



National Oceanic and Atmospheric Administration's

**National Weather Service**



**National Weather Service  
Alaska Region  
Sea Ice Program**

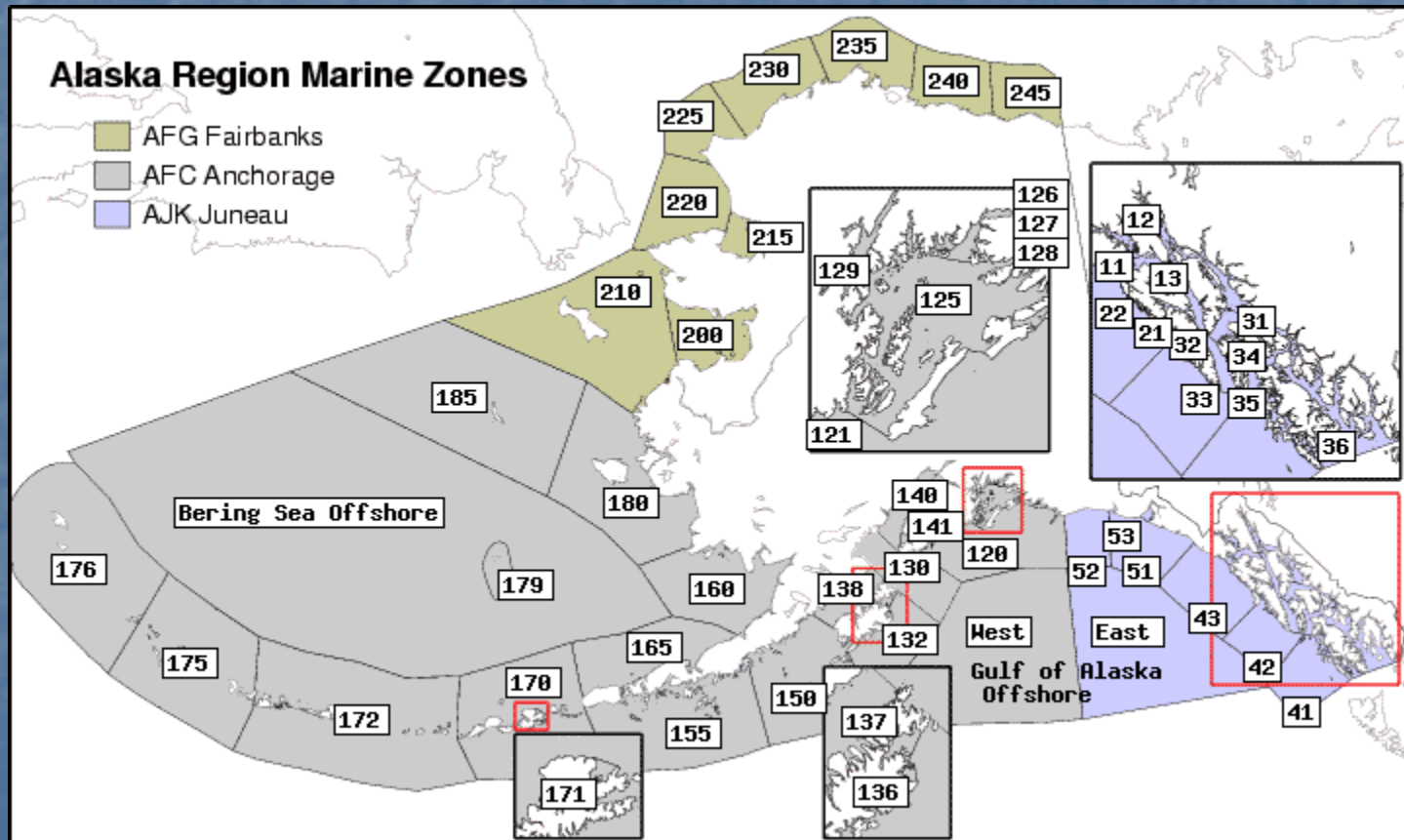
**3rd Symposium on the Impacts of an  
Ice-Diminishing Arctic on  
Naval and Maritime Operations**

**Wednesday 10 June 2009**

Gary Hufford

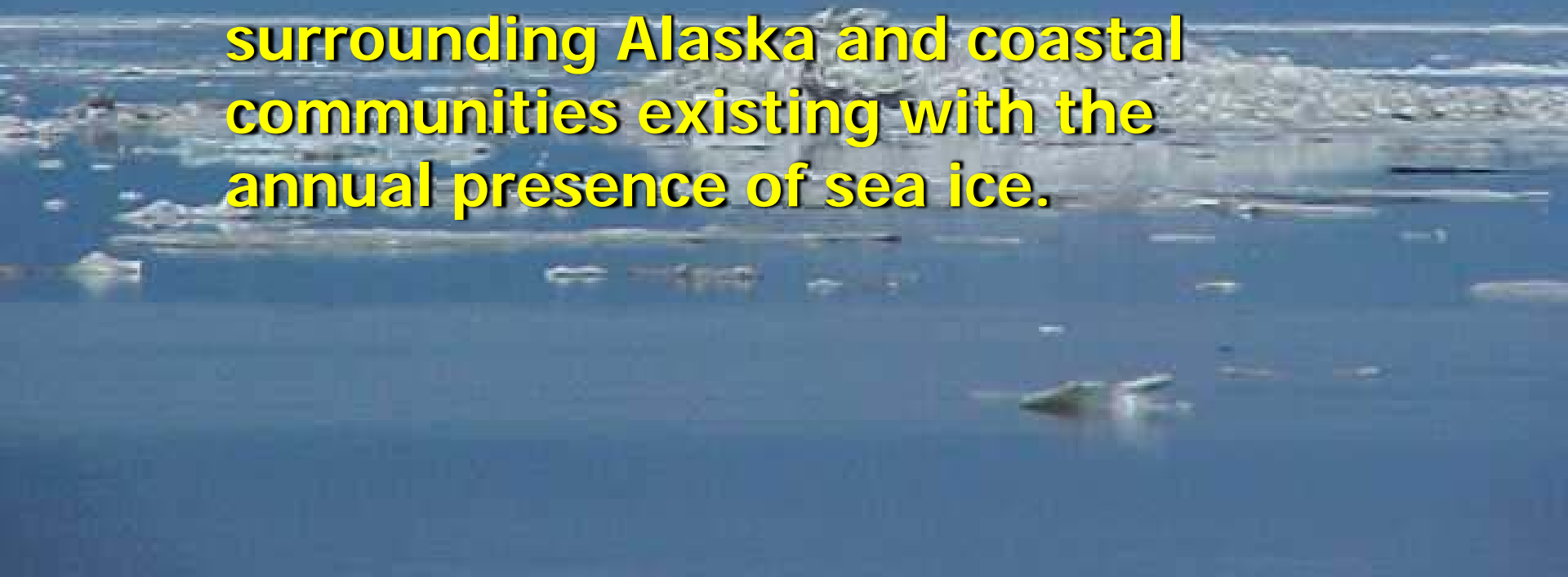
Environmental and Scientific Services Division  
NOAA/NWS Alaska Region Headquarters

# NWS Alaska Marine Zones



# ALASKA SEA ICE PROGRAM

Products aid ships navigating in and near the ice-covered waters surrounding Alaska and coastal communities existing with the annual presence of sea ice.



An aerial photograph of a sea ice field. The foreground shows a dark, narrow lead (open water) cutting through a field of broken ice floes. The ice floes are irregular in shape and size, ranging from small chunks to larger, more solid-looking pieces. The background shows a vast expanse of ice stretching towards a distant, hazy horizon under a clear blue sky.

❖ Local ice program is vital to NOAA and NWS missions in Alaska

❖ Maritime and coastal hazards often require 24 hour access to changing sea ice conditions

❖ Alaska Ice Program is well respected and appreciated by a wide range of customers in governments, industries and local communities

# Alaska Sea Ice Customers

- Native Communities
- Fishing Fleets
- Oil Industry
- Shipping
- Transportation
- Tourism
- US Coast Guard
- NWS Forecasters
- Homeland Security
- State of Alaska
- AK Fish & Wildlife
- Decision Support

# Alaska Native Communities

- Subsistence hunts along the ice edge and off shorefast ice
- Alaska Ice Program is consulted for timing of hunts and safety of hunting groups
- Previous Ice Forecaster provided vital information on ice location and movement essential to rescue of lost hunting party

# Alaska Fishing Fleets

- Bering Sea Fishery (\$4 Billion)
- Ship Captains often consult the ice forecaster for immediate data on ice position and movement...including weekends and through the night
- Most ships have Internet access






# \$ Shipping & Transportation \$

- Cook Inlet, Bering, Beaufort & Chukchi Seas
- Anchorage Port depends on Cook Inlet Ice Analysis for safe and efficient container and barge traffic through the ice season
- Alaska Coastal communities rely on Ice Forecasts for summer restocking barges
- Red Dog mine near Kotzebue needs ice information for start and end of shipments

# Oil/Gas Industry

- Cook Inlet, Chukchi and Beaufort Seas
- Ice Program touches oil and gas interests at the development stage through production and product delivery
- Ice location and movement are critical to safe oil and gas operations in environmentally sensitive ecosystems.



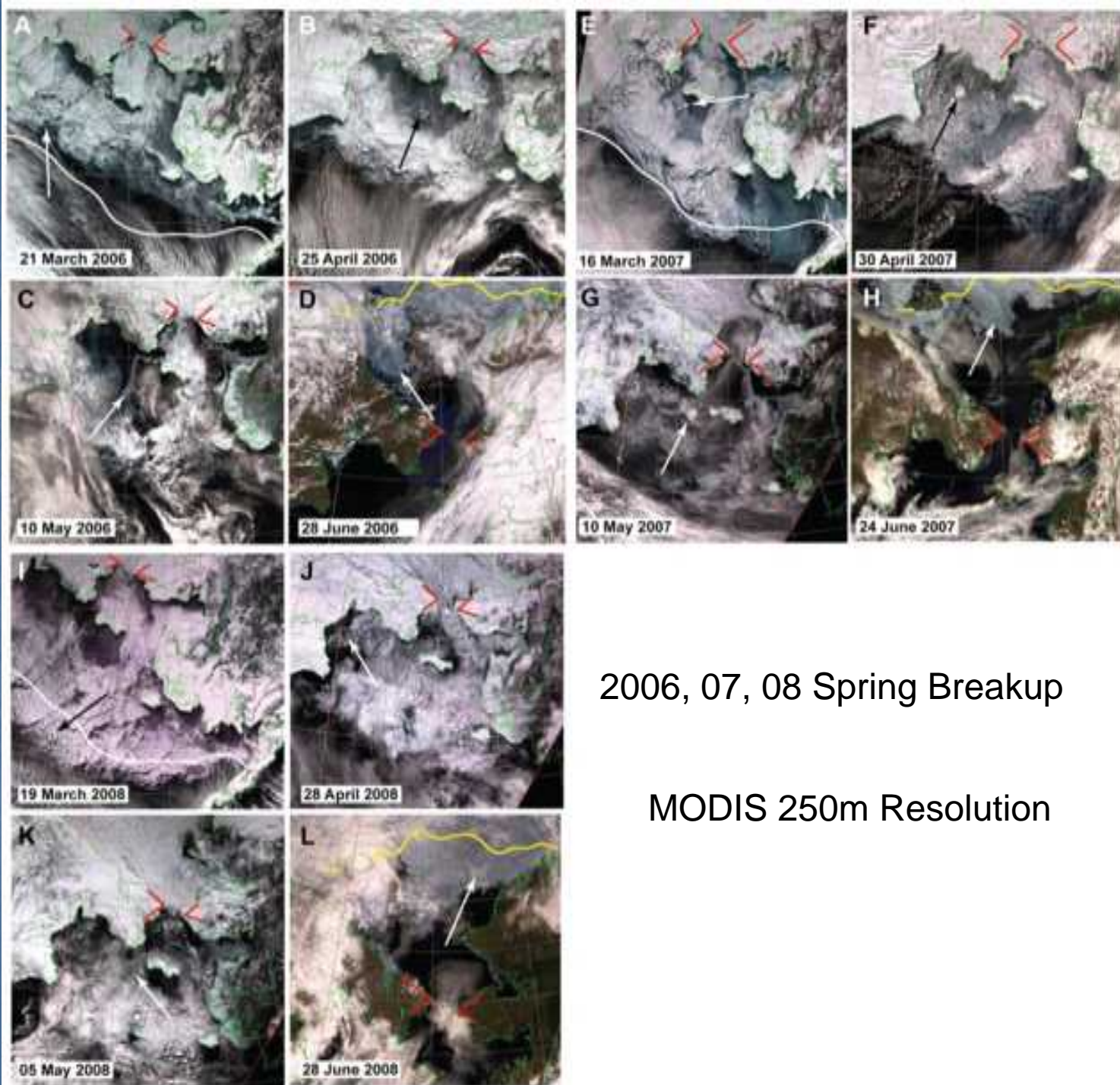
**Seabulk Pride  
Feb 2, 2006  
5 million gallons of oil**

# **Decision Support**

**Ex. Managers Concerned With Climate  
Change On Marine Mammals**

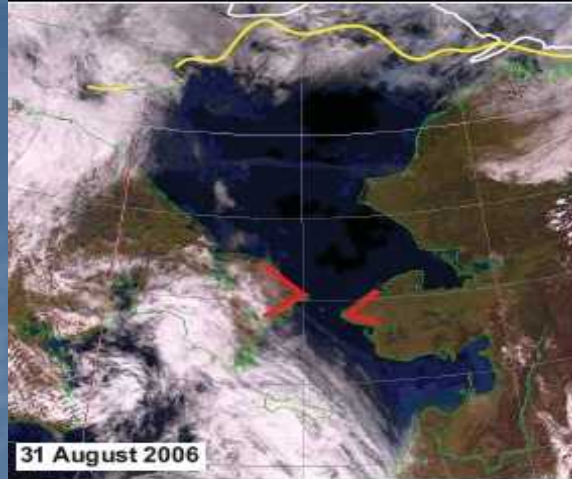


22 16:53



2006, 07, 08 Spring Breakup

MODIS 250m Resolution



## Late Summer Ice Extent

# ALASKA SEA ICE PRODUCTS

Issued Monday, Wednesday and Friday

- **Sea Ice Advisory** - text product
- **Ice Analysis** - graphic
- **5 Day Sea Ice Forecast** - graphic
- **Monthly Year Group Analysis and Outlook** – year group text product appended to ice analysis the first week of each month and carried for 3 ice days. Outlooks prepared quarterly.

A graphical **Sea Surface Temperature Analysis** produced Tuesday and Thursday.



FZAK80 PAFC 162302

ICEAFC

SEA ICE ADVISORY FOR WESTERN AND ARCTIC ALASKAN COASTAL WATERS

NATIONAL WEATHER SERVICE ANCHORAGE ALASKA

310 PM ADT MONDAY JULY 16 2007

FORECAST VALID SATURDAY JULY 21 2007

CONFIDENCE...HIGH.

SYNOPSIS...HIGH PRESSURE NORTHWEST OF BANKS ISLAND WILL WEAKEN THROUGH THURSDAY THEN REMAIN STATIONARY NORTH OF ALASKA THROUGH SATURDAY. A TROUGH OF LOW PRESSURE WILL EXTEND FROM EASTERN RUSSIA ACROSS CENTRAL ALASKA BY THE END OF THE WEEK.

-ARCTIC OCEAN-

-BEAUFORT SEA-

-CHUKCHI SEA-

PKZ230-CAPE BEAUFORT TO POINT FRANKLIN-

PKZ235-POINT FRANKLIN TO CAPE HALKETT-

PKZ240-CAPE HALKETT TO FLAXMAN ISLAND-

PKZ245-FLAXMAN ISLAND TO DEMARCATION POINT-

THE ICE EDGE LIES FROM NEAR POINT BARROW TO 71.9N 156.1W TO 71.9N 163.9W TO 70.9N 160.5W TO 71N 165.8W TO 71.5N 168.9W TO 70N 169W TO 69.9N 170.4W TO 70.7N 172.6W TO 72N 174W TO 72.8N 176W TO 71.4N 175.1W TO 70.8N 176W TO 70.7N 175.5E AND CONTINUES TO THE WEST. THE EDGE IN ALASKAN WATERS IS MAINLY 3 TO 8 TENTHS FIRST YEAR THIN... FIRST YEAR MEDIUM AND YOUNG ICE. AN AREA OF OPEN WATER VERY ROUGHLY 50 TO 100 NM WIDE LIES OFF THE COAST EAST OF 146W.

FORECAST THROUGH SATURDAY...OPEN WATER WILL EXTEND ACROSS THE ALASKA NORTH COAST BY SATURDAY. ICE IN THE CHUKCHI SEA WILL MOVE TO THE NORTH NORTHWEST 15 TO 25 NM.

KCOLE JULY 2007

...JULY 2007 YEAR GROUP ANALYSIS...

THE YEAR GROUPS FOR JULY ARE 1993...2003...1997 AND 2001 IN THAT ORDER. 1993 IS ALSO THE YEAR GROUP FROM JUNE. 2001 WAS THE SECOND CHOICE IN JUNE BUT SHOWS MUCH LESS CONFORMITY THAN PREVIOUSLY. ALL FOUR YEARS WERE COMPARED TO 2007 ON THE BASIS OF ICE POSITION AT THE FIRST OF JULY...SEA SURFACE TEMPERATURES AT THE FIRST OF JULY... ONE AND THREE MONTH AVERAGES OF SEA LEVEL PRESSURE...500 MB HEIGHTS AND 850 MB TEMPERATURES. THESE COMPARISONS WERE TAKEN INTO ACCOUNT FOR FINAL YEAR GROUP SELECTION. AFTER CHOOSING 1993 AS THE YEAR GROUP FOR JULY THE ATMOSPHERIC COMPARISONS WERE ALSO USED TO ADJUST THE 2007 SUMMER OUTLOOK. THE MAIN DIFFERENCE BETWEEN 1993 AND 2007 IS THE POSITION OF THE ARCTIC HIGH PRESSURE. IN 1993 THE SURFACE HIGH AND UPPER LEVEL RIDGE WERE CENTERED NEAR BANKS ISLAND WHILE IN 2007 THE HIGH HAS BEEN MORE TO THE WEST HOLDING AN AVERAGE POSITION JUST OFF THE ALASKA NORTH COAST BETWEEN 150W AND 155W. THIS COULD BE THE REASON FOR THE FASTER CLEARING OF THE ICE OFF THE NORTHWEST ALASKA COAST AS THE WARMER AIR MOVES NORTH TO THE WEST OF THE HIGH. FOR THIS REASON THE OPENING OUTLOOK DATES LISTED BELOW HAVE BEEN ADJUSTED A FEW DAYS EARLIER. THE OUTLOOK FOR ICE RETURNING TO THE ALASKA NORTH COAST WILL REMAIN EARLY IN THE THIRD WEEK OF OCTOBER. COMPARING 2007 AND 1993 SEA SURFACE TEMPERATURES THIS YEAR ARE TRENDING COOLER TEMPERATURES THAN IN 1993. THIS AGREES WITH NOAA CLIMATE PREDICTION CENTER/S PREDICTION OF A LA NINA...OR COOLING WATER TEMPERATURES.

2007 SUMMER SEASON ICE OUTLOOK...

<u>EVENT</u>	<u>2007</u>
COAST OPEN BARROW TO PRUDHOE BAY THE LAST AREA TO OPEN WILL BE BETWEEN 150W AND 155W	7/15
COAST OPEN TO CANADA	7/15
MAIN ICE EDGE BETWEEN 160W AND 170W NORTH OF	
70N	7/7
71N	7/12
72N	9/25
73N	N/A DUE TO EXPECTED LA NINA CONDITIONS
ICE RETURN TO NORTH COAST	10/20

# Digital Ice Products

Geo-spatially enabled (shapefiles)  
graphical products using ESRI  
ArcMap Software

Geodatabase design for ice products  
allows easier access to data for  
research and climatology.

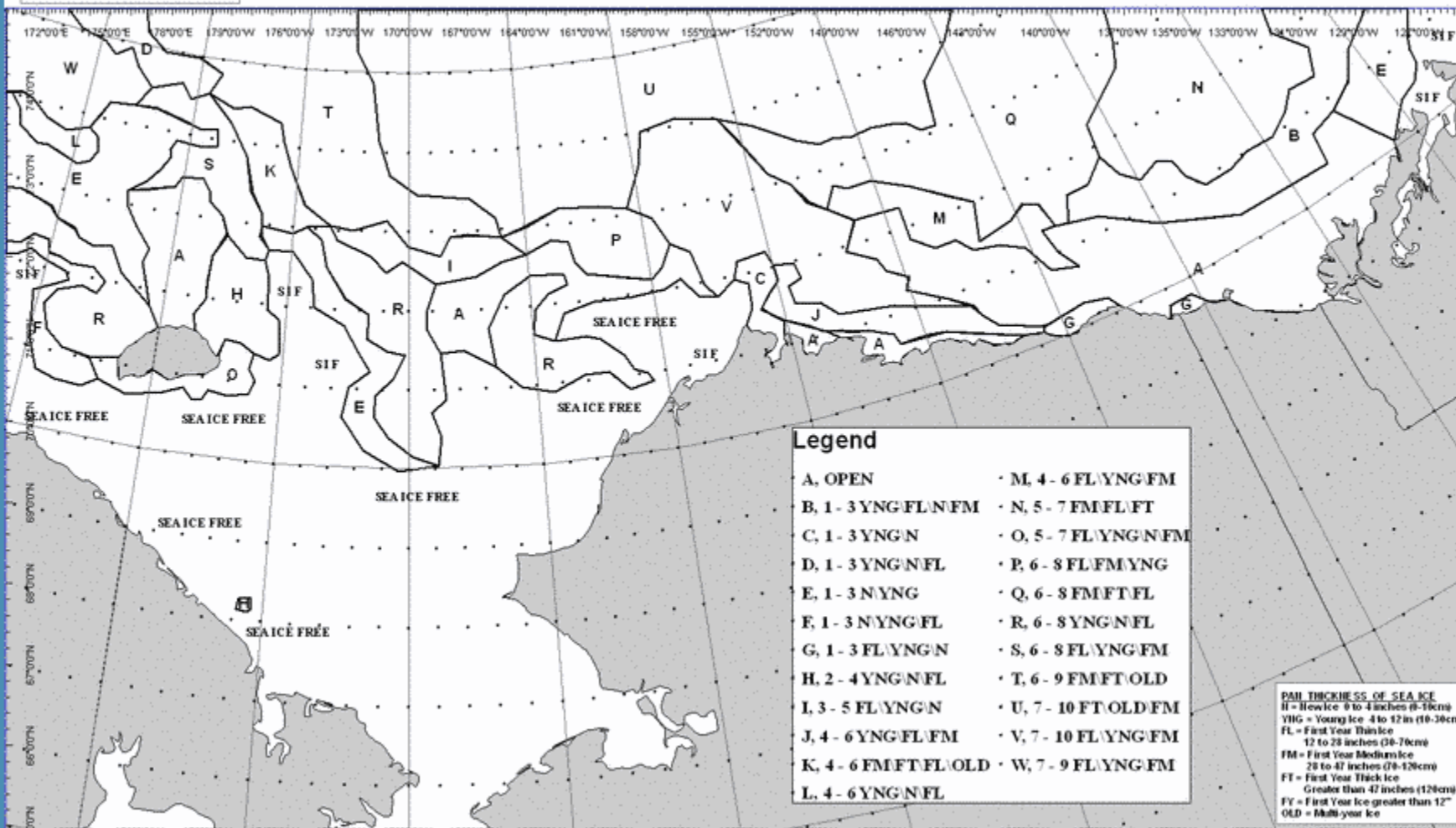
GIS GoogleEarth kmz images will be  
available...soon.

— Ice Edge  
 EST = Estimated Ice Edge  
 SIF = Shorefast Ice or Beach Ice  
 5-7 = Ice concentration in tenths  
 Open Water = less than 1/10th ice concentration

**ALASKA SEA ICE ANALYSIS**  
**NATIONAL WEATHER SERVICE**  
**ANCHORAGE, ALASKA**



**ISSUED: MONDAY 16 JULY 2007**  
**CONFIDENCE: HIGH**

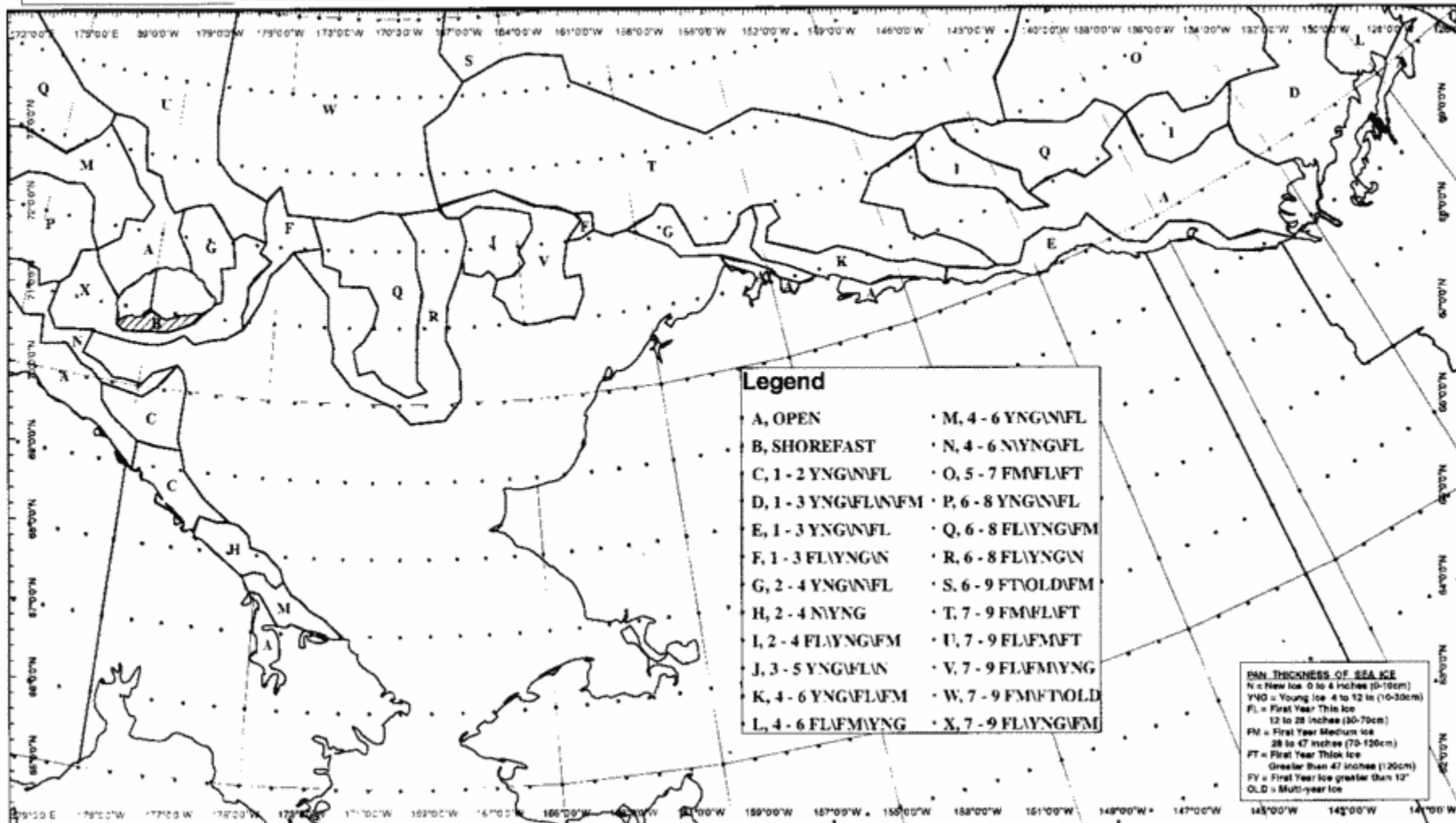


— Ice Edge  
 EST = Estimated Ice Edge  
 BI = Shorefast ice or Beach Ice  
 5-7 = ice concentration in tenths  
 Open Water = less than 1/10th ice concentration

**ALASKA 5 DAY SEA ICE FORECAST**  
**NATIONAL WEATHER SERVICE**  
**ANCHORAGE, ALASKA**



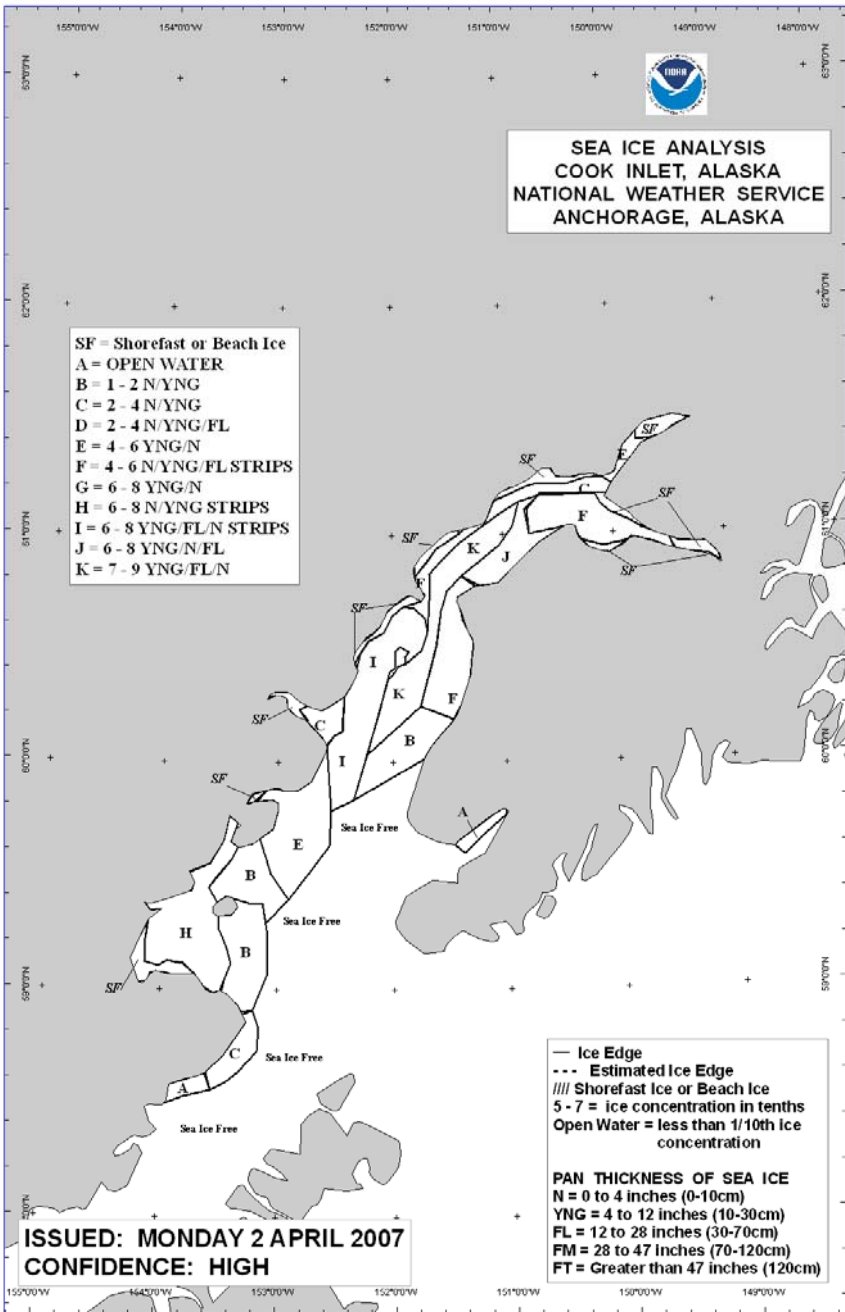
**ISSUED: Friday 13 July 2007**  
**FORECAST VALID: Wednesday 18 July 2007**





**SEA ICE ANALYSIS  
COOK INLET, ALASKA  
NATIONAL WEATHER SERVICE  
ANCHORAGE, ALASKA**

**SF = Shorefast or Beach Ice**  
**A = OPEN WATER**  
**B = 1 - 2 N/YNG**  
**C = 2 - 4 N/YNG**  
**D = 2 - 4 N/YNG/FL**  
**E = 4 - 6 YNG/N**  
**F = 4 - 6 N/YNG/FL STRIPS**  
**G = 6 - 8 YNG/N**  
**H = 6 - 8 N/YNG STRIPS**  
**I = 6 - 8 YNG/FL/N STRIPS**  
**J = 6 - 8 YNG/N/FL**  
**K = 7 - 9 YNG/FL/N**



— Ice Edge  
 --- Estimated Ice Edge  
 /// Shorefast Ice or Beach Ice  
 5 - 7 = ice concentration in tenths  
 Open Water = less than 1/10th ice concentration

**PAN THICKNESS OF SEA ICE**  
**N = 0 to 4 inches (0-10cm)**  
**YNG = 4 to 12 inches (10-30cm)**  
**FL = 12 to 28 inches (30-70cm)**  
**FM = 28 to 47 inches (70-120cm)**  
**FT = Greater than 47 inches (120cm)**

**ISSUED: MONDAY 2 APRIL 2007**  
**CONFIDENCE: HIGH**

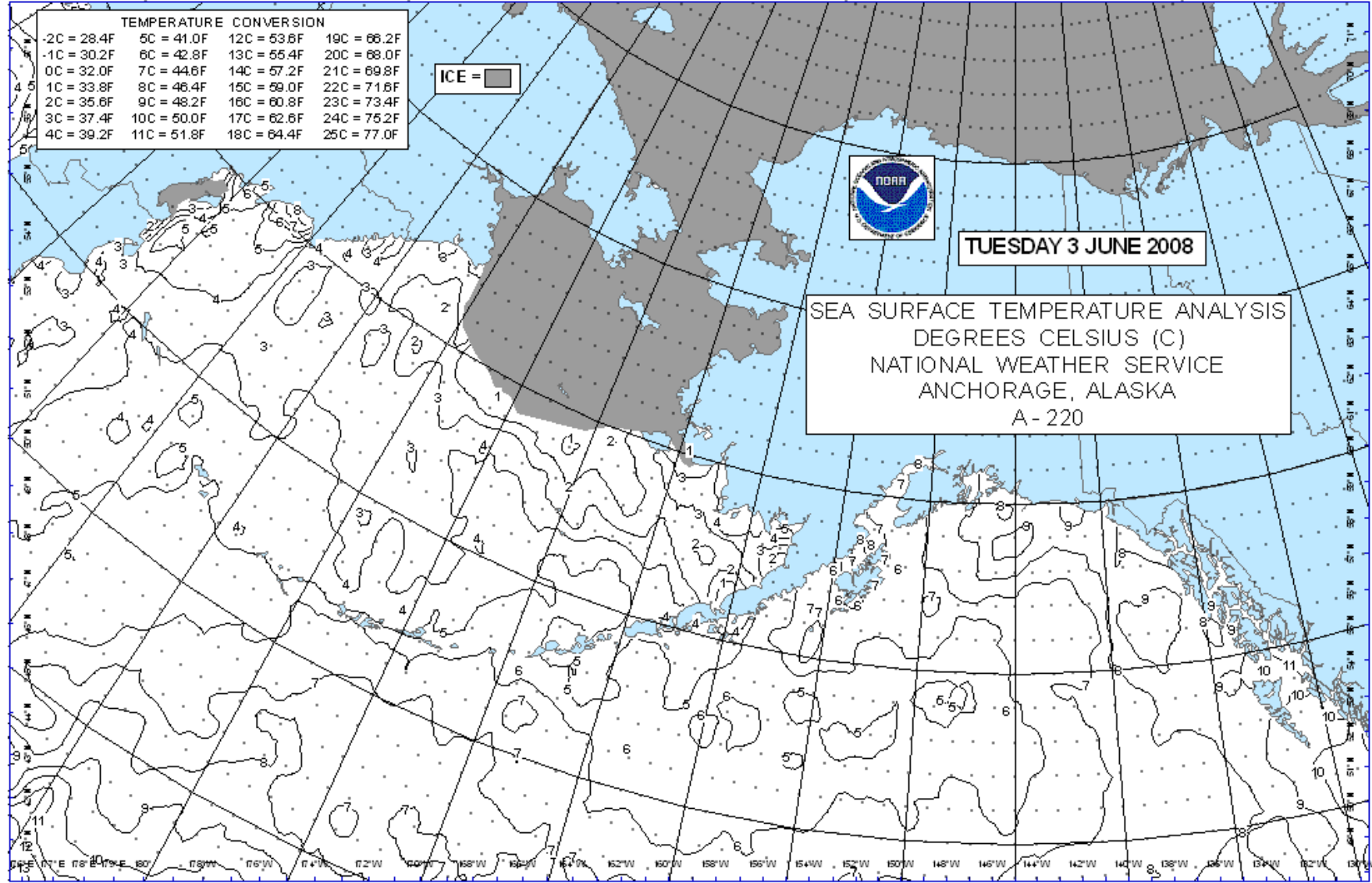
TEMPERATURE CONVERSION			
-2C = 28.4F	5C = 41.0F	12C = 53.6F	19C = 66.2F
-1C = 30.2F	6C = 42.8F	13C = 55.4F	20C = 68.0F
0C = 32.0F	7C = 44.6F	14C = 57.2F	21C = 69.8F
1C = 33.8F	8C = 46.4F	15C = 59.0F	22C = 71.6F
2C = 35.6F	9C = 48.2F	16C = 60.8F	23C = 73.4F
3C = 37.4F	10C = 50.0F	17C = 62.6F	24C = 75.2F
4C = 39.2F	11C = 51.8F	18C = 64.4F	25C = 77.0F

ICE = [shaded area]



TUESDAY 3 JUNE 2008

SEA SURFACE TEMPERATURE ANALYSIS  
 DEGREES CELSIUS (C)  
 NATIONAL WEATHER SERVICE  
 ANCHORAGE, ALASKA  
 A- 220



# Types of Analysis Data

- SAR – Synthetic Aperture Radar
- POES Satellite
- MODIS Satellite – high resolution
- Ice Observations & digital photos
- Over Flights – USCG and others



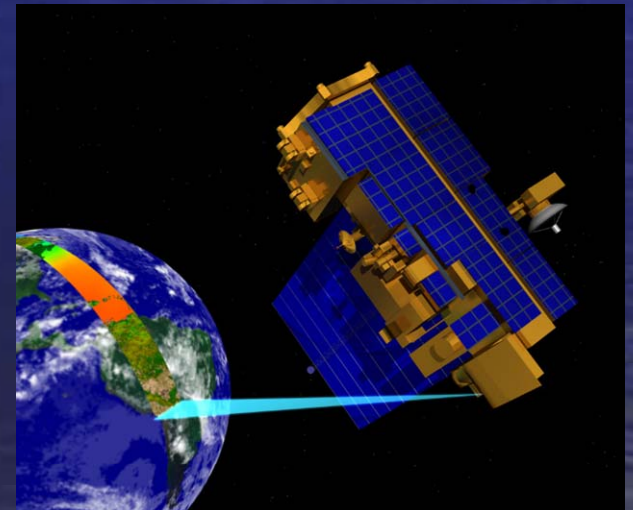


# MODIS

High Resolution Satellite  
250m Color Composite Imagery

2 Polar Orbiting Satellites

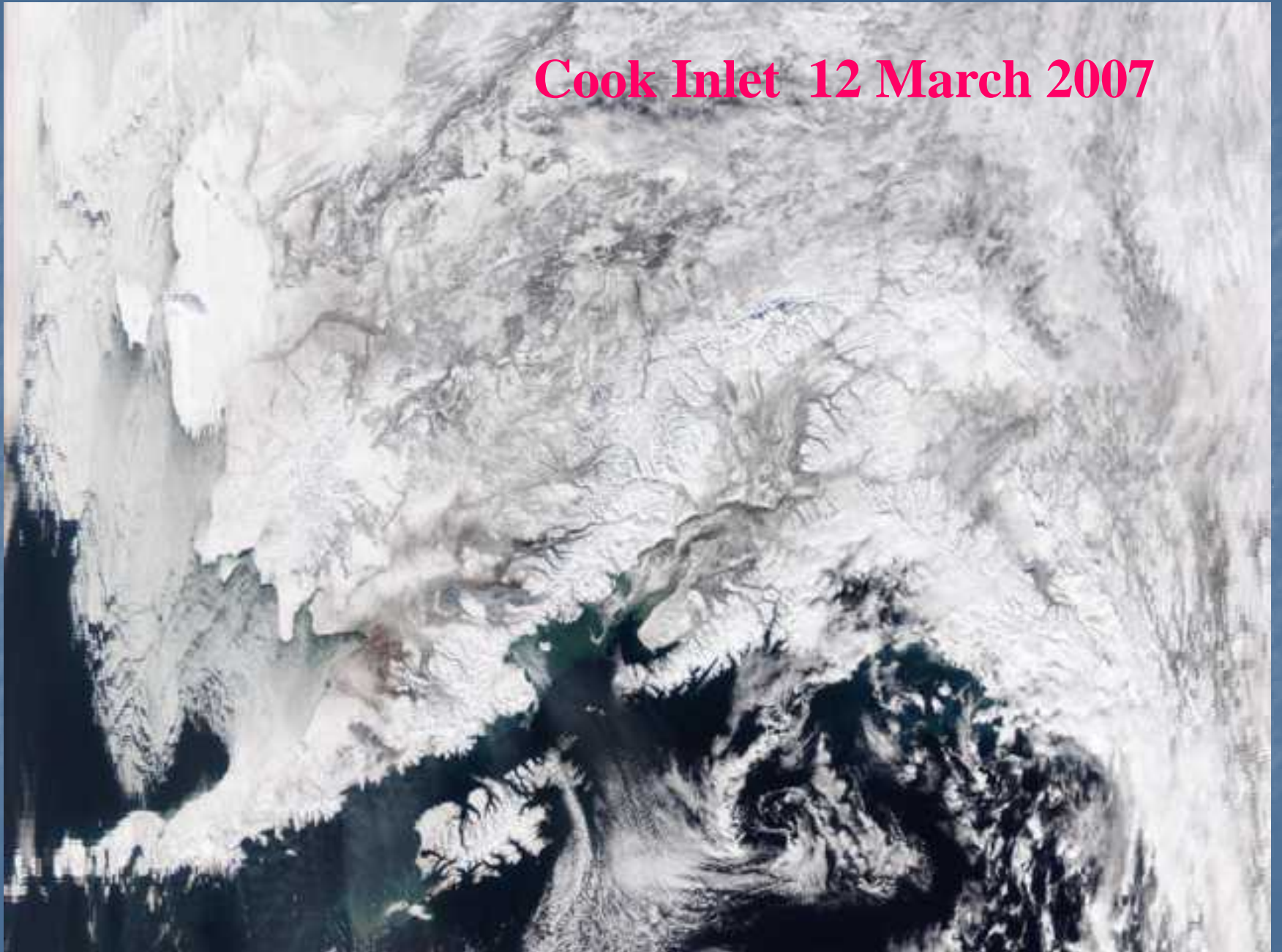
Terra  
Aqua



# Bering Strait Area 15May 2007



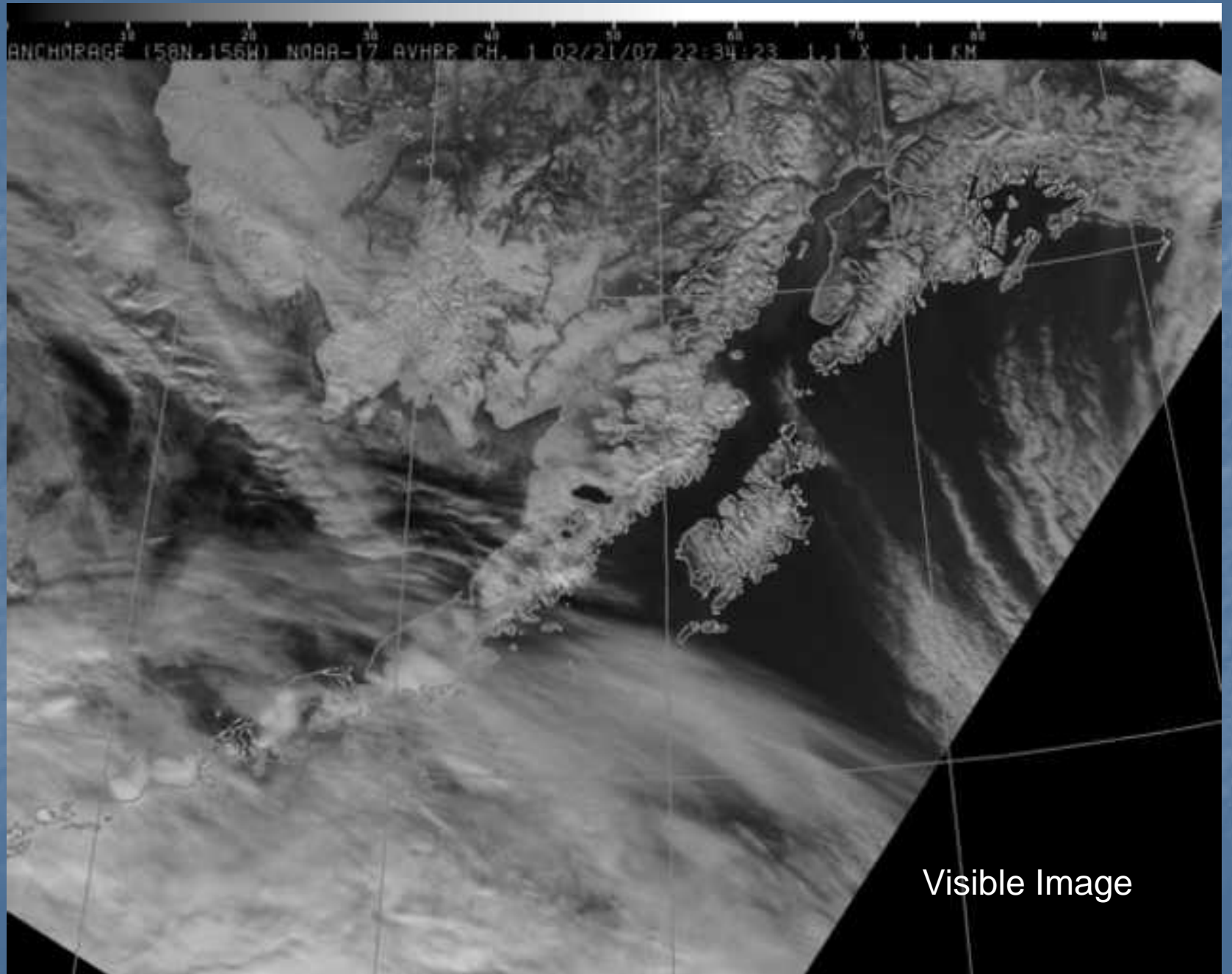
**Cook Inlet 12 March 2007**



# POES

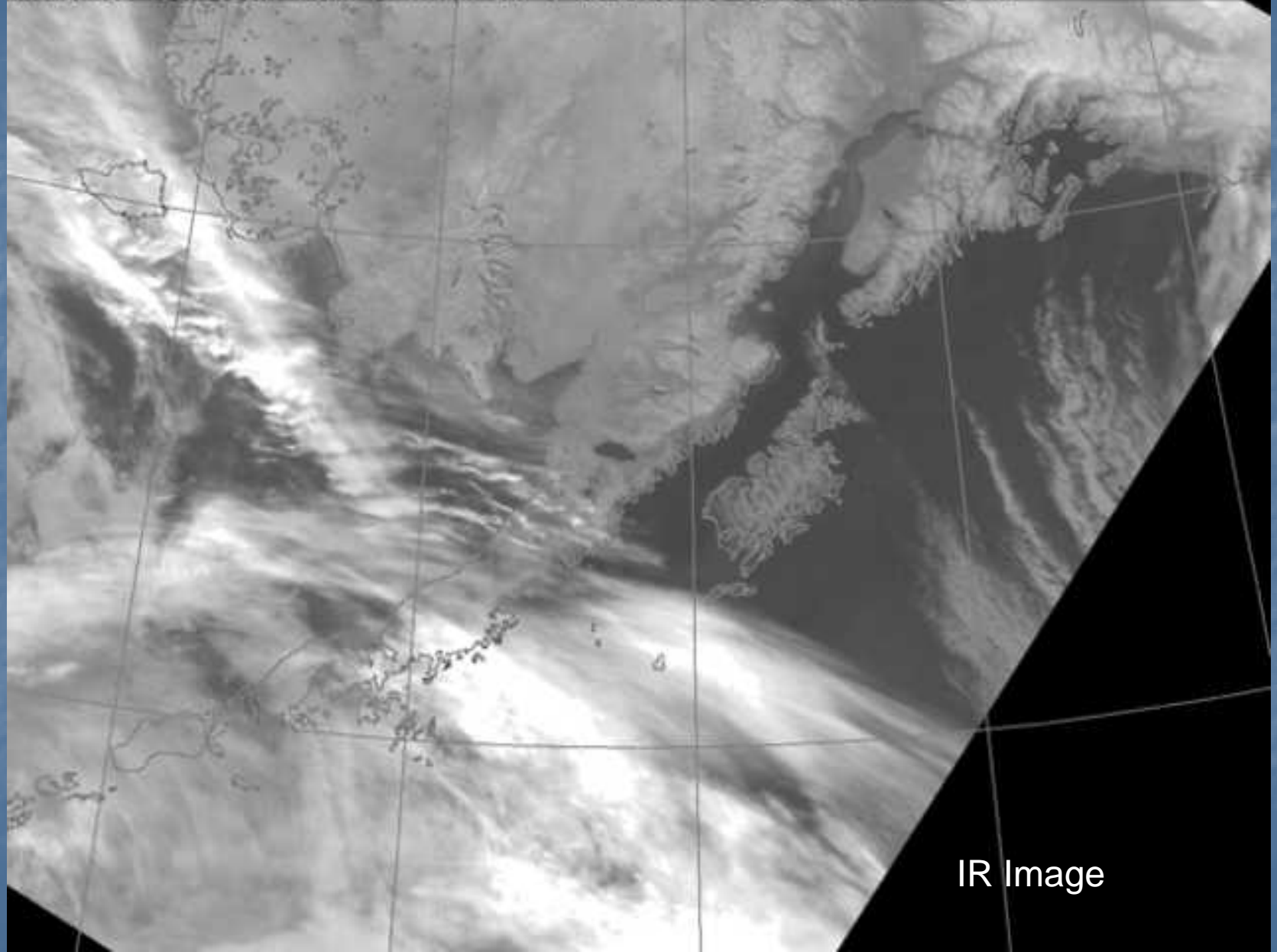
## Polar Orbiter Satellite

Visible and IR – dependent on cloud cover



Visible Image

ANCHORAGE (58N,156W) NOAA-17 AVHRR CH. 4 02/21/07 22:34:23 1.1 X 1.1 KM



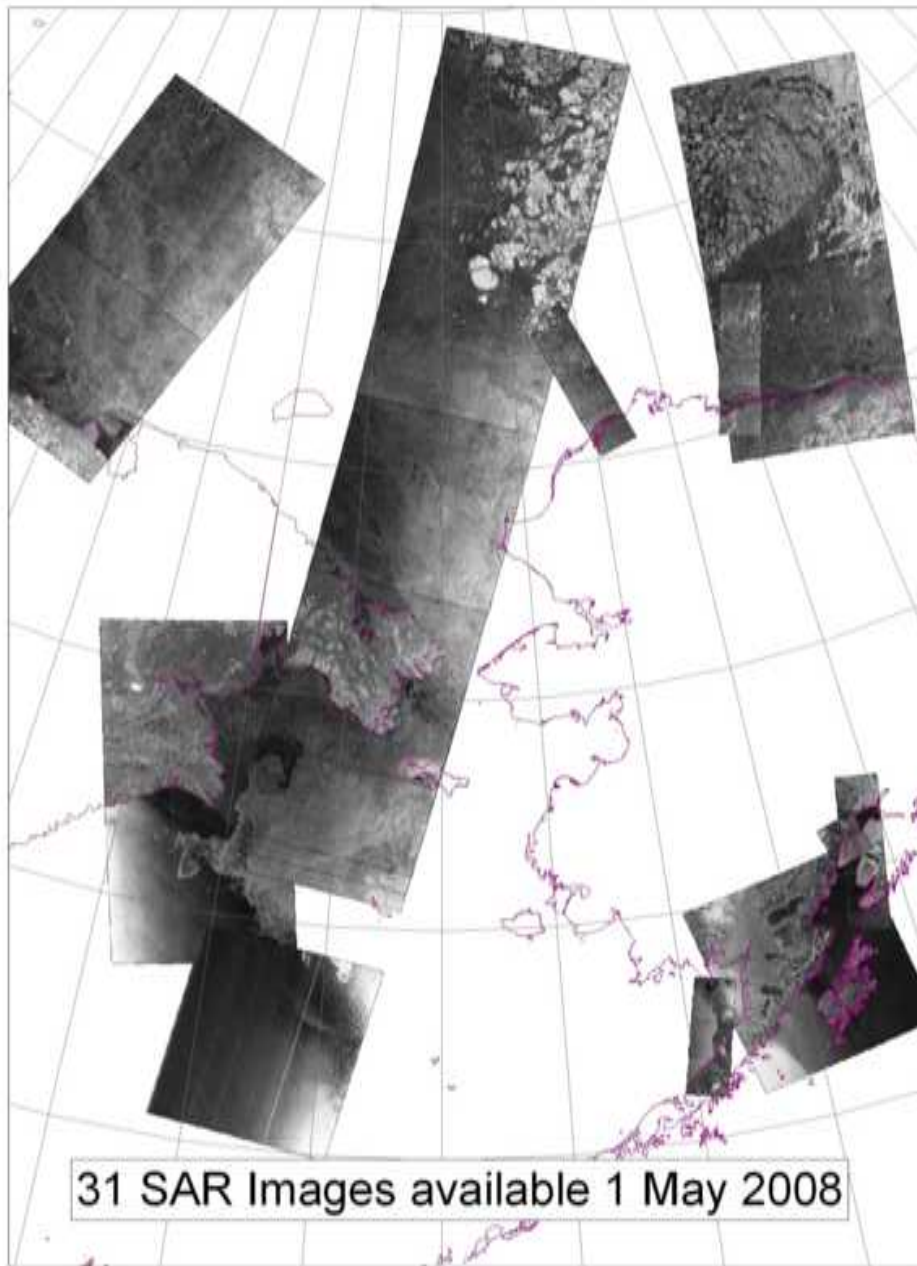
IR Image

# SAR IMAGERY

## Synthetic Aperture Radar

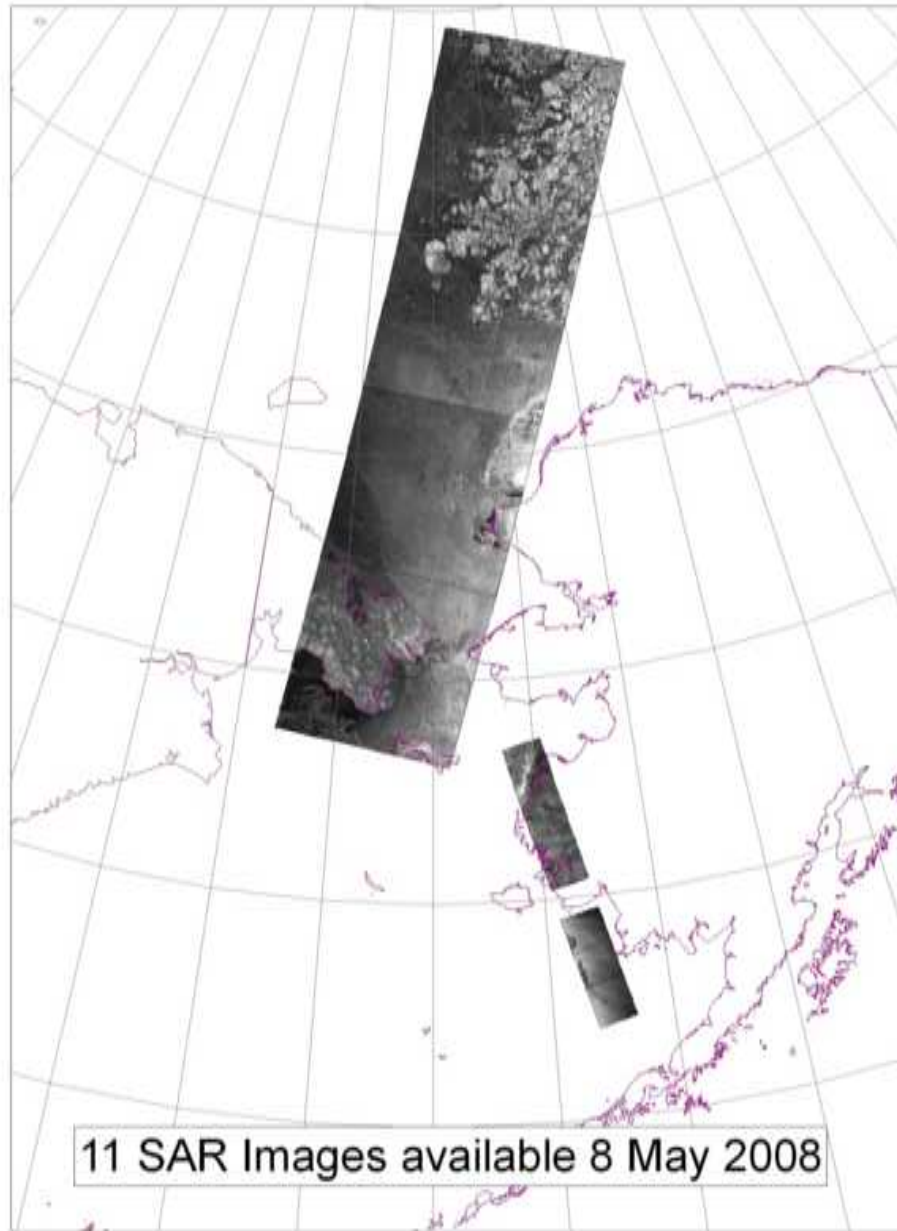
Combined project of  
NOAA  
NESDIS  
NIC  
ASF

SAR products drastically reduced in availability with loss of RADARSAT-1 data in May, 2008.



31 SAR Images available 1 May 2008





# Ice Observations & Pictures

Ships

Barges

Oil Platforms

Over Flights

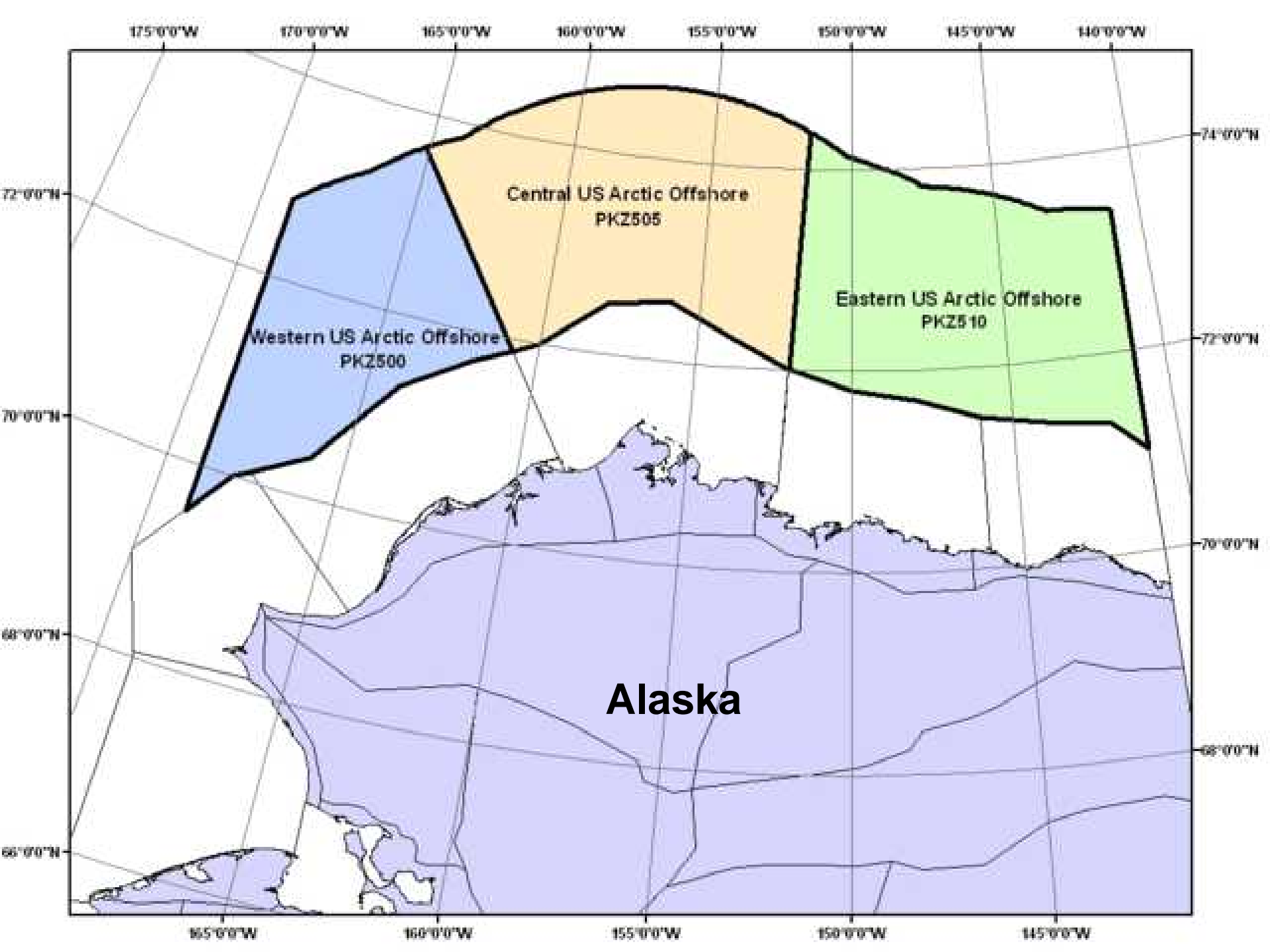
Coastal Areas

# February 2006 Cook Inlet





**Cook Inlet**



# Future Plans

- GoogleEarth ice analysis files later this year
- Color coded charts and shapefiles to be available on the Internet
- Old Alaska ice graphics to be digitized and added to the database
- Tidal movements of ice in Cook Inlet
- Support Climate Change Affects

