OPTICAL AND ANCILLARY MEASUREMENTS AT HIGH LATITUDES IN SUPPORT OF THE MODIS OCEAN VALIDATION PROGRAM

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MAJOR RESULTS

data base from in-situ measurements in the Greenland and Norwegian Seas

qantification of the accuracy of atmospheric correction and in-water Case 1 and Case algorithms and data products

proposal of improvements to the MODIS algorithms for the investigated region

OTHER MEASUREMENTS AND OBSERVATIONS

Concentration and size distribution of gas bubbles

Sea surface state and whitecap coverage

Wind horizontal velocity

Air temperarture and relative humidity

Atmospheric pressure

Total aerosol and sea salt particle concentration and size distribution

Sky state photographs

Sea ice conditions

Water Temperature and conductivity profiles

Horizontal current components

WATER SAMPLE ANALYSES

ap (λ)	**Particulate absorption spectrum**
ad (λ)	**Detrital particle absorption spectrum**
ag (λ)	**Colored dissolved absorption spectrum**

Discrete phytoplankton pigments

Total suspended matter

Particulate organic carbon

Dissolved organic carbon

Particle size distribution

Phytoplankton taxonomy

OPTICAL MEASUREMENTS

Ed (0+, λ) Incident spectral downwelling irradiance

Lu (0+, λ) Above-water spectral upwelling radiance

Lsky	**Spectral sky radiance**
ts (λ)	**Spectral solar atmospheric transmission**
Ed (z, λ)	**En-water spectral downwelling irradiance**
Lu (z, λ)	**In-water spectral upwelling radiance**
Eu (z, λ)	**In-water spectral upwelling irradiance**
PAR(z)	**Photosynthetically available scalar irradiance (400-700 nm)**
a (z, λ)	**Spectral absorption coefficient**
c (z, λ)	**Spectral beam attenuation coefficient**
bb (z, λ)	**Spectral backscattering coefficient**
c(z,660)	**Red beam attenuation at 660 nm**
c(z,488)	**Blue beam attenuation at 488 nm**
Chl-fl (z)	**Chlorophyll fluorescence**

(a) July 10, 1979

(b) June 28-30, 1980

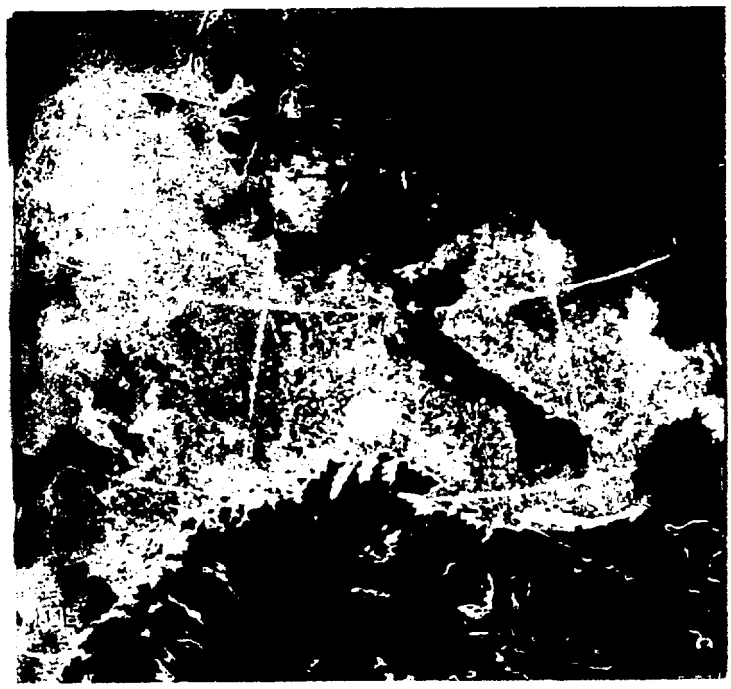
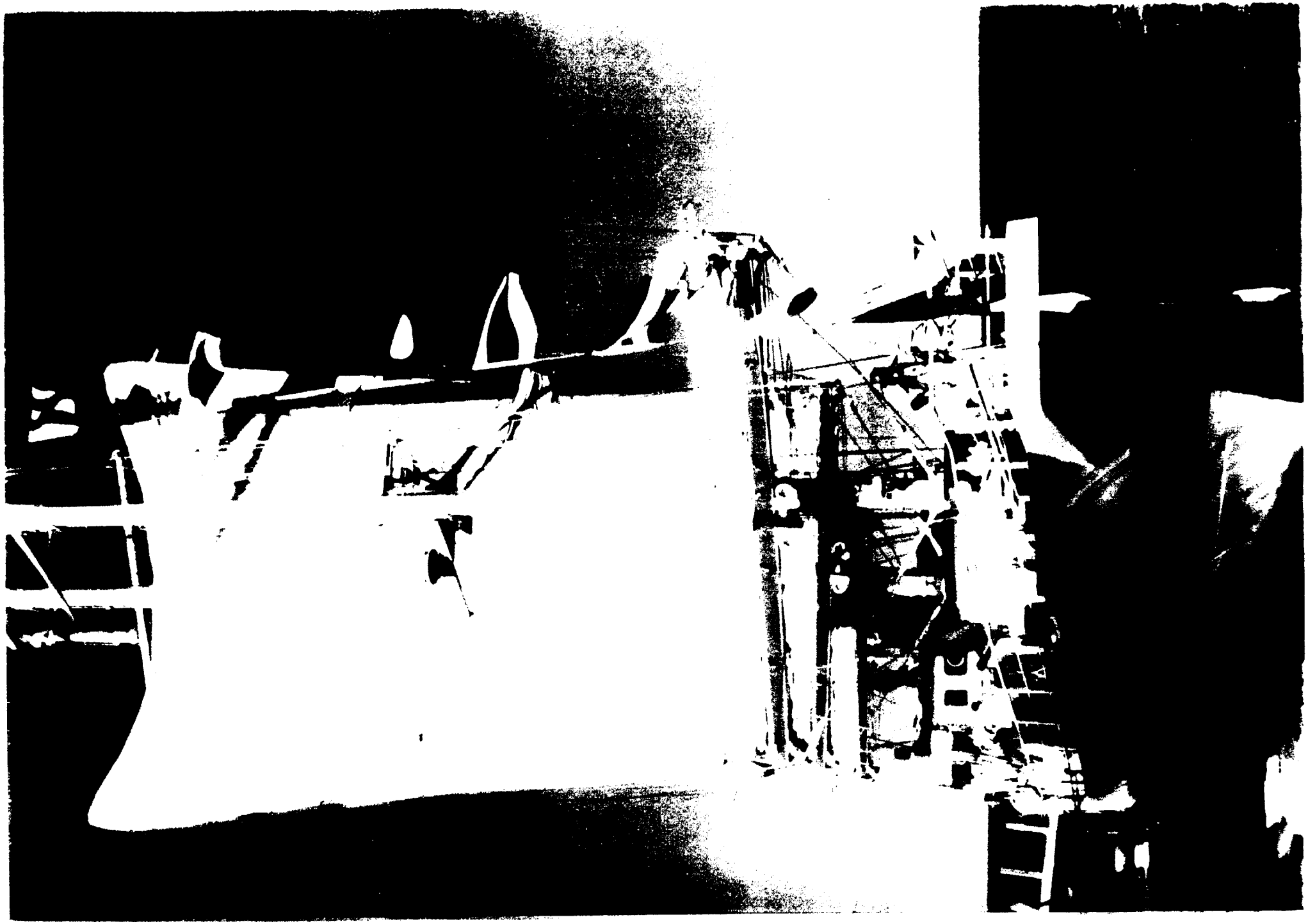
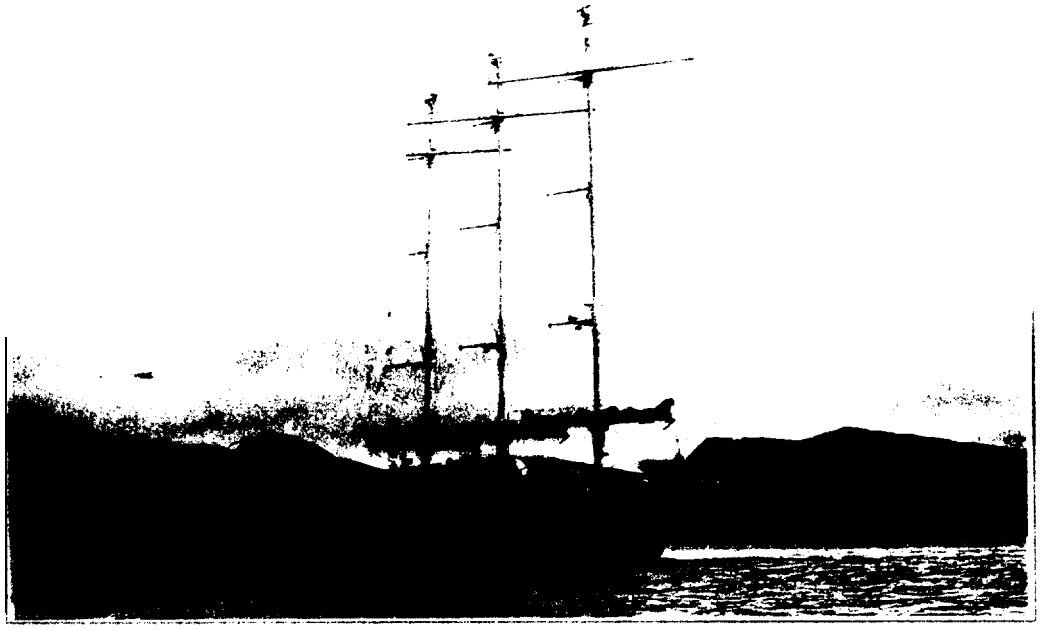


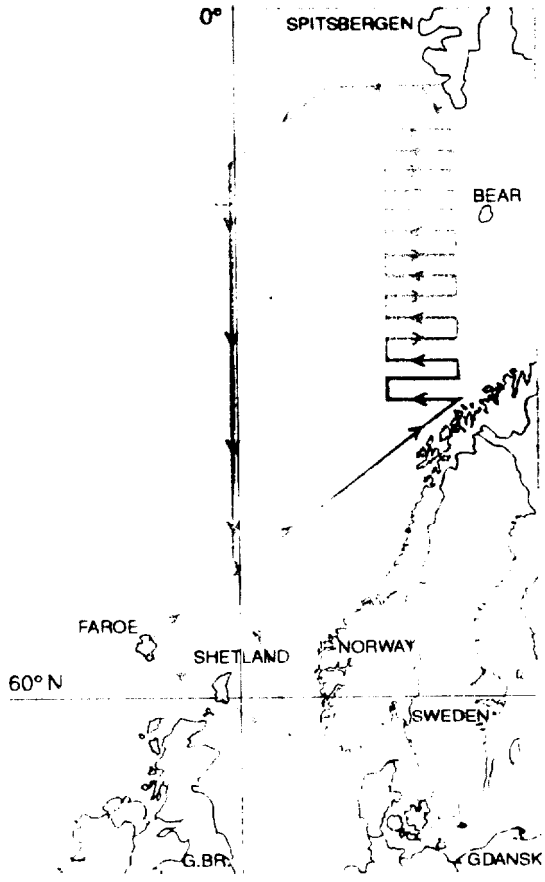
Figure 2. CZCS imagery of the Barents, Norwegian, and Greenland Seas (from Mitchell et al. 1992). As indicated panel (a) is for July 10, 1979 and panel (b) for June 28-30, 1980. Although the image is for early summer each year, significant interannual variability is evident. A land mask is indicated by the white borders; a cloud/ice algorithm generated a mask resulting in extensive regions that are obscured in the imagery.





RESEARCH VESSEL **"OCEANIA"**

displacment - 370 T
lenght - 48,93 m
breadth - 8,99 m
draught - 3,80 m
sails - 700 m²
engine - 310 HP
unlimited cruising range
2 months endurance
ecological clean
14 person scientific crew



Oceania

SPECIFIC OBJECTIVES

- **conduct optical and ancillary measurements in the Greenland and Norwegian Seas**

- **quantify errors in MODIS-derived water-leaving radiance, Case 1, and Case 2 algorithm products**

- **develop understanding of the error budgets in Case 1 and Case 2 bio-optical algorithms (effects of particles, dissolved matter, submerged bubbles)**

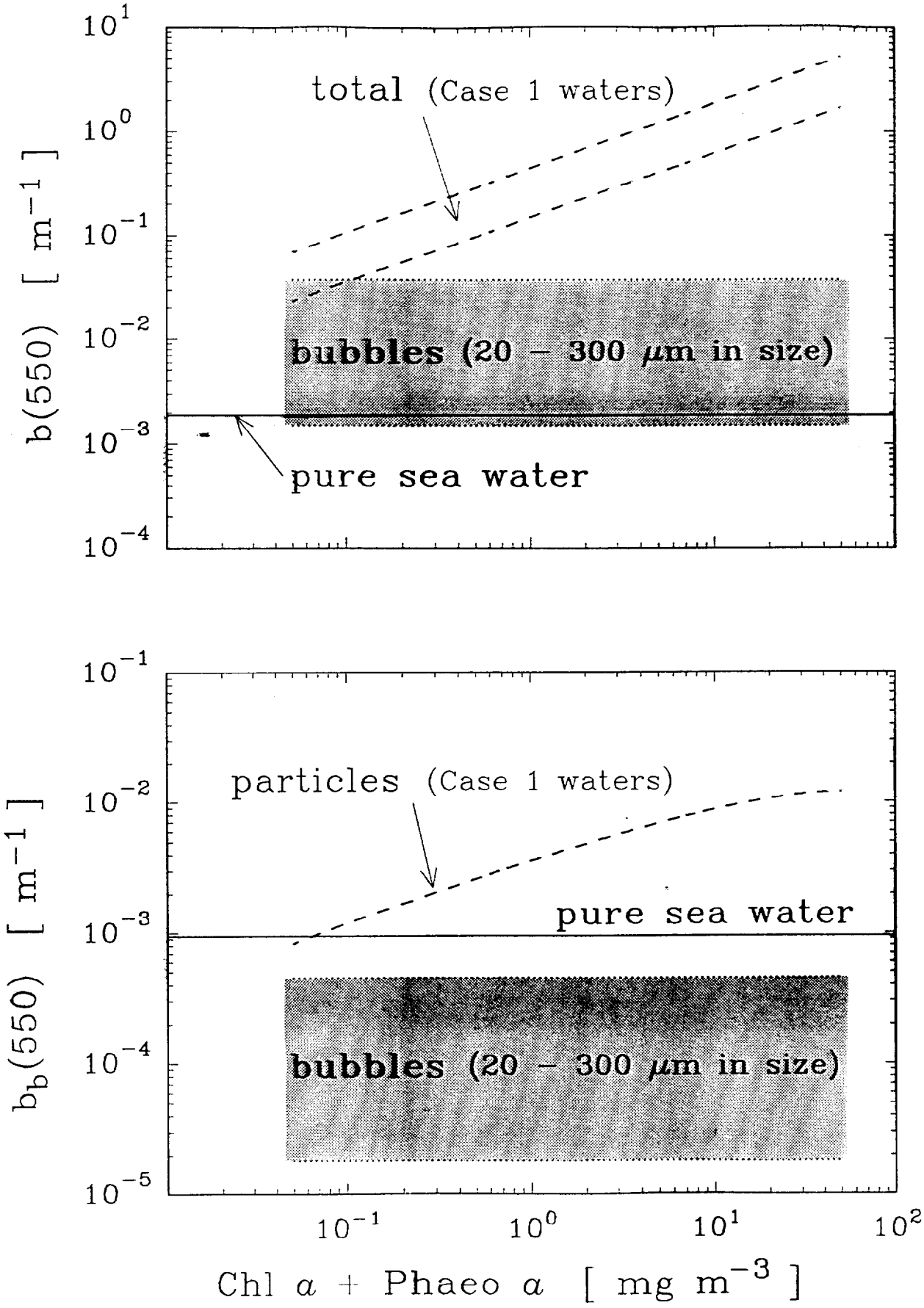
- **examine errors in the in-situ determinations of water-leaving radiance and wind-dependent parameterization of whitecap coverage**

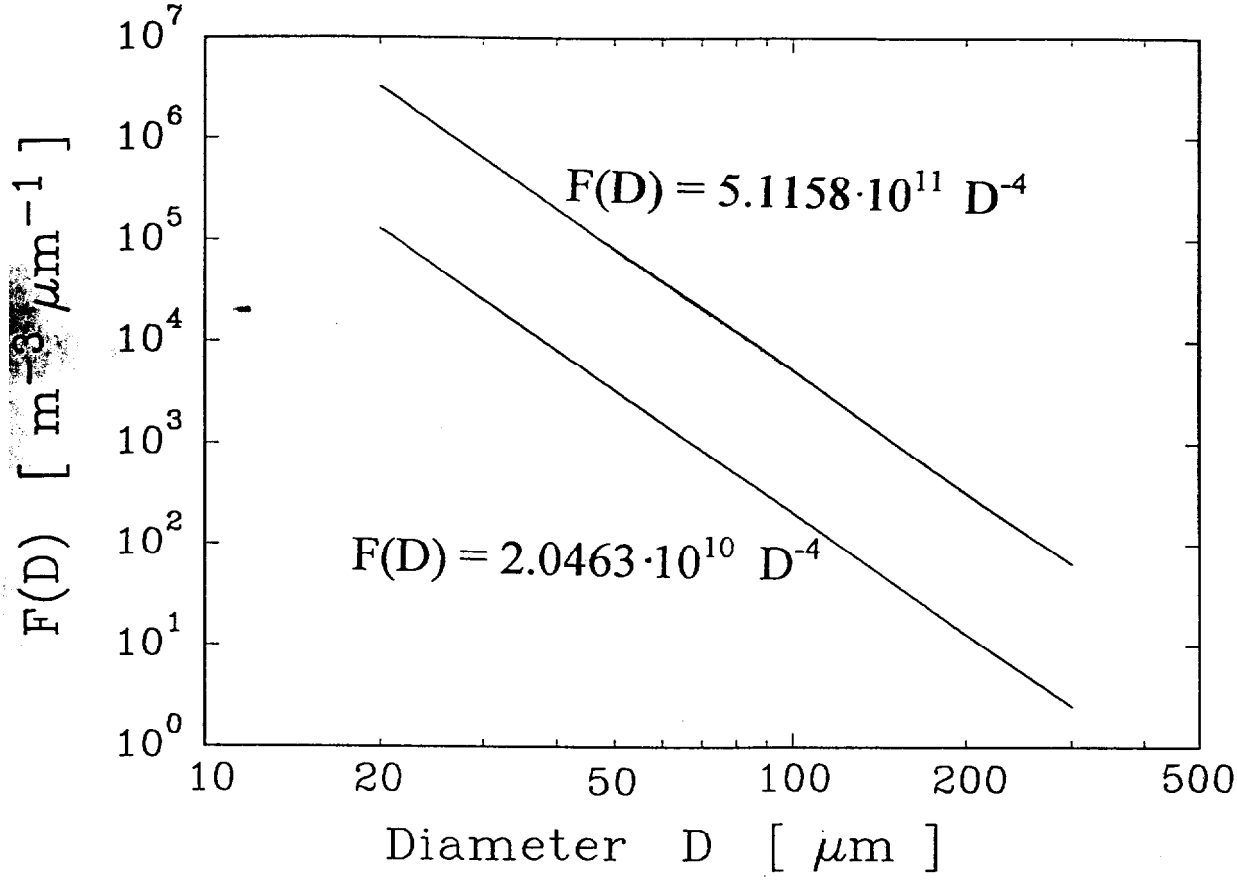
OVERALL GOALS

- **identify regional biases and characterize error budgets for the Level-2 MODIS ocean data products in the Arctic**

- **develop understanding of these errors**

- **improve algorithms**


total (Case 1 waters)
bubbles (20 – 300 μm in size)
pure sea water
b(550) [m⁻¹]
particles (Case 1 waters)
pure sea water
bubbles (20 – 300 μm in size)
b_b(550) [m⁻¹]
Chl a + Phaeo a [mg m⁻³]


F(D) = 5.1158·10^11 D^-4
F(D) = 2.0463·10^10 D^-4
F(D) [m^-3 μm^-1]
Diameter D [μm]
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0
10
20
50
100
200
500

STATEMENT OF THE PROBLEM

- need for validation activities at high latitudes
- differences in bio-optical algorithms between polar and temperate/tropical waters
- wind-dependent effects of near-surface bubble clouds