ARC3O workflow

1 Prepare masks for season and ice types

GCM
Sea-ice thickness
Snow thickness
Surface temperature

→ Processing for each point →

Mask for seasons
Melting snow, bare summer ice, cold conditions

Mask for ice types
First-year ice, multiyear ice

2 Prepare sea-ice profiles for cold conditions

GCM
Sea-ice thickness
Snow thickness
Surface temperature

Masks (ice types and seasons)

→ Processing for cold conditions points →

Snow-covered ice profiles
Layer temperature, salinity, thickness, wetness, density, correlation length, snow/first-year/multiyear ice

Bare ice profiles
Layer temperature, salinity, thickness, wetness, density, correlation length, first-year/multiyear ice

3 Compute sea-ice surface brightness temperature for cold conditions

Snow-covered ice profiles → MEMLS → ***Snow-covered ice brightness temperature*** → x snow-cover fraction →

Bare ice profiles → MEMLS → ***Bare ice brightness temperature*** → x bare fraction →

Cold conditions ice brightness temperature

4 Compute sea-ice surface brightness temperature for all conditions

Cold conditions ice brightness temperature

Masks (seasons)

→ Processing for each point →

Ice brightness temperature
Cold conditions: *Cold conditions ice brightness temperatures*
Melting snow: *Snow surface temperature*
Summer bare ice: *Constant inferred from observations (266.78 K)*

5 Add sea-ice concentration and atmospheric effect

GCM
Sea-ice concentration
Melt pond fraction
Snow-ice column surface temperature
Sea surface temperature
Atmospheric columnar liquid water and water vapor

Ice brightness temperature

→ Simple ocean emission and atmospheric radiative transfer model (Wentz and Meissner , 2000) →

Brightness temperature at top of atmosphere

Figure 1 from
Burgard, C., Notz, D., Pedersen, L. T., and Tonboe, R. T. (2020): "The Arctic Ocean Observation Operator for 6.9 GHz (ARC3O) – Part 2: Development and evaluation", The Cryosphere, 14, 2387–2407, https://doi.org/10.5194/tc-14-2387-2020.