

midterm outline of topics

1. Seager, Serreze, and Scambos (northern hemisphere part) papers; *Global Outlook* chapters 1 through 5 and 7
2. ice on earth
 - (a) H₂O crystals: growth from liquid & vapor, shape
 - (b) precipitation of ice from the atmosphere
 - (c) snow diagenesis: densification & near-surface processes
3. components of the cryosphere
 - (a) broad themes
 - formation
 - connections among components
 - issues of scale
 - (b) sea ice
 - formation process; ice types
 - Arctic v. Antarctic: general characteristics
 - (c) snow
 - (d) lake & river ice
 - (e) frozen ground
 - thermal regime; seasonal cycles
 - distribution
 - (f) glaciers and ice sheets
 - classification: thermal, surface facies, flow
 - conservation equations: momentum, mass, energy
 - momentum balance
 - * boundary conditions
 - * constitutive relationship between stress and strain
 - energy balance
 - * processes affecting ice temperature (terms in the conservation equation)
 - * temperature profiles

4. the arctic cryosphere (through to sea ice, not Greenland Ice Sheet)
 - (a) Arctic ocean basics: stratification, circulation
 - (b) sea ice
 - formation processes, seasonal cycle
 - trends, variability
 - causes for change
5. global climatology
 - (a) energy balance
 - (b) general circulation of atmosphere
 - (c) general circulation of ocean
 - shallow
 - thermohaline circulation
 - North Atlantic Deep Water formation processes
 - (d) seasonal cycles
 - (e) modes of variability (especially NAM/SAM)