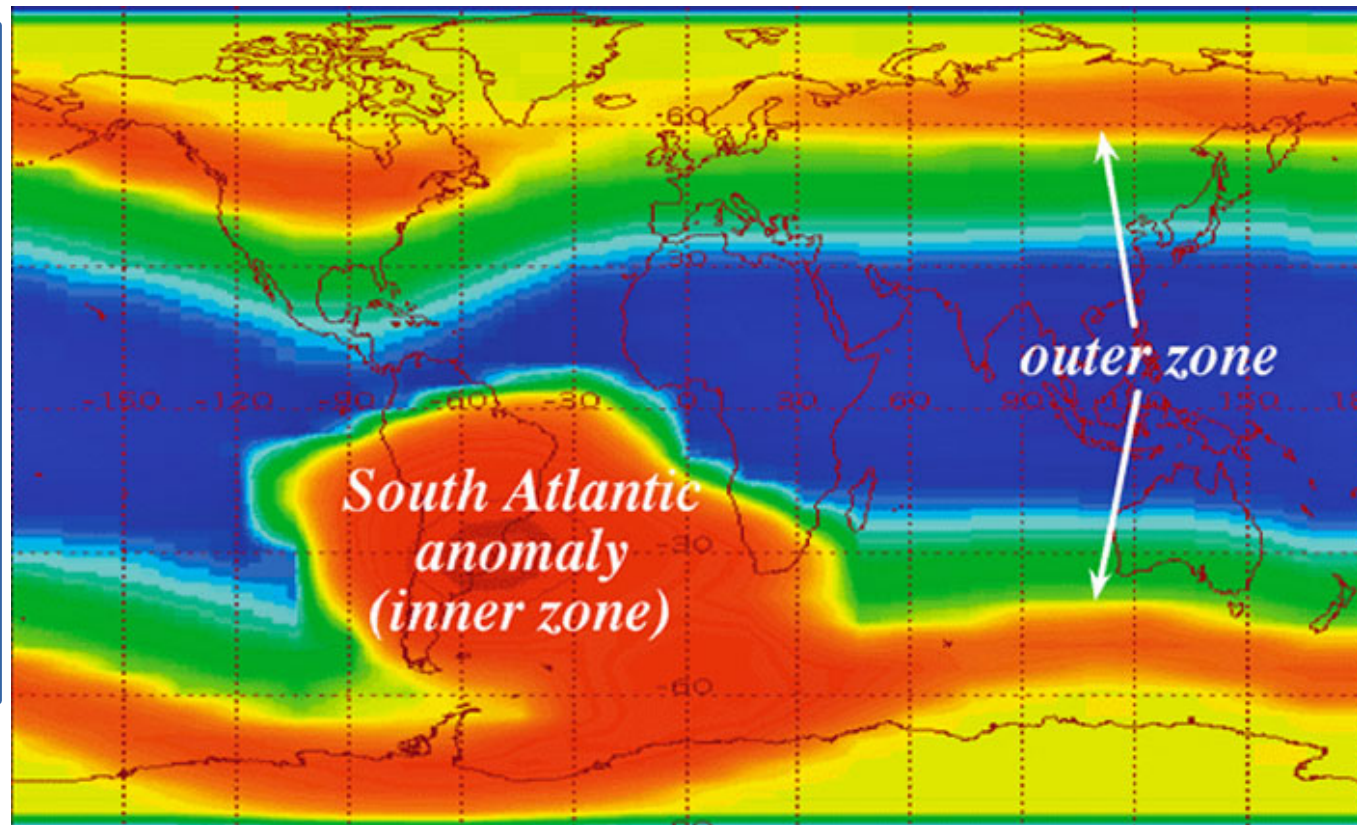
Interplanetary field

show a strong interplay

Geomagnetic field anomalies

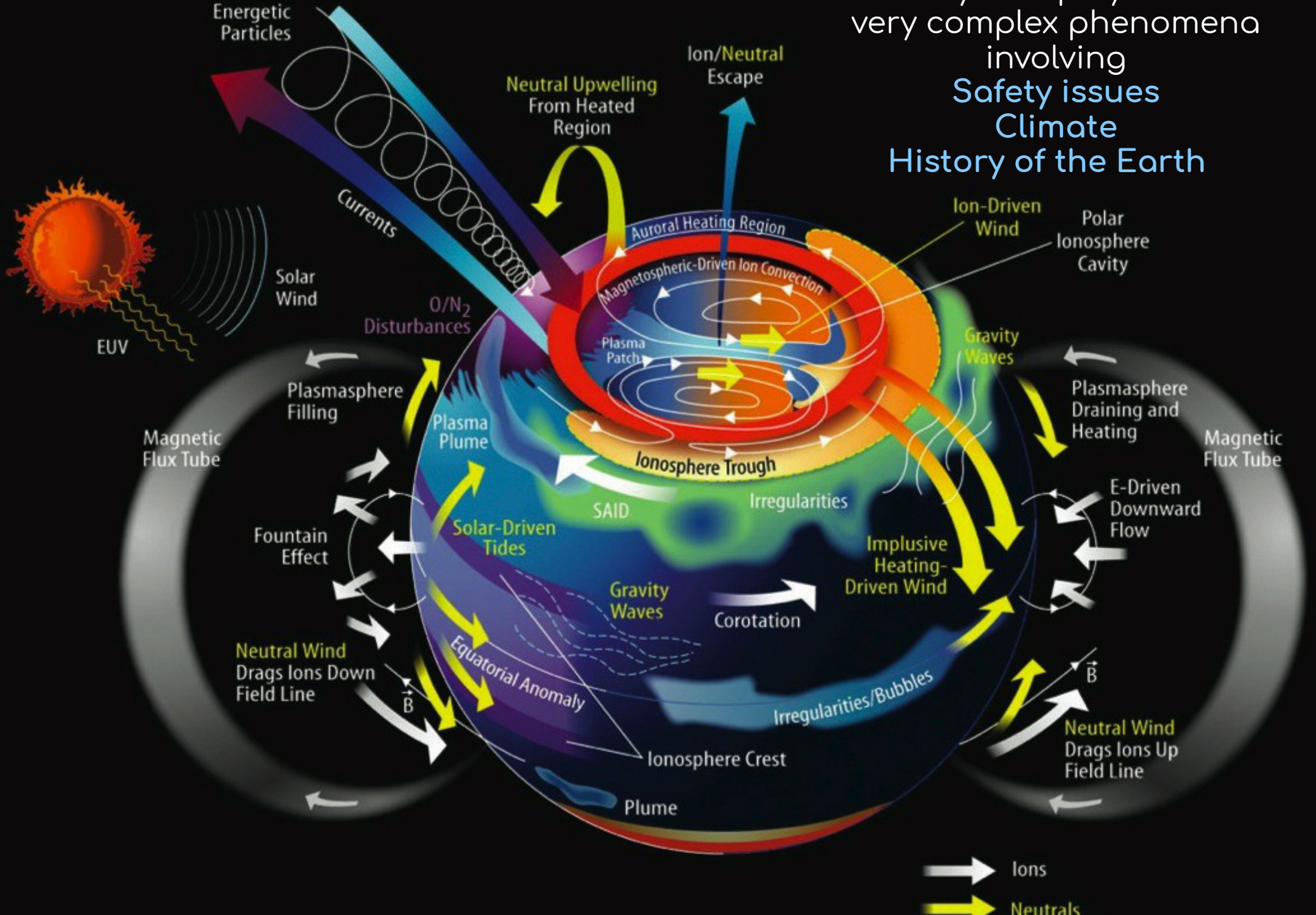
play  
fundamental role  
in  
cosmic rays flux on Earth

ISS, satellites and  
expeditions have to take it  
into account

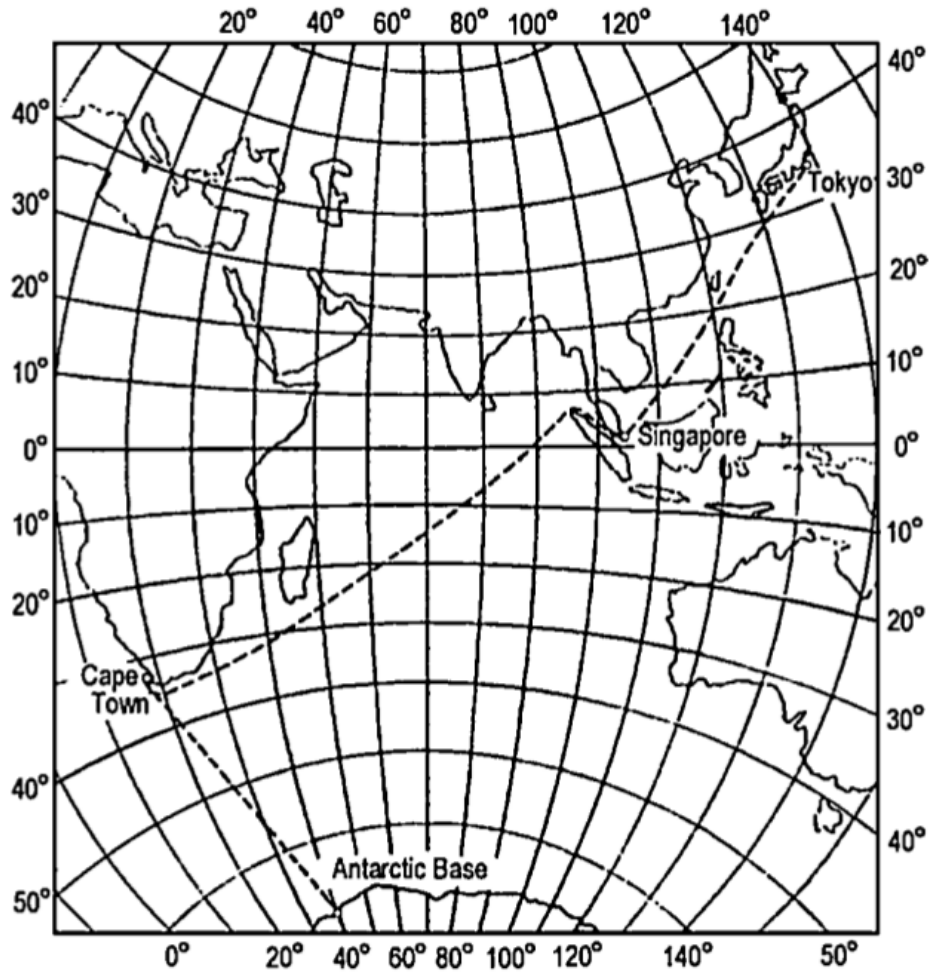




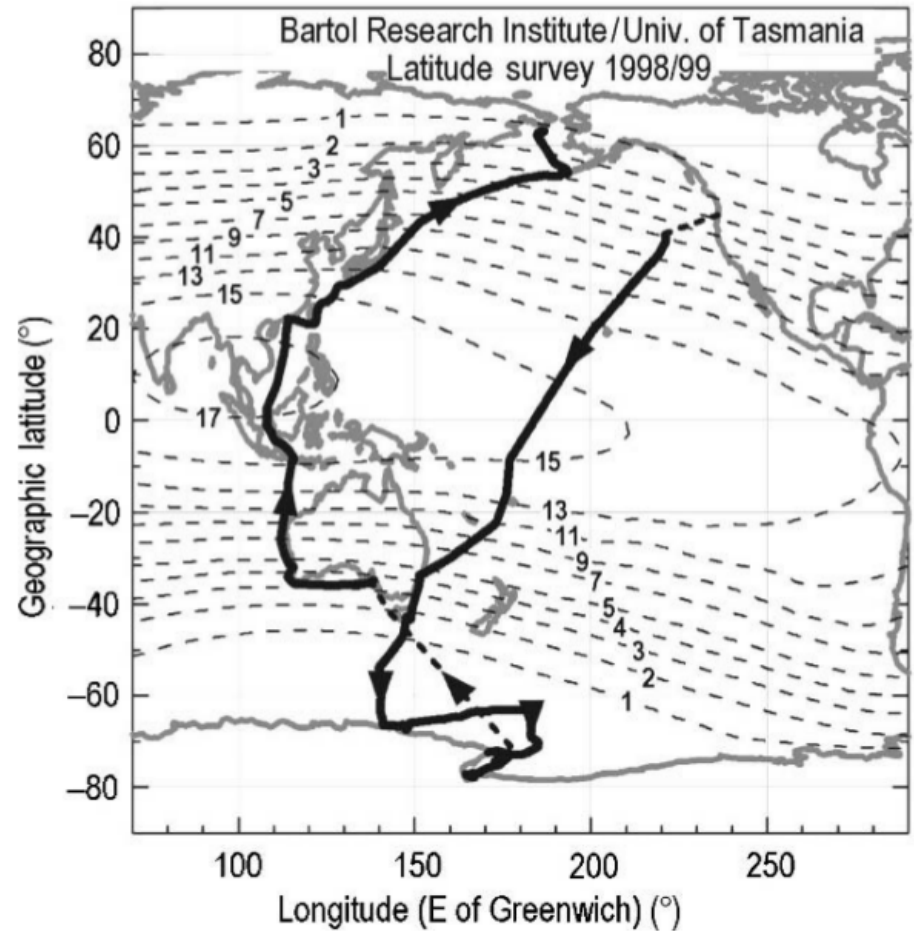
Magnetosphere and Cosmic ray interplay is a very complex phenomena involving  
Safety issues  
Climate  
History of the Earth



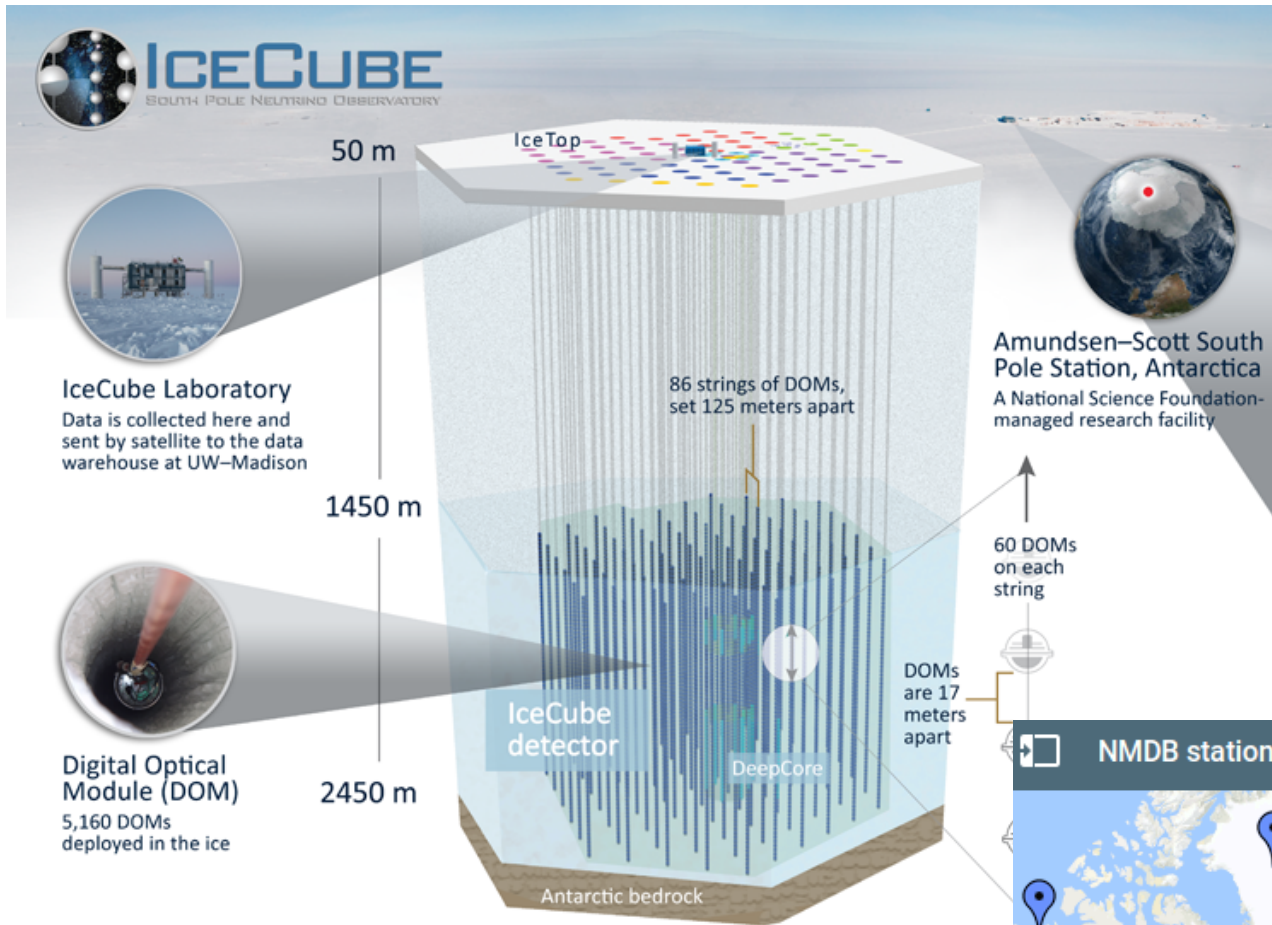
Polar Ship Survey, 1999



Soya Ship route, 1960







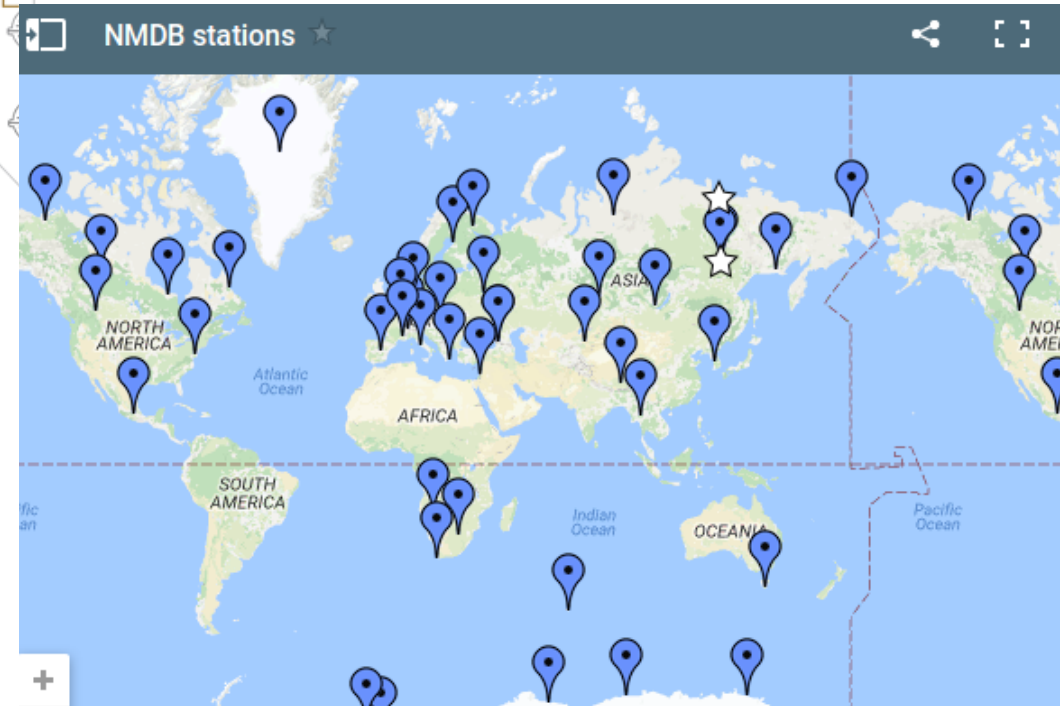
**IceCube Laboratory**  
Data is collected here and sent by satellite to the data warehouse at UW–Madison

**Digital Optical Module (DOM)**  
5,160 DOMs deployed in the ice

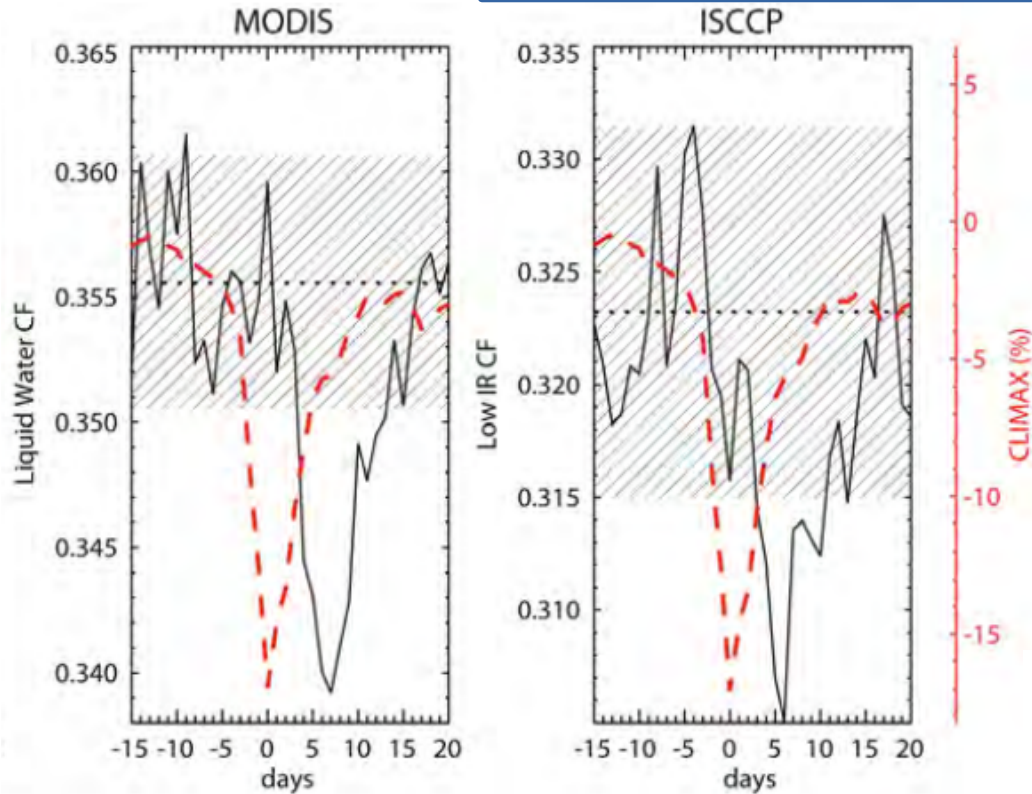
Neutron Monitor Network  
is the widest network  
for monitoring neutrons



Ice Cube Neutrino  
Observatory, Antarctica  
Muon Veto on Surface

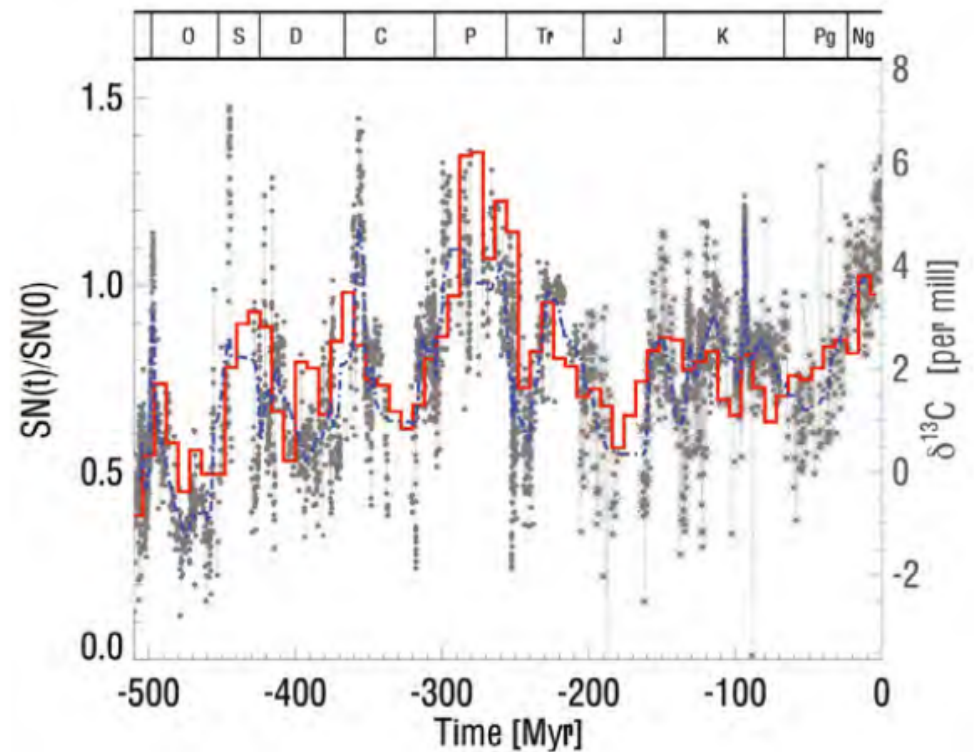


# Cosmic Rays, Life and Paleoclimate



Cosmic Rays and Life  
Bioactivity on Earth  
is correlated to  
CR flux modulation  
(here estimated with the  
expected local supernova rate  
During last 500 Myears)

Cosmic Rays and Clouds  
Condensation Nuclei density is  
influenced by CR flux  
Ref. To CLOUD @CERN





The PolarQuEEEst detector

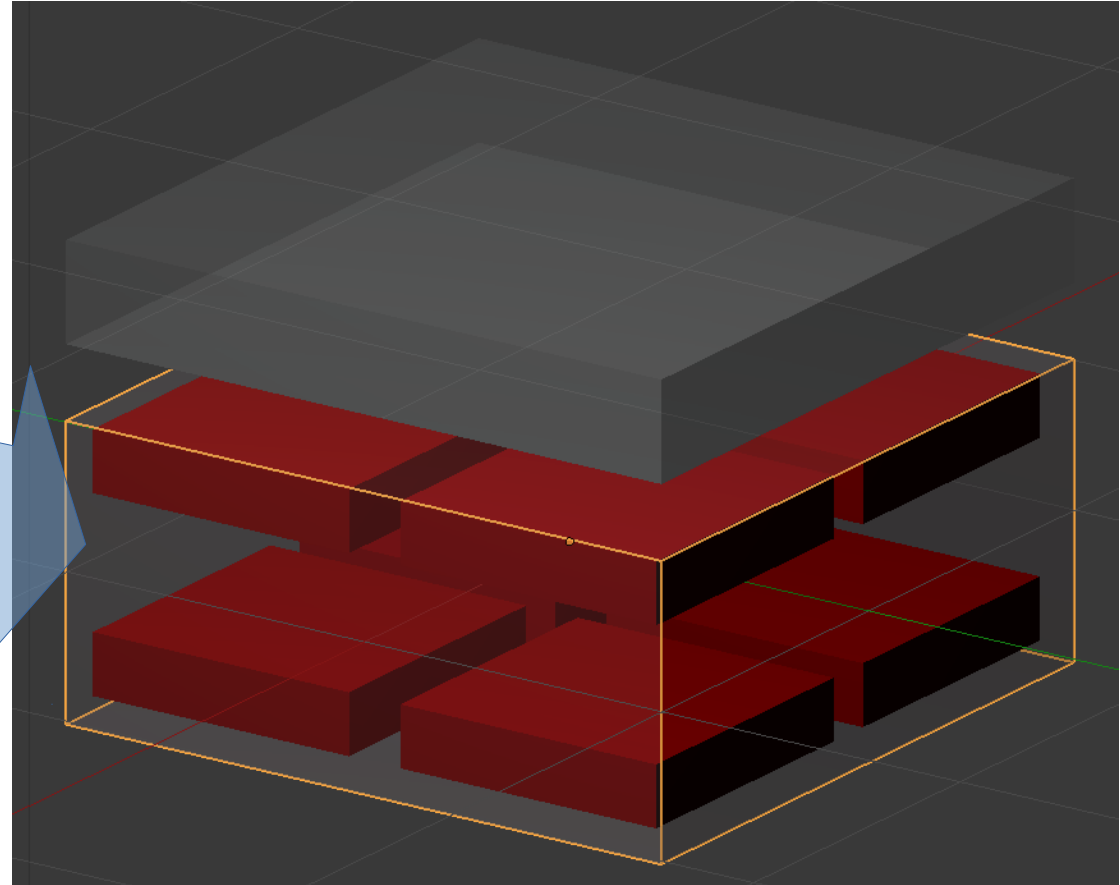
... an Extremely Compact Telescope ...

...full optional, anyway...

# The PolarQuEEEst Detector

## The detector case:

- Size 55X55X25 cm<sup>3</sup>
- Weight: 7 kg
- Shielding container:
  - Water tight / Air tight
  - Plexiglass or plastic + glass fiber
  - Atmosphere: Nitrogen
  - Light tight (black)
- Very low transmittance (<0.1 W/m<sup>2</sup>K) or transmittance adapted to electronics power absorption

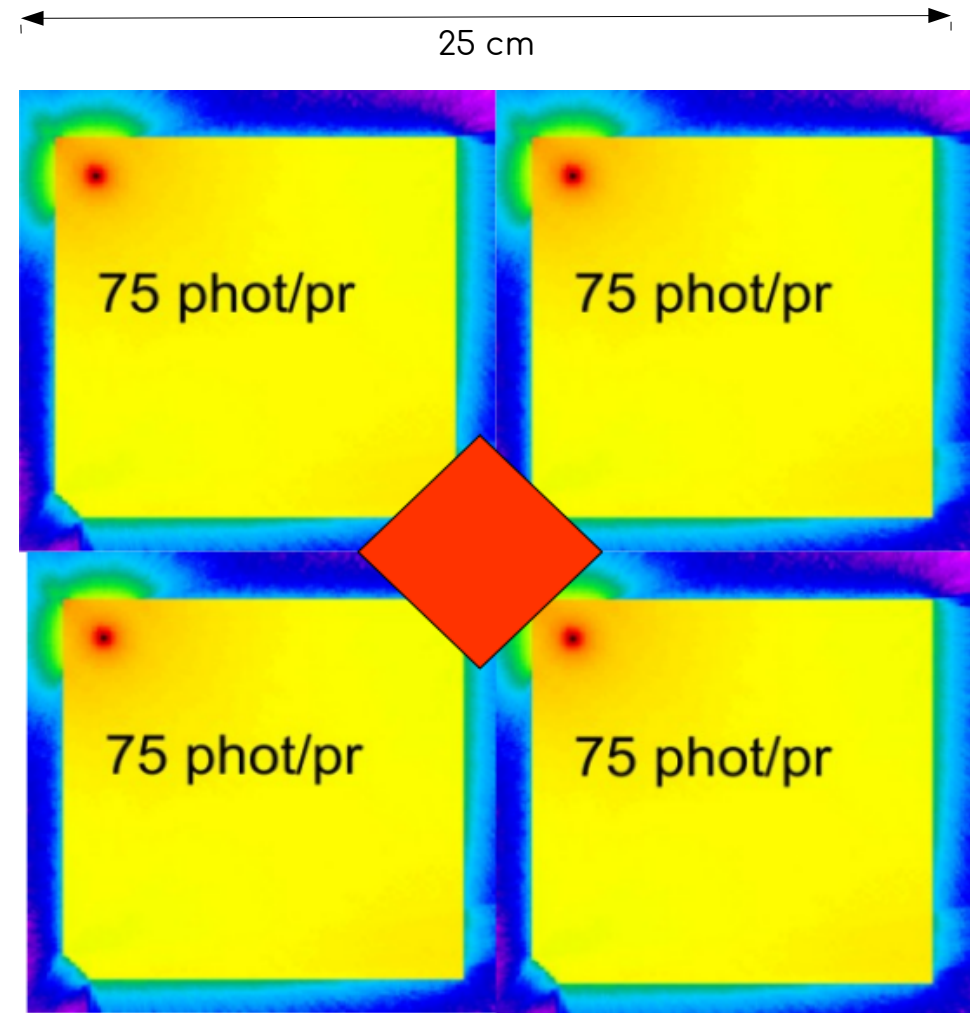




# The PolarQuEEEst Detector

## The detector

- 2 Detector Surface 50X50 cm
- Distance between planes: 22 cm
- 4 tiles per plane
- Each tile 2 SiPM
- Efficiency > 96% (overall)
- Trigger: AND among 2 planes
- Each plane: OR among 4 tiles
- Muon rate: 10-15 Hz
- Dark rate per 3 plane (4 tiles):  $3 \cdot 10^{-4}$  Hz
- S/N  $\sim 5 \cdot 10^4$

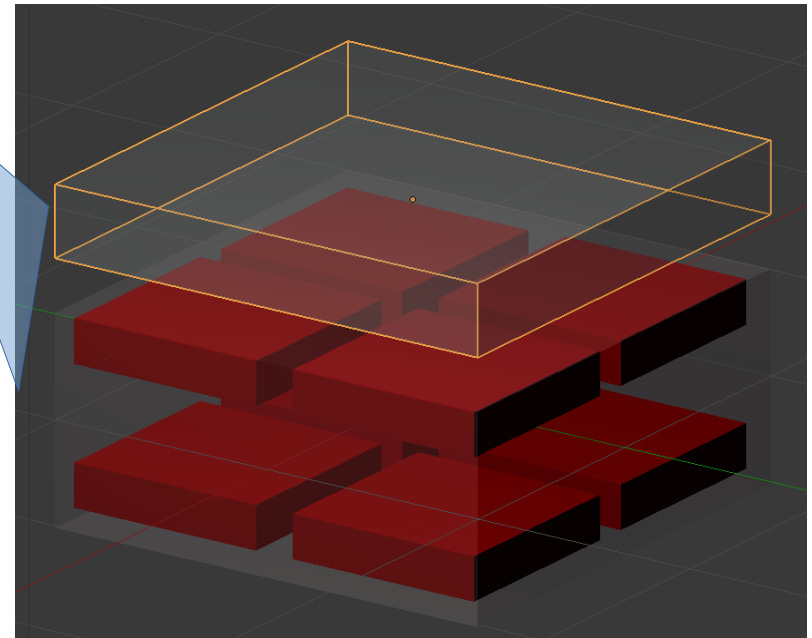
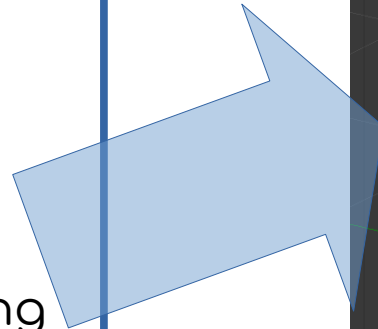


# The PolarQuEEEst Detector

The electronics case  
will contain

- Discriminators-digitalization
- Coincidence Unit
- P/T/U analog signal processing
- GPS engine
- SSD disk for data storage

Could be powered by a dedicated  
photovoltaic panel cabling



+ weather  
station  
(onboard or  
dedicated)

Prototype based on  
Raspberry Pi + GPS unit





The PolarQuest2018 route

... and a bit of History ...

...the Eskimo say :

'only time and ice are masters'...

2018, Beginning of July

Isafjordur, NW Iceland



2018, Half July



Kings Bay, NY-Alesund, Svalbard



The great Norwegian explorer **Roald Amundsen** and Lincoln Ellsworth flew in two Dornier Wal flying boats from Kings Bay, on the island of Spitsbergen in Norway's Svalbard Archipelago, to nearly **88°N**, a record farthest north by air.

On **May 11, 1926 Amundsen-Ellsworth-Nobile** expedition in the airship Norge flew from Kings Bay to Teller, Alaska by way of the **North Pole**.

The **Norge's designer and pilot, Italian Umberto Nobile in 1928**, returned to Kings Bay as sole leader of his own expedition in the airship Italia. **On May 25, 1928, the Italia crashed on the ice north-east of Spitsbergen** on the return from an attainment of the North Pole. The Italia carried a crew of 16.

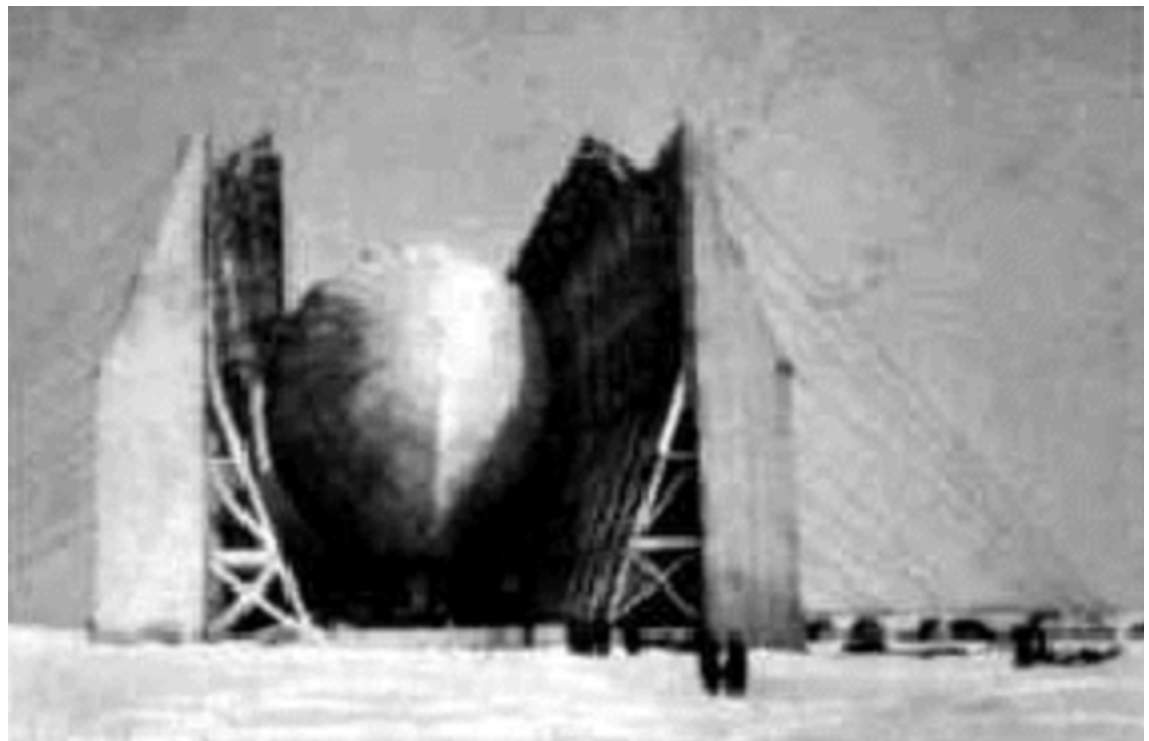
After the crash the Italia gained altitude again with 6 people onboard and was never found.

**Giuseppe Biagi, by sending SOS via Ondina 33**, the radio of the expedition, made possible the rescues.

**Survivors, Nobili was among them, used a red dye to paint red stripes on the tent** to make it more visible from the air and the site became known in the extensive press coverage as the Red Tent.

The rescue operations involved **Italy, France, Finland, Norway and URSS forces, till July 15<sup>th</sup>, and 9 among rescuers died.**

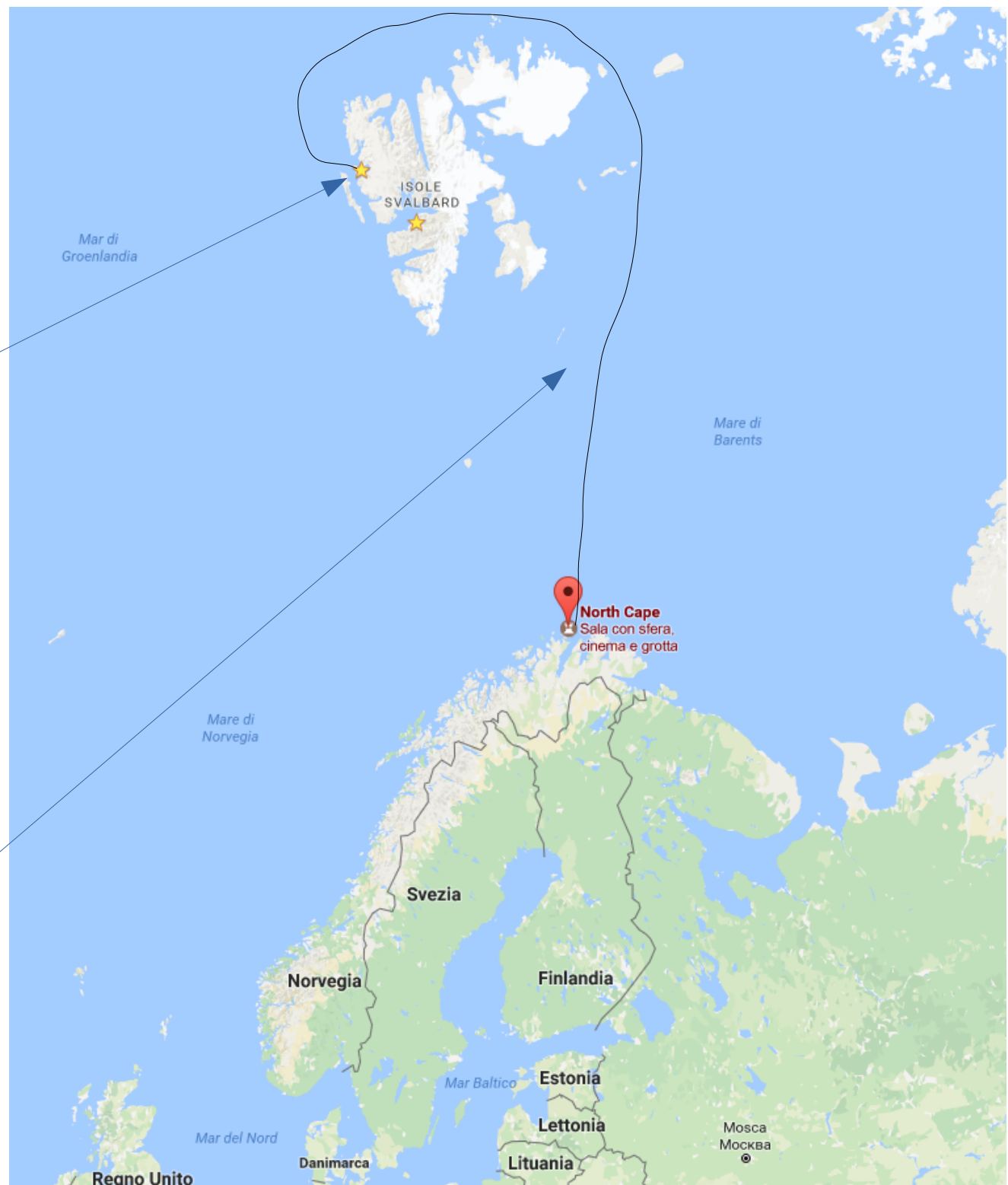
**Roald Amundsen generously died** while trying to rescue Nobili expedition survivors onboard of a Latham-47, disappeared and never found.



2018, by the  
end of August

Ny-Alesund will be the **base camp** while waiting for the best moment to take our chance to the **very north, as high as 81.2°** which is a distance of only **530 nautical miles** from the North Pole!

Then, if the weather is fine, we'll try a **circumnavigation of Svalbards** then straight to south, to Cape North.



# The PolarQuEEEst Network

## 3 PolarQuEEEst detector

1. onboard on Polar Nanuq

2. installed in a  
Norwegian High School

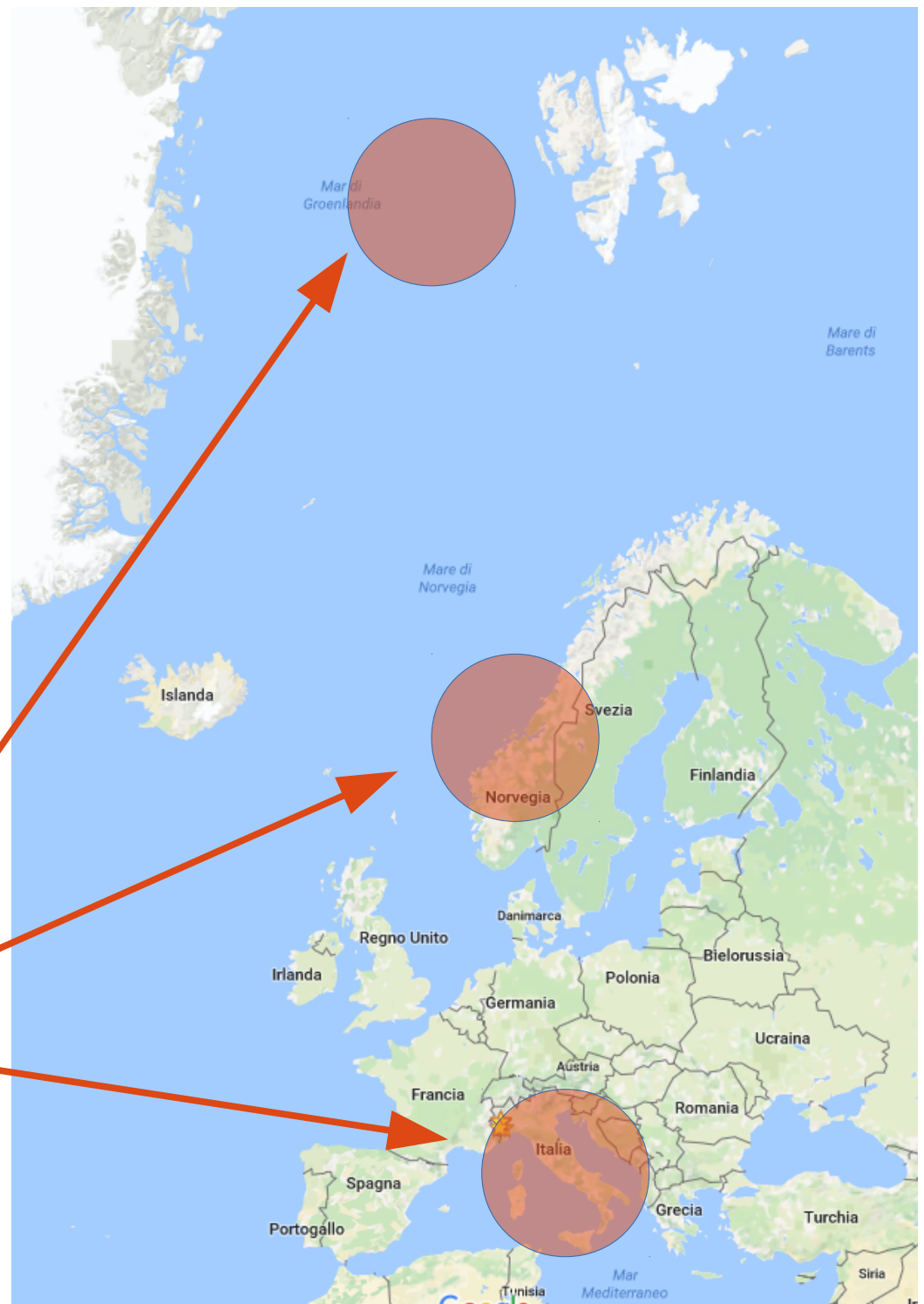
3. installed in an  
Italian High School

Both mounted by students as  
usual in EEE tradition

Almost

45° in latitude span

5000 km





...ready for the UnexpectEEEd?

