ARM
Atmospheric Radiation Measurement

The 2nd ARM Mobile Facility

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Timeline

- $4M to spend
- Workshop in June 06
- Specification to STEC for its Dec06 meeting
- Call for proposals among DOE labs in 2007
- Construction in FY2008 (or earlier)

Our idea: a marine-oriented AMF

- Oceans vastly undersampled vis a vis clouds & rad'n
- Ocean observing systems (Argo floats, ...) undergoing major upgrade
- I predict oceans will take more center stage as peculiarities of global change become apparent
- 1st AMF has gotten ship & island proposals already, but none have been accomplished
- Nauru : we learned about island effects
  - with planning, they can be overcome!

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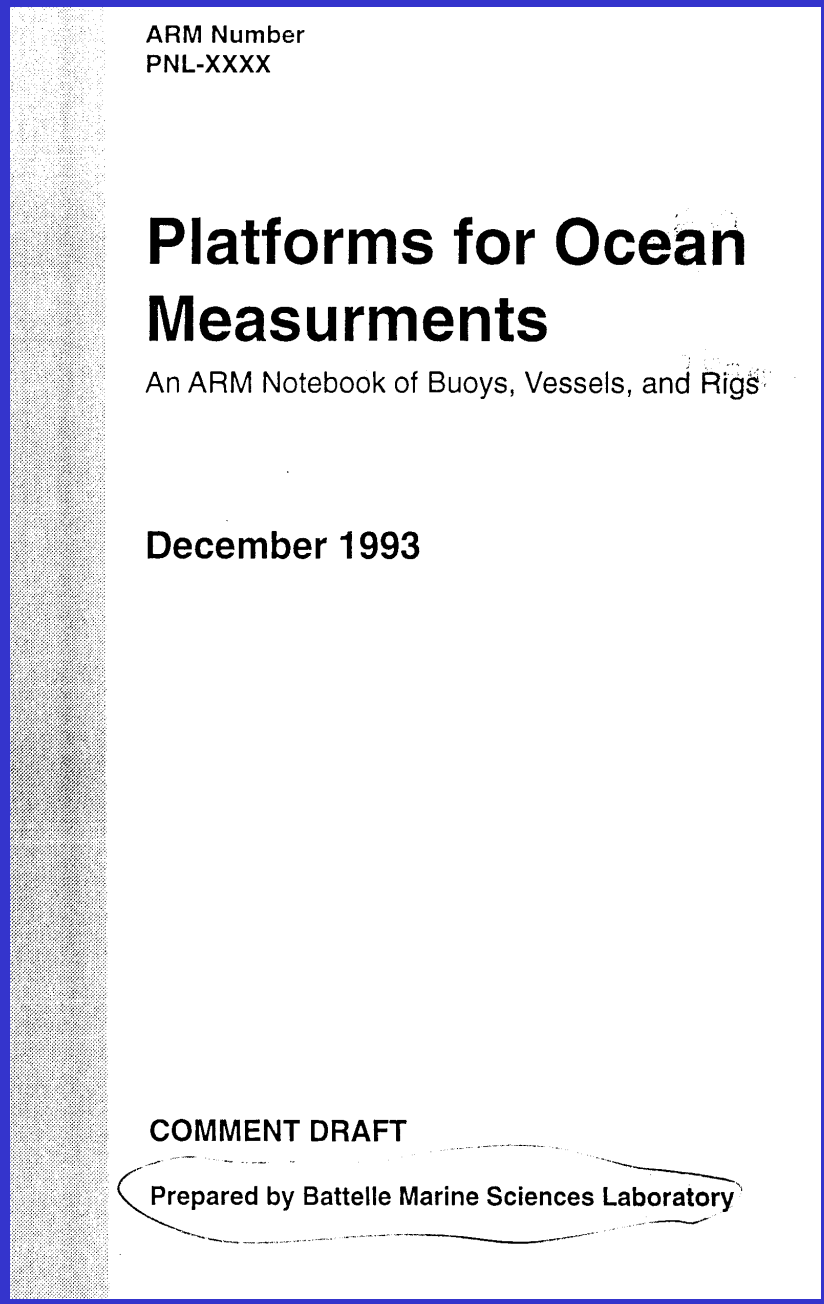
ARM has thought about this before



ARM Number
PNL-XXXX

Platforms for Ocean Measurments

An ARM Notebook of Buoys, Vessels, and Rigs

December 1993

COMMENT DRAFT

Prepared by Battelle Marine Sciences Laboratory

Marine science/modeling goals

- marine low cloud remains single most poorly understood cloud, and most poorly simulated
- radiation closure in a simpler environment
  - sea surface simpler and easier to model than land
- fate of dust & pollution plumes over oceans
- sea-ice/cloud environment
- less polluted, or unpolluted, clouds (eg Antarctic)

Ocean & land have very different diurnal cycles (here, extreme storms)

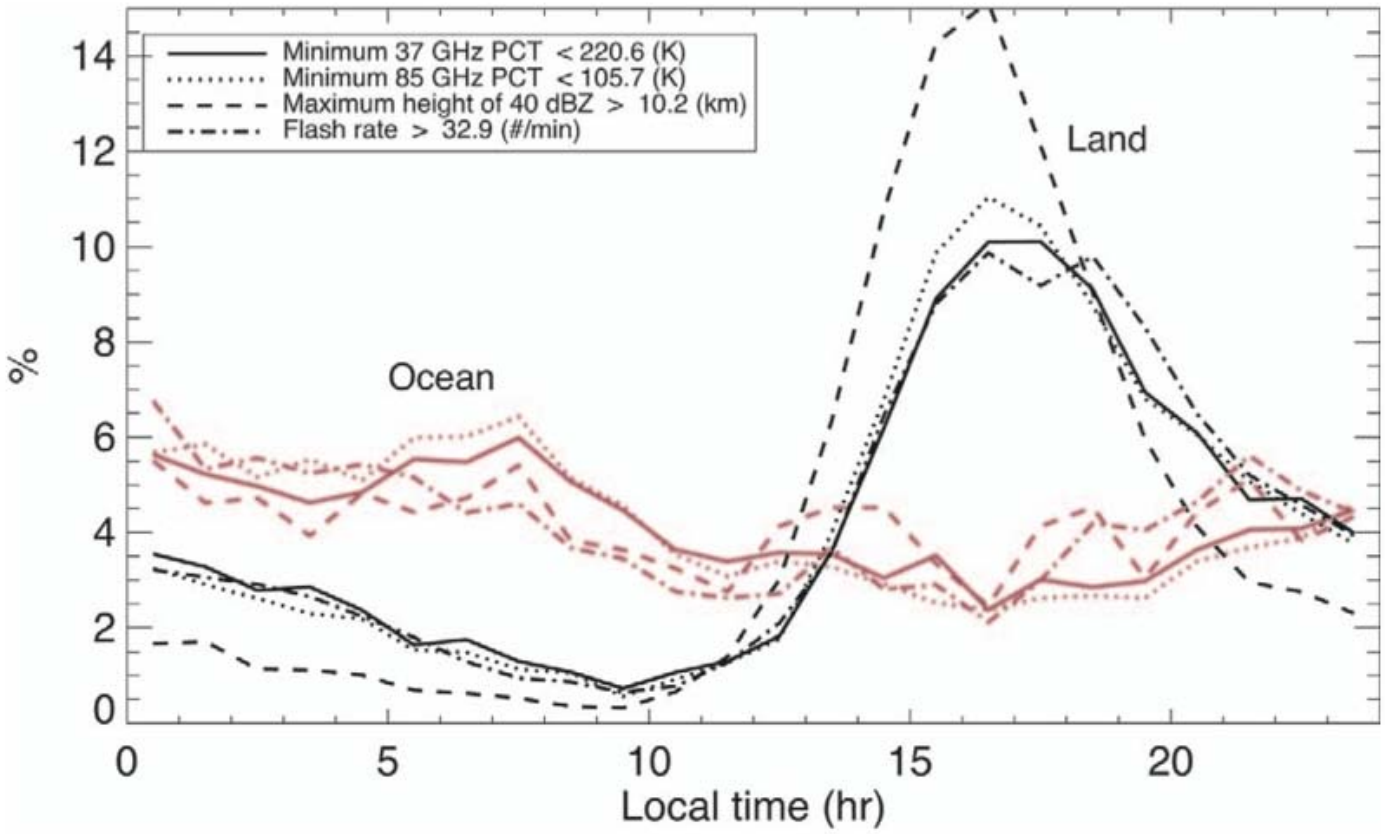


FIG. 5. Diurnal cycle of the three most extreme categories (top 0.1%; Figs. 2 and 3) for each parameter separated by land and ocean PFs. There are not enough extreme events over oceans to use only the top two categories.

Source: Zipser, BAMS, Aug 2006

How to go marine?

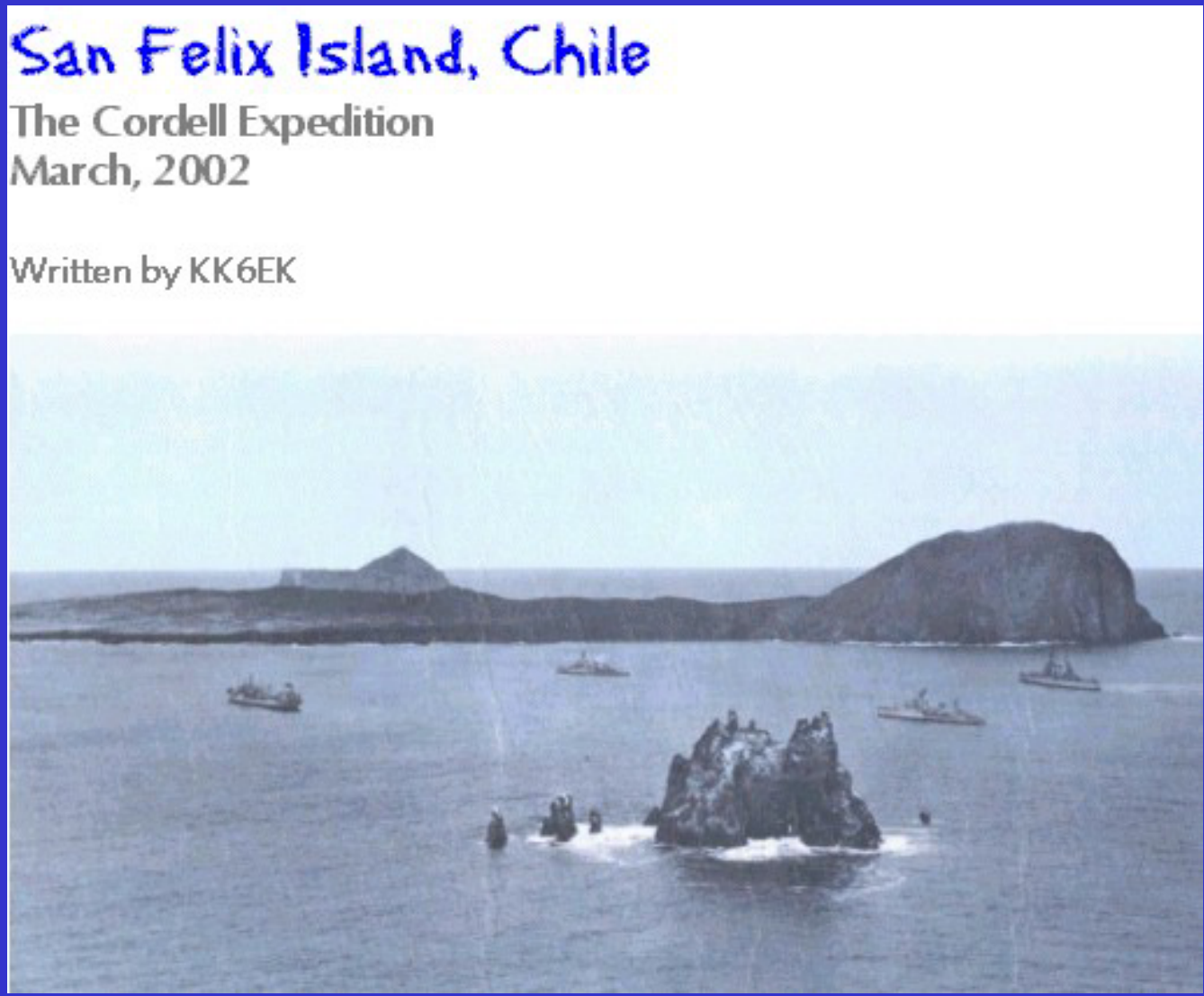
Crawl before walking

- Islands
- Off-shore platforms
- BIG ships with regular routes
  - Container ships
  - Oil tankers
- Moored ships
- Icebreakers
- Partial ship, partial island deployments?

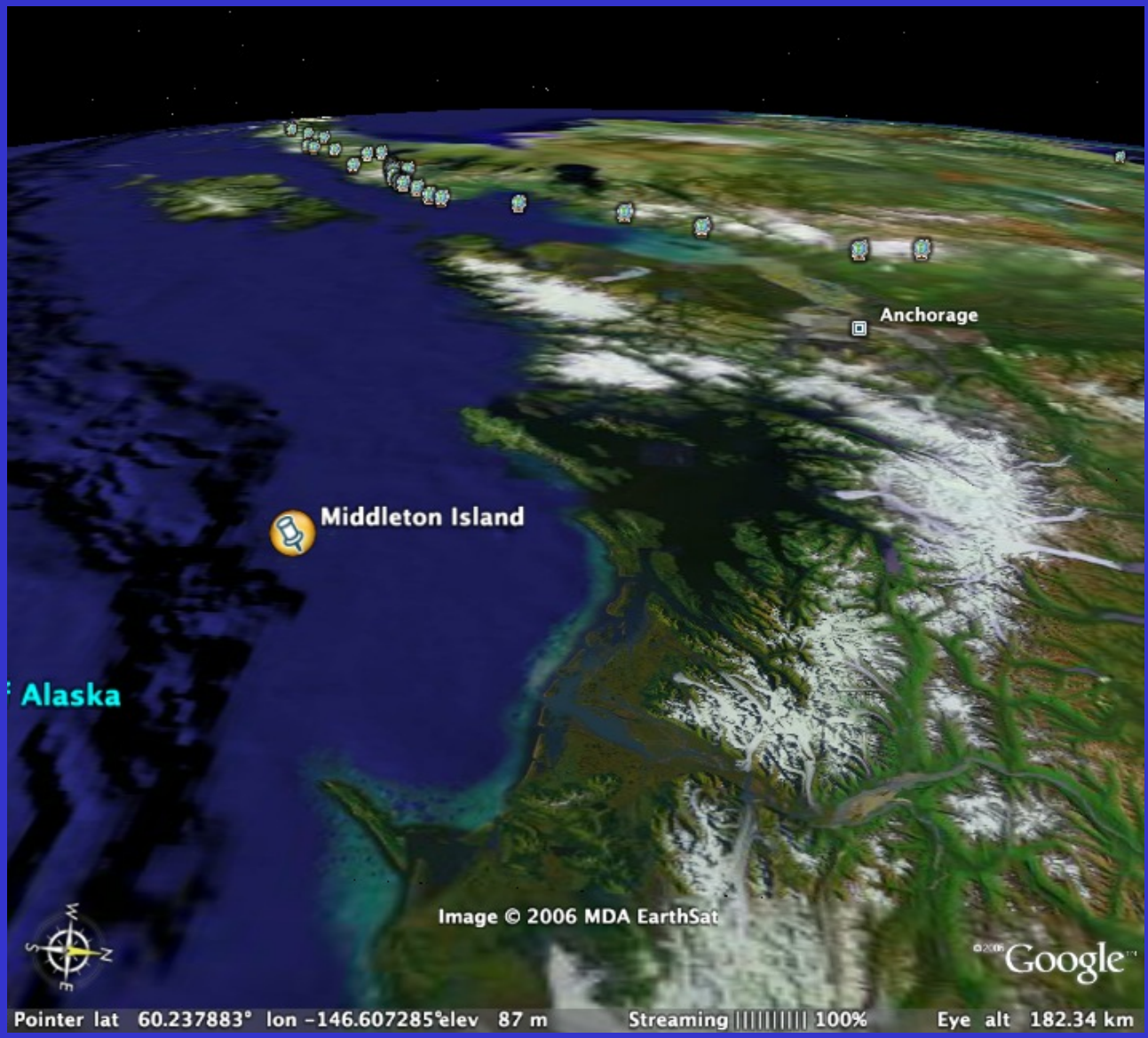
Remote Islands – Lighthouses

Destruction Island, WA

Remote Islands – San Felix, Chile



Remote Islands – Gulf of Alaska



Middleton has a NOAA radar

Remote Islands – Antarctica
Dumont D'Urville

Remote Islands – Antarctica
King George

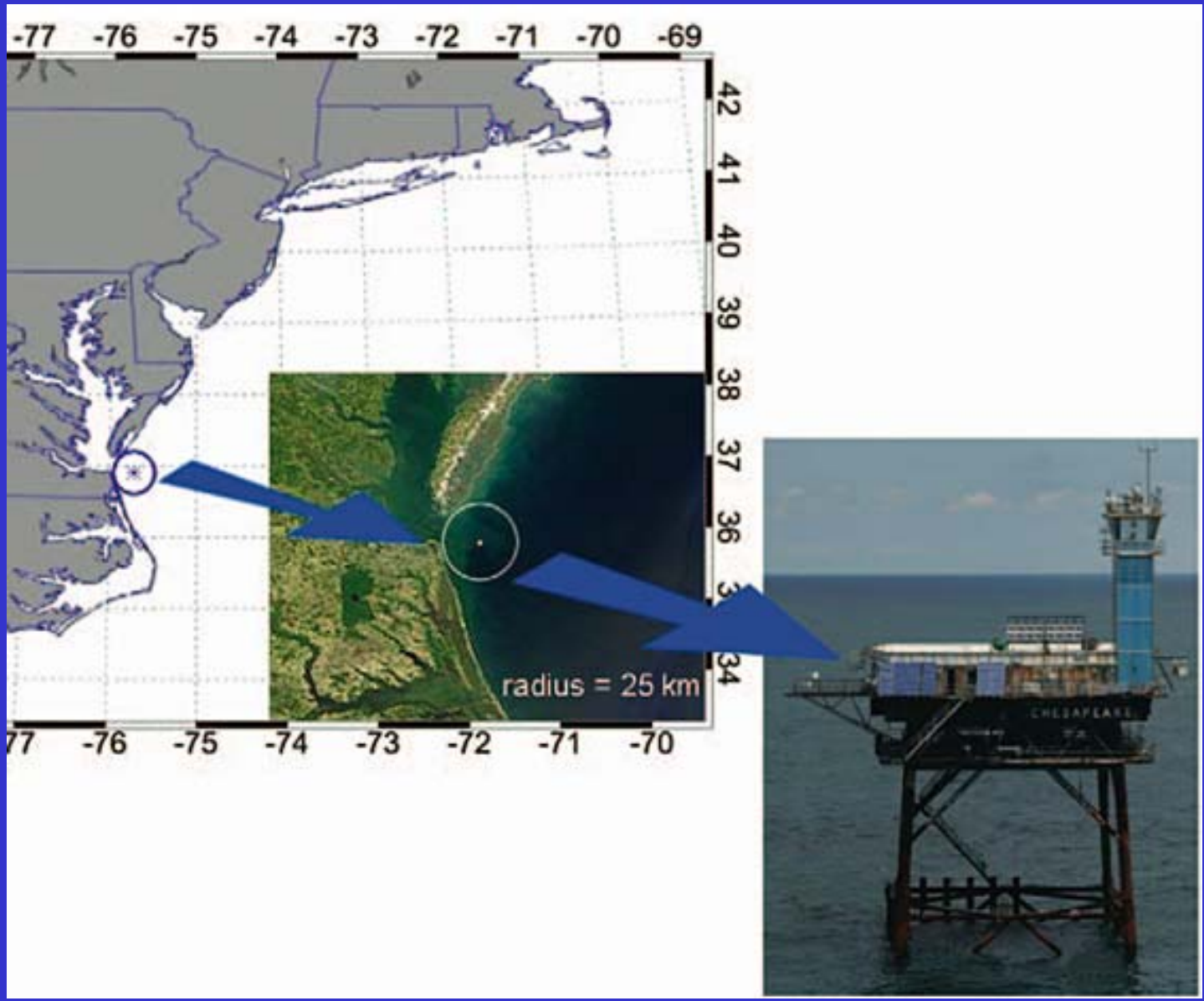
Teniente March research station on King George Island in Antarctica has the only semi-commercial airfield connecting to South America.

Coastal Platforms

Chesapeake Lighthouse (COVE)

SW Pass, Louisiana

Platform example — COVE



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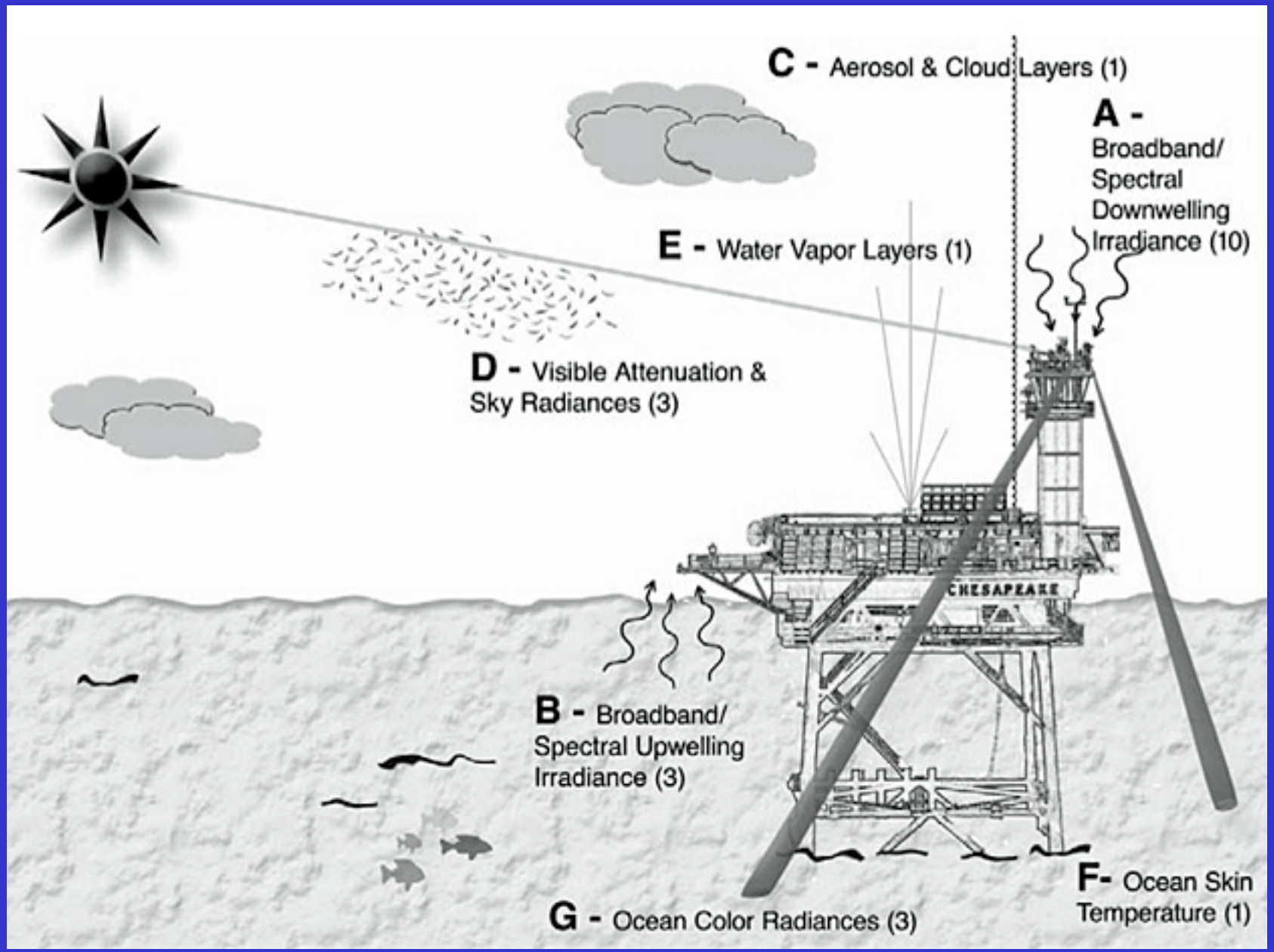
COVE — variables measured



COVE — cloud fraction by month

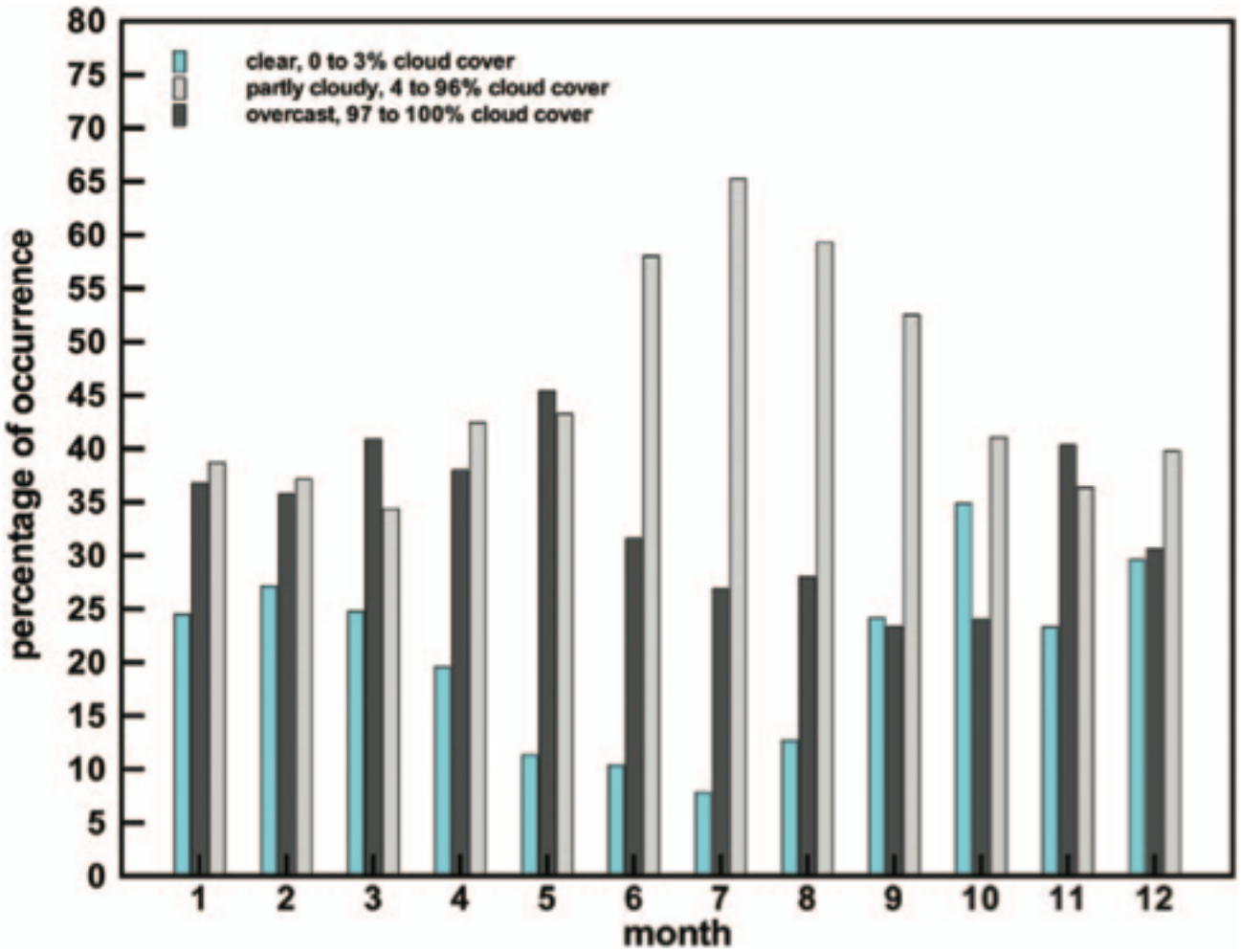


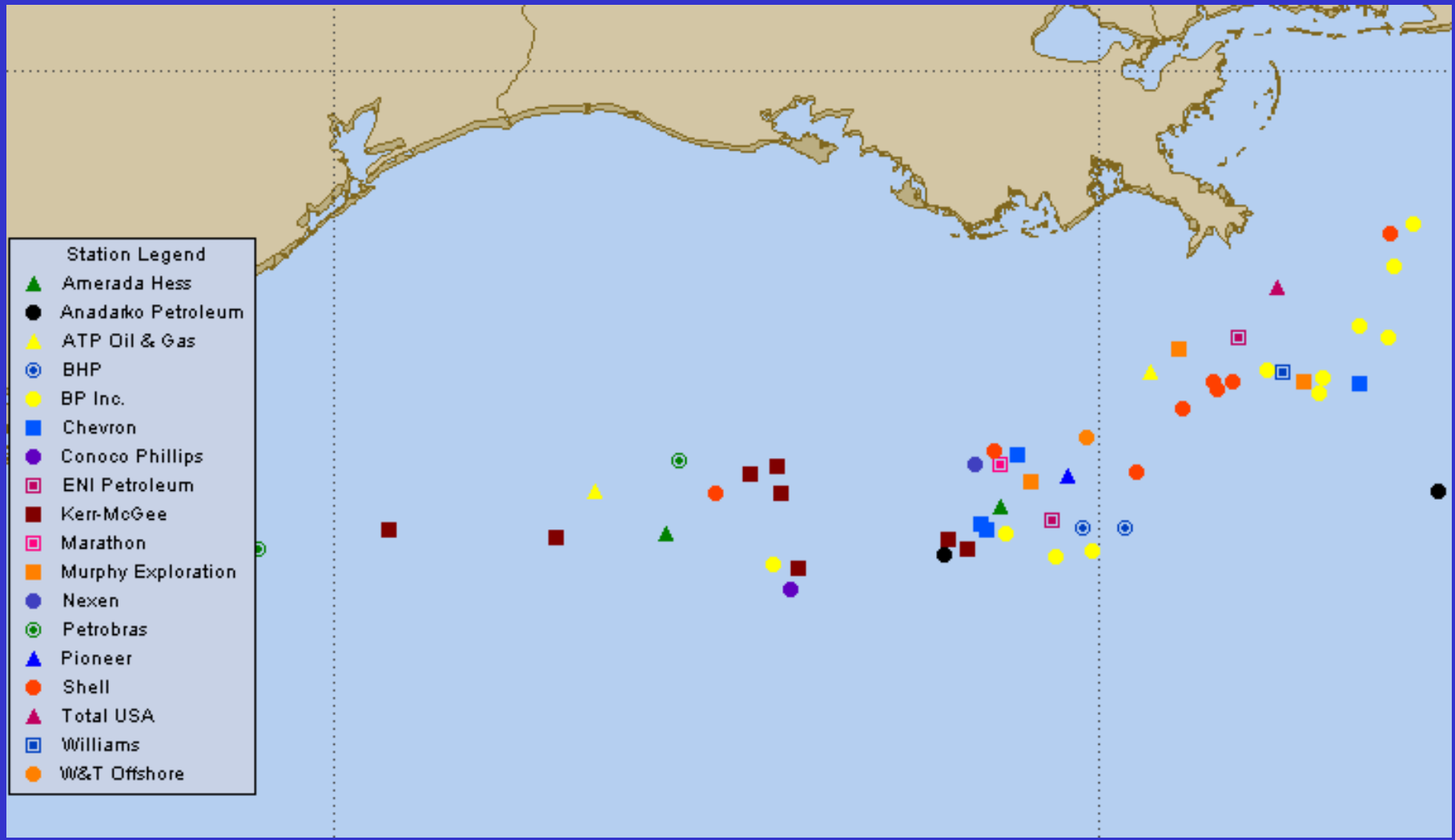
FIG. 5. Monthly cloud coverage (based on Long and Ackerman 2000) derived from radiation observations made at the COVE site. Clear, partly cloudy, and overcast conditions are based upon 15-min radiation observations. Daytime only.

Oil Platforms

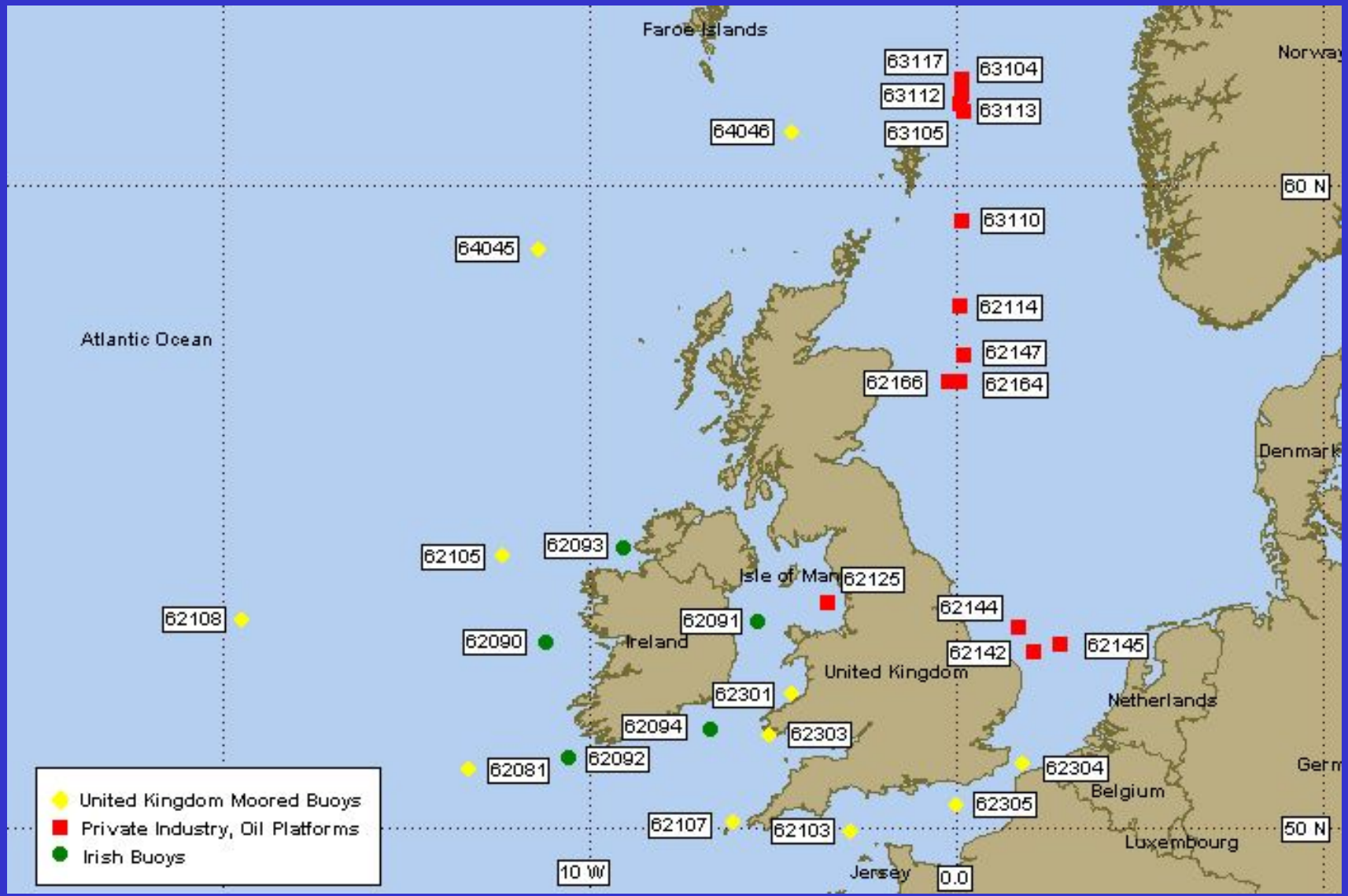
Current platforms range from shallow (<100 ft) to deep water (~1000 ft).

There are plans for floating platforms in up to 5000 feet of water

Gulf Oil Platforms - detail, Louisiana



Oil Platforms - North Sea



To-be-decommissioned oil platforms off Calif. are in 300–700' of water

Their fate is currently being debated.

13 such platforms in Calif. "Rigs to Reef" initiative (from Vandenberg to Long Beach)

Ships have carried big research seatainers

Foreground: wind profiler

Background: lidar, radar

Major Difficulties

- Salt corrosion
- Pounding in heavy seas
- Accessibility (for repairs, maintenance, ...)
- Personnel happiness on long deployments
- Building robust seatainers, instruments, ...
- Cloud models lack good forcing datasets over oceans, esp. far from sonde sites and land radars

Major Difficulties — Ships

- Research cruises go to places that are interesting oceanographically but maybe not cloud-wise
- Biases: fair-weather, standard routes, …
- No diurnal cycle, unless moored
- ARM can't pay for ship ($10-20K/day)
- A big scanning radar might not fit
- Rocking and rolling platform
- Space constraints

Possible new instruments

- Shortwave spectrometer
- Raman lidar (commercial?)
- High-spectral resolution lidar
- Scanning radar (phased array for speed?)
- Scanning microwave with many wavelengths (perhaps co-scanning with radar)
- Scanning passive VIS and IR
- Scanning Doppler wind lidar

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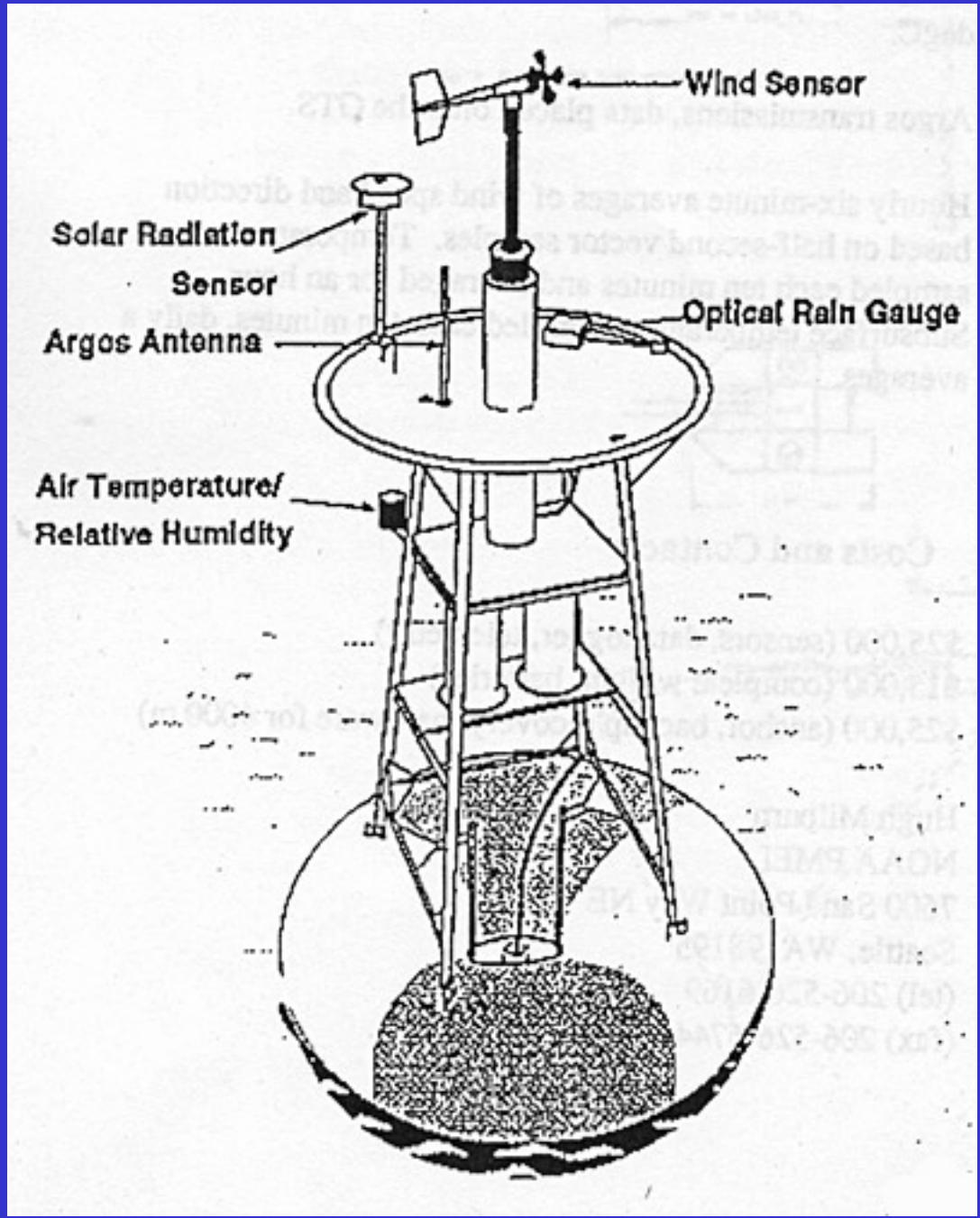
Buoys as the new Extended Facilities



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Summary

- World focus on oceans is growing
- A marine AMF would be scientifically attractive, esp. to modelers
- Past marine datasets have gotten heavy use
- It would move ARM away from a land-only bias
- Go to islands & platforms, ships later
- Creating forcing datasets for models is more problematical than over land
- There are many other difficulties … but ARM has always faced difficulties and surmounted them!