Collaborative Research on Sunlight and the Arctic Atmosphere-Ice-Ocean System (*AIOS*)

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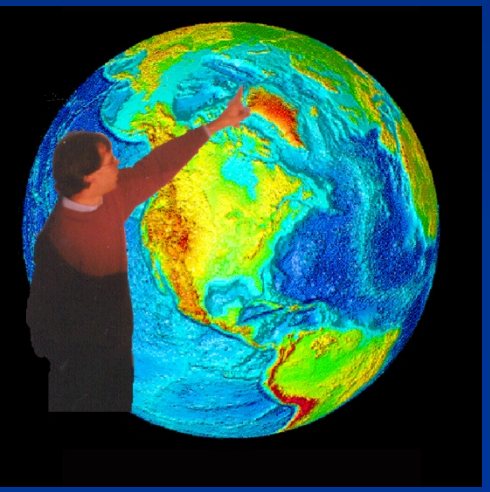

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The AIOS sunlight team

Sunlight and the Arctic *AIOS*

Goals

1. Enhance our understanding of the present role that solar radiation plays in the Arctic AIOS
2. Improve our ability to predict its future role.
3. Determine spatially and temporally the partitioning of solar energy

Where does all the sunlight go?

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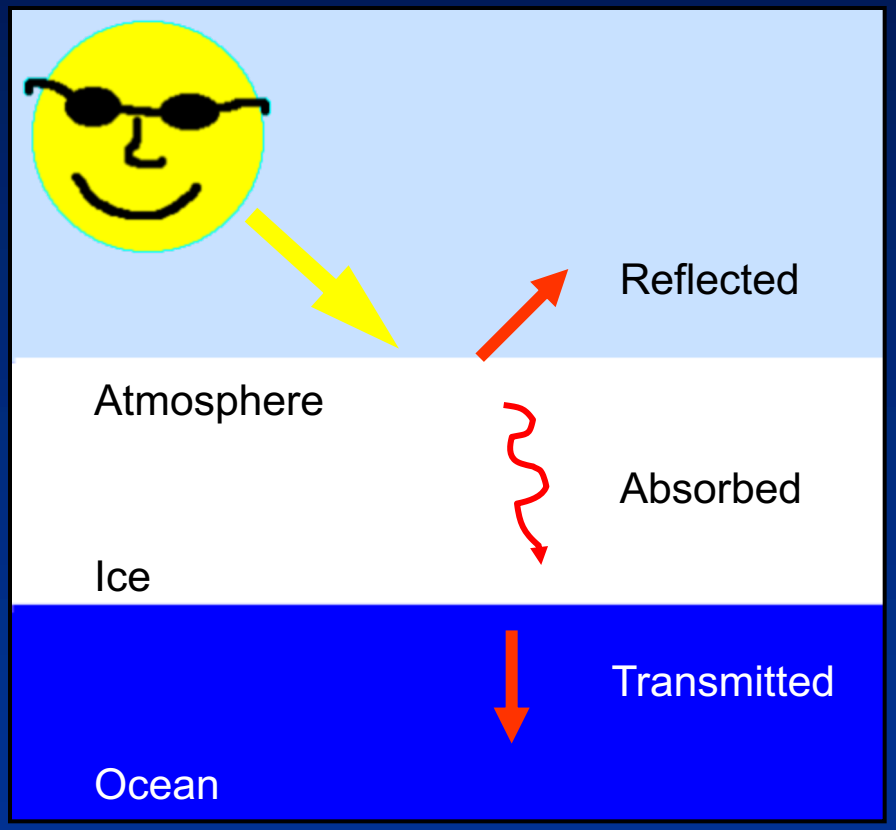
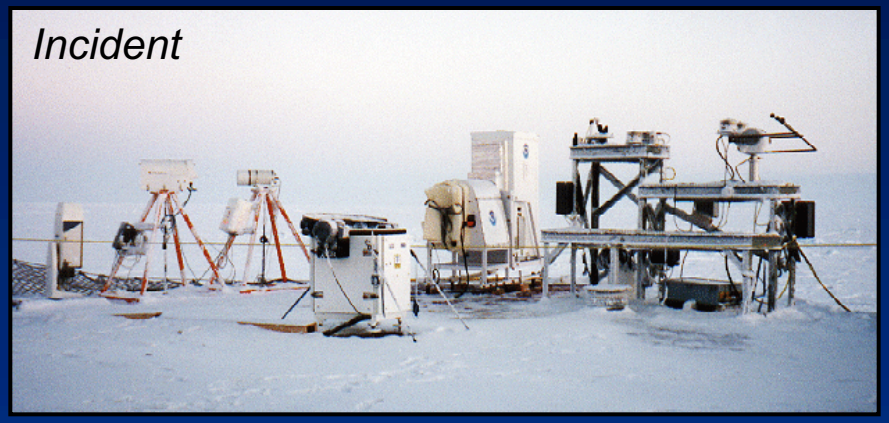


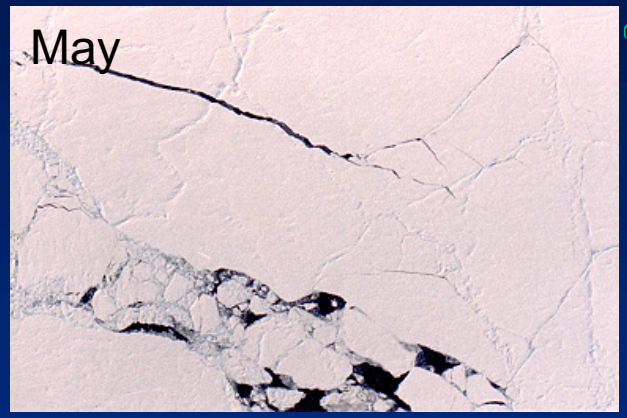


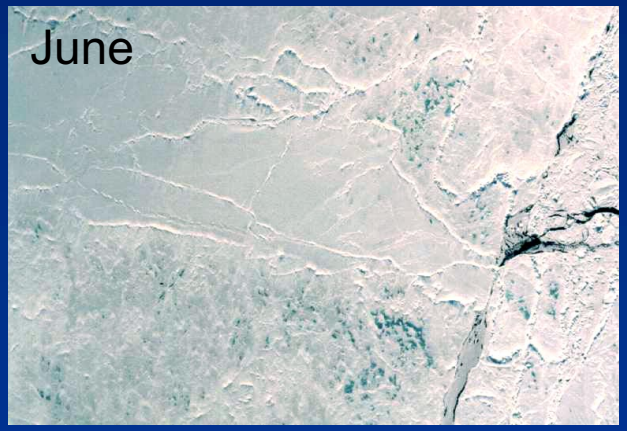
Incident = reflected + absorbed + transmitted

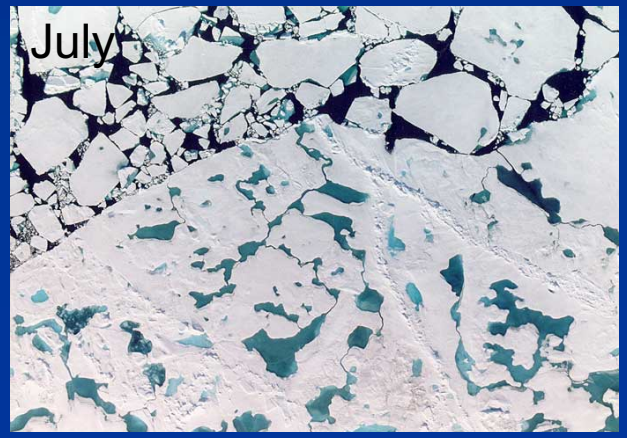
- Only three possible fates for sunlight
  - reflected back to atmosphere
  - absorbed in snow and ice
  - transmitted to ocean
- Determine over large scale

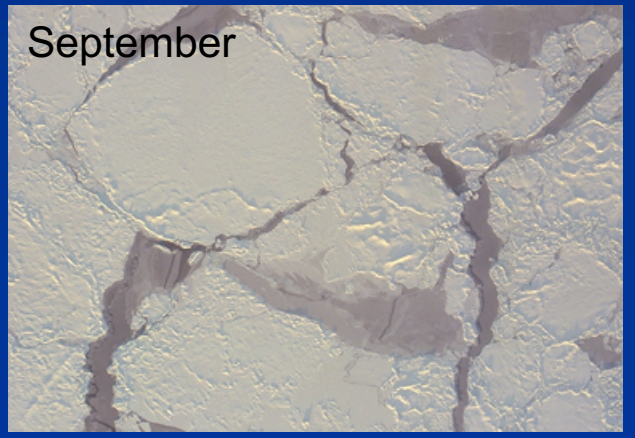
How hard can it be?

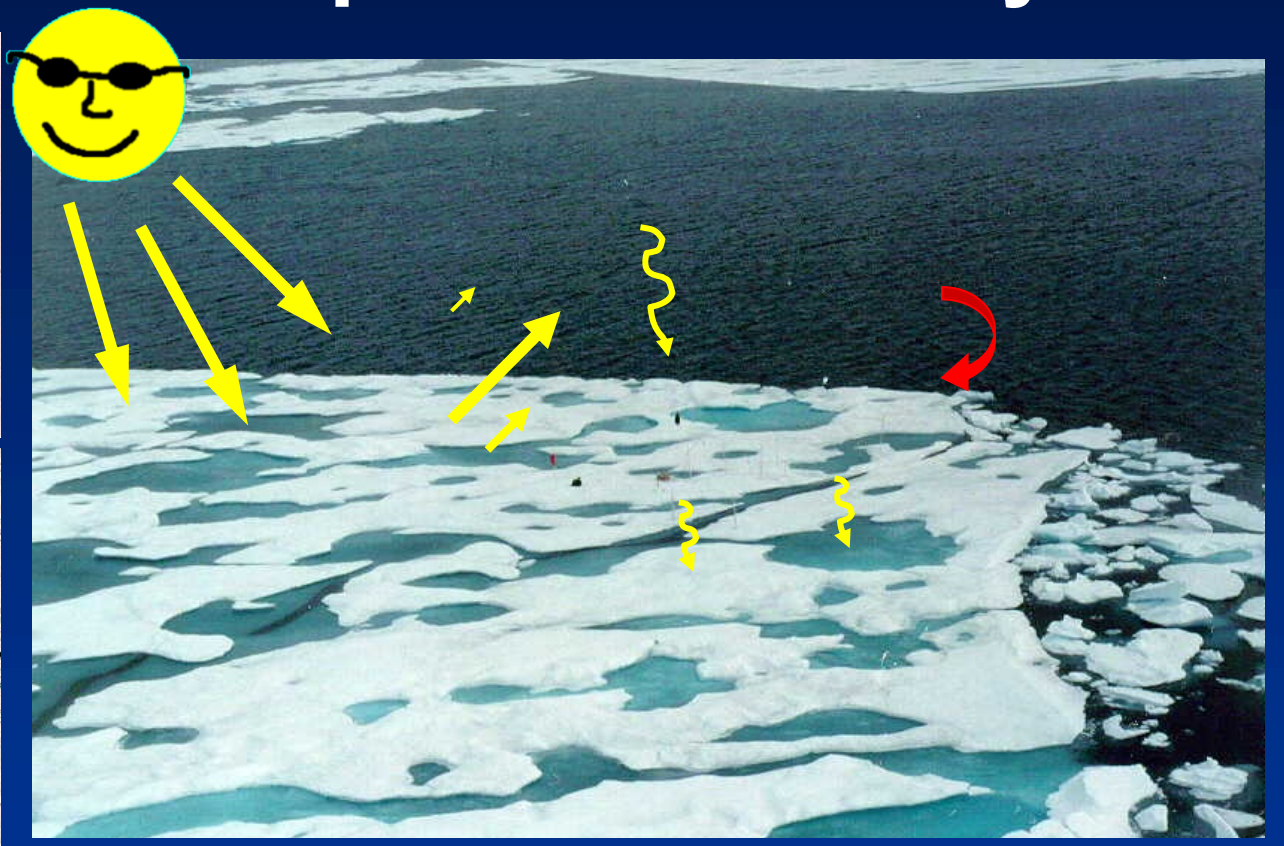
Temporal and spatial variability





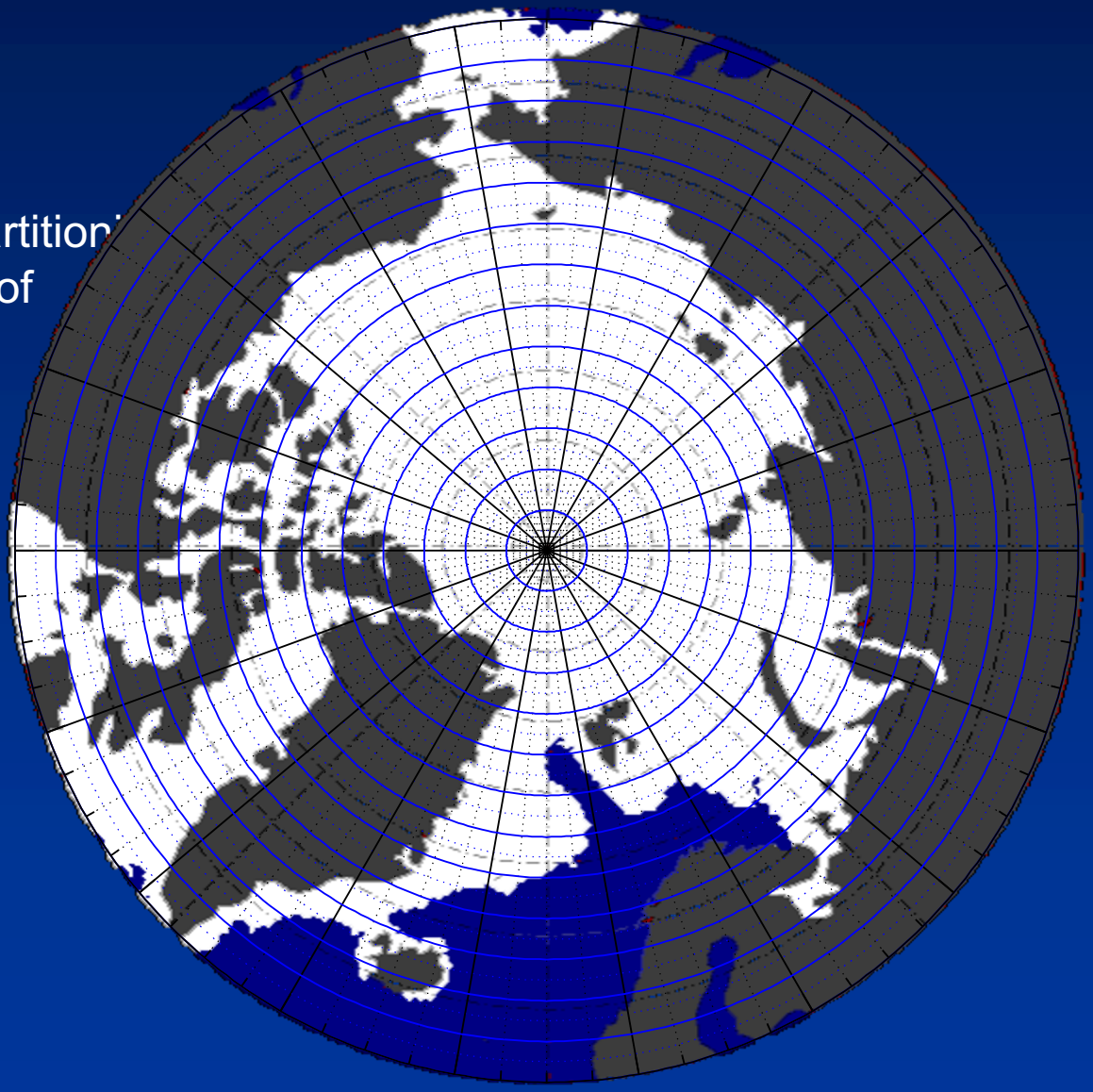






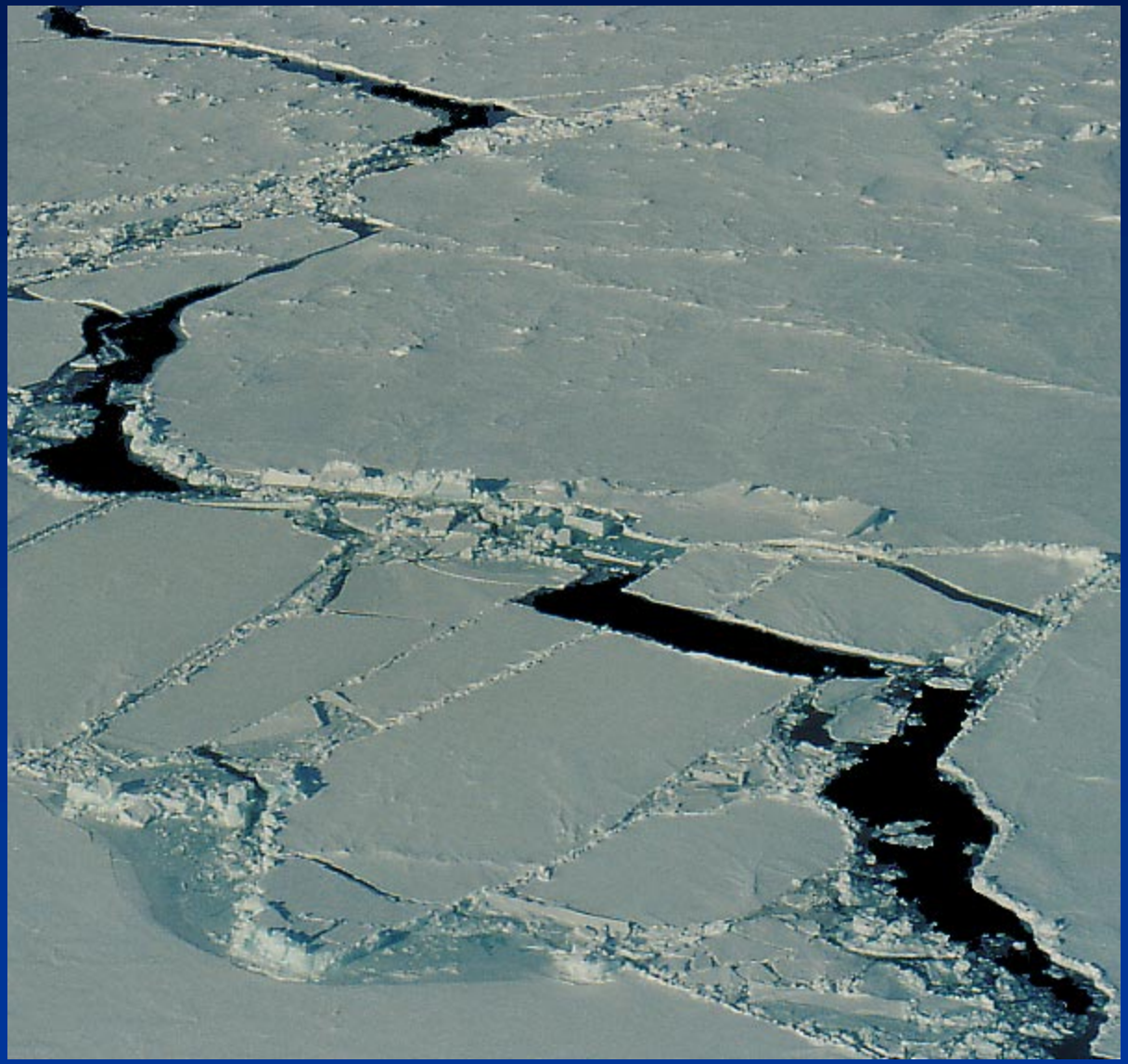
Region of Interest

- Pan – Arctic over ocean
- All on 25 x 25 km EASE grid
  (**E**qual **A**rea **S**calable **E**arth)
- Generate description of solar partition
- Daily values from 1979 to 2007 of
  - Incident solar energy
  - Reflected solar energy
  - Absorbed in snow and ice,
  - Transmitted to ocean
- Spectral, integrated, PAR



EASE grid over the Arctic Basin…from 1979 to 2007…daily

Solar input to open water



Input:
- Incident (F_r) from ERA-40
- Ice concentration (C)
- Water albedo (α) = 0.07

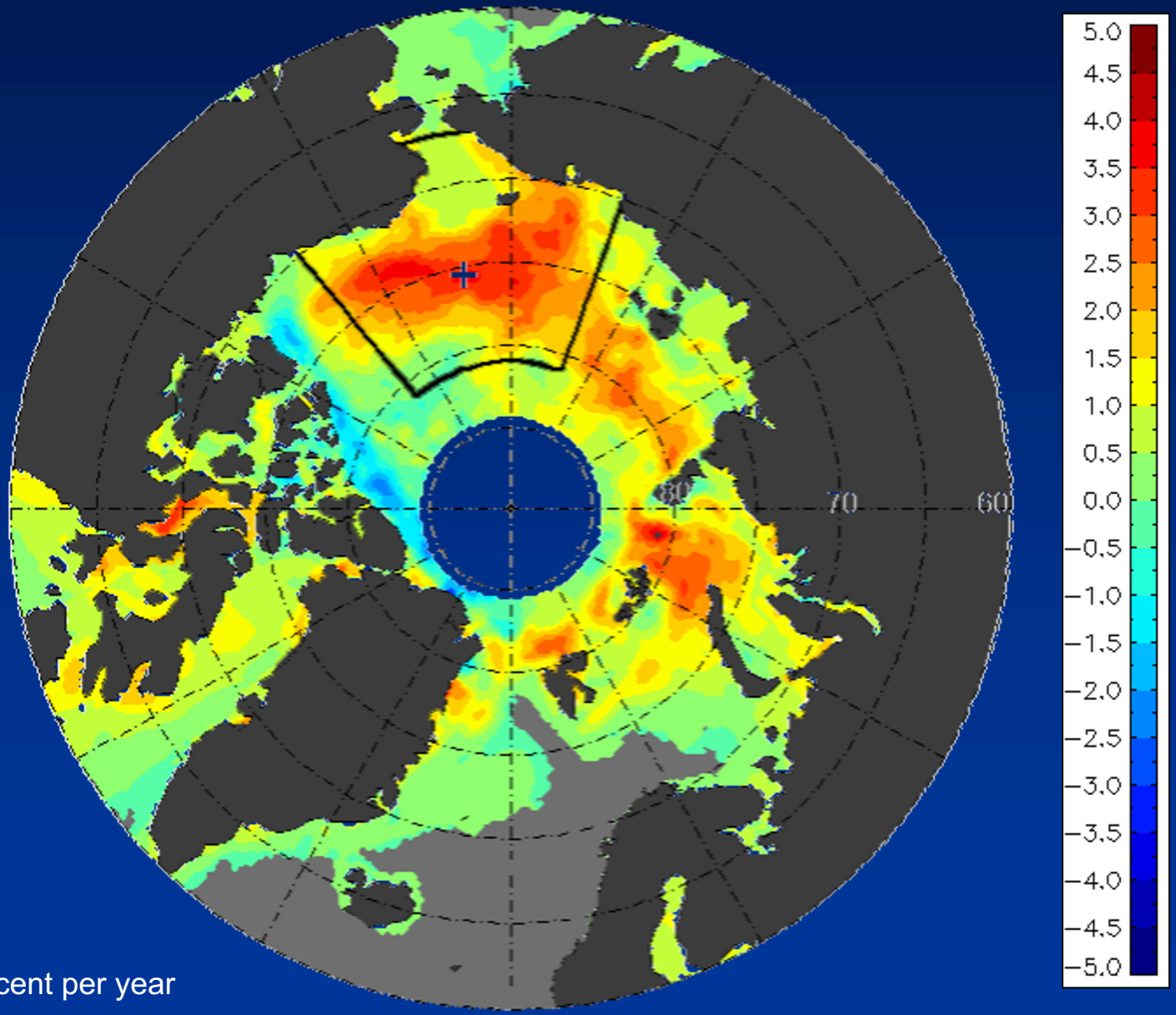
Output:
Solar input to the ocean (F_w)

$$F_w = F_r (1 - \alpha) (1 - C)$$

Assume ice is opaque, for now

Incident solar, ice concentration, and albedo -> heat input

27 year trend of annual ocean solar heat input



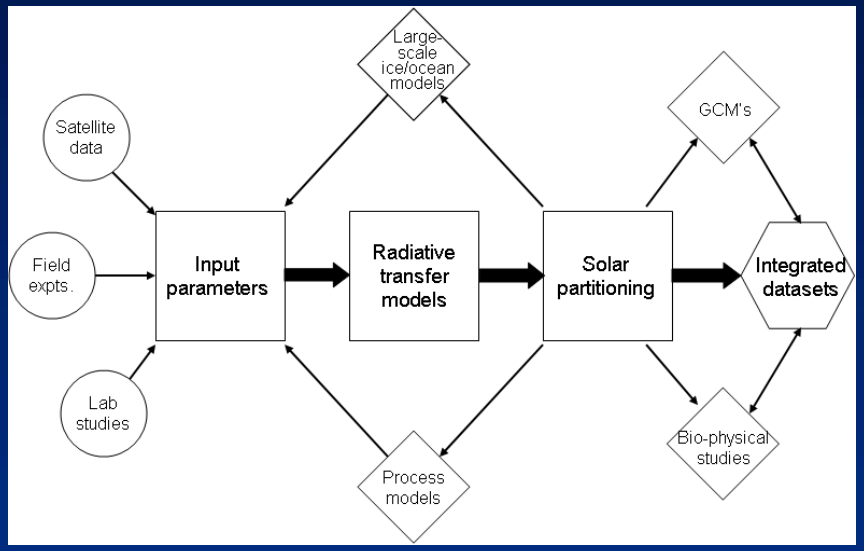
Units are percent per year

Increasing solar heat input in 85% of area

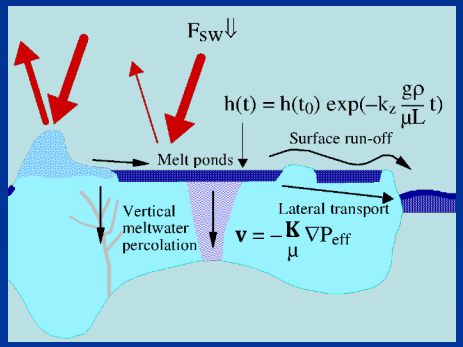
Next step: the ice

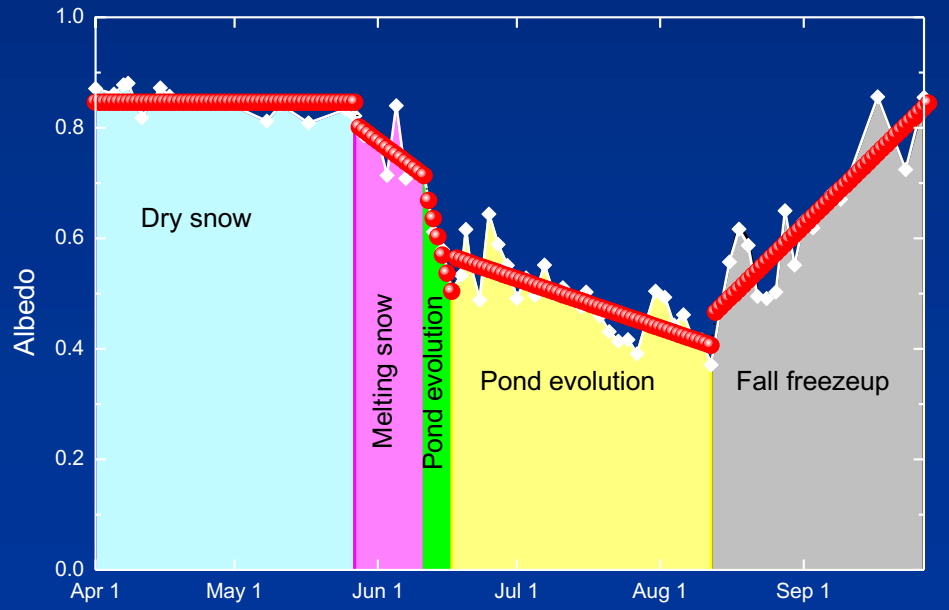
- Solar partitioning by ice
  - Reflected
  - Absorbed
  - Transmitted

- Input from:
  - process studies
  - field experiments
  - models
  - satellites



- Snow depth and ice thickness distributions
- Timing of onset of melt and freezeup
- Seasonal evolution of ice albedo
- Pond evolution
- Every day, over the entire grid





Do the hard part

Outreach

Scientific community
- Archived datasets
- Web site
  - Map based
  - One click to data
- Integrated datasets will benefit
  - Sea ice mass balance
  - Oceanography
  - Atmospheric chemistry
  - Large-scale modeling
  - Future field planning

Public
- General interest article on ice-albedo feedback
- Public lectures
- K-5 synthesis puzzles

Synthesize and collaborate