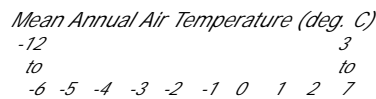


# Permafrost Extent by Surficial Deposit



- Bedrock
- Colluvium: Hillside
- Colluvium: Retransp.
- Glacial: Old
- Glacial: Young
- Eolian: Sand
- Eolian: Loess
- Glaciofluvial: Old
- Glaciofluvial: Young
- Glaciolacustrine
- Glaciomarine
- Fluvial: Aband./Terr.
- Fluvial: Active/Inact.
- Alluvial-Marine
- Coastal: Beach
- Coastal: Delta
- Water

See color legend below

# Permafrost Characteristics of Alaska

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A new permafrost map of Alaska, using a terrain-unit approach for mapping permafrost distribution based on climate and surficial geology is presented in conjunction with the Ninth International Conference on Permafrost held at the University of Alaska, June 29 to July 3, 2008. This map represents the third iteration of a permafrost map for Alaska, following the circum-arctic permafrost map (Brown et al. 1997), which made minor modifications to the initial map by Ferrians (1965). To map permafrost, we developed a rule-based model (see color-coded table) that incorporated mean annual air temperatures (MAAT) from the PRISM climate map and the surficial geology map (see back), of Karlstrom et al. (1964). We used terrain-permafrost relationships developed by Kreig and Reger (1982) and our knowledge of permafrost distribution to assign permafrost characteristics to each surficial deposit under varying temperatures. Surficial geology greatly affects permafrost characteristics because of differences in topography, soil texture (which affects moisture and thermal properties) and hydrology (surface-water and groundwater). We modified the surficial geology map to update some areas with new information (e.g., eolian loess and sand, and glaciomarine deposits).

We coded the permafrost map with surficial geology, MAAT, primary soil texture, permafrost extent, ground ice volume, and primary thermokarst landforms. The map focuses on the top 10 m of permafrost, where permafrost can be more readily mapped from surface features, determined by simple field measurements, and where ground ice usually is most abundant. Distribution of permafrost shown on the map is therefore also based on our knowledge about the presence or absence of permafrost within the upper 10 m. Although we used recent MAAT in our rule-based model, we note that permafrost distribution is greatly affected by past climates.

We relied on many sources for the effort but are not able to cite all references here. The main map shows permafrost thickness values based on MacCarthy (1952), Brewer (1958), Ferrians (1965), Péwé (1975), Osterkamp and Payne (1981), Lachenbruch et al. (1987), and Collett et al. (1989). Depths were determined by temperature logging or interpretation of ice-bearing permafrost from geophysical data. Southerly sites are included when the presence of permafrost is evident even if permafrost thicknesses were not determined.

The following characteristics are shown on small thematic maps on the reverse side of the main map:  
 Ground temperatures (usually measured at depths 20-30 m) were obtained from boreholes by V. Romanovsky, G. Clow, K. Yoshikawa, and T. Osterkamp as part of the Thermal State of Permafrost project for the International Polar Year (Brown and Romanovsky 2008). Only recent data are used.

Ground ice volumes were estimated for the upper 5 m of permafrost using terrain relationships established by Kreig and Reger (1982) and our field data. Ground ice volume near the surface is higher in colder regions due to active ice-wedge formation and ice segregation in fine-grained deposits. Buried glacial ice in old or stagnant young moraines is included, but is irregularly distributed at this map scale.

Pingo distribution was compiled mostly from Holmes et al. (1968), Galloway and Carter (1978), and Walker et al. (1985) and by satellite image interpretation. There are >1500 known pingos in Alaska. In central Alaska and nearby Yukon areas, there are ~760 pingos, mostly open-system. Closed-system pingos predominate in the North Slope, Seward Peninsula, and Noatak regions. Not all pingos have been inventoried.

The distribution of ice wedges was determined from the literature, from polygonal patterns evident on remote sensing imagery, and from our field experience. Ice wedges actively form mainly in the continuous permafrost zone, and are inactive to weakly active in the discontinuous zone (Péwé 1975). Holocene ice wedges, which are limited to the top 3-5 m of permafrost, are smaller than large, deep (up to 35 m) syngenetic ice wedges formed during the Late Pleistocene. Symbols for abundant ice wedges denote general locations, whereas, symbols for sparse Holocene and Late Pleistocene wedges indicate specific areas, though distribution remains poorly known.

Thermokarst landforms are abundant in all permafrost zones (Jorgenson et al. 2008). They are varied, due to differences in temperature, ground ice volume, soil texture, slope, and hydrologic conditions. Abundance of thermokarst is difficult to map because of the wide range in size of features from small pits to large lakes, and similar landforms may have different origin.

The permafrost zones underlie 80% of Alaska, including continuous (32%), discontinuous (31%), sporadic (8%), and isolated (10%) permafrost. Glaciers and ice sheets occupy 4% of the area.

Many improvements are needed for a better permafrost map, including: a surficial geology map with updated information and better spatial accuracy; more information of terrain/ground ice/temperature/permafrost relationships; more temperature boreholes; and improved spatial models.

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## Legend

### Permafrost Distribution

- Glacier
- Continuous (>90%)
- Discontinuous (50-90%)
- Sporadic (10-50%)
- Isolated (>0-10%)
- Absent (0%)
- Large Waterbodies (unfrozen below)

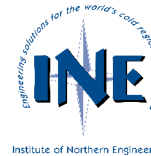
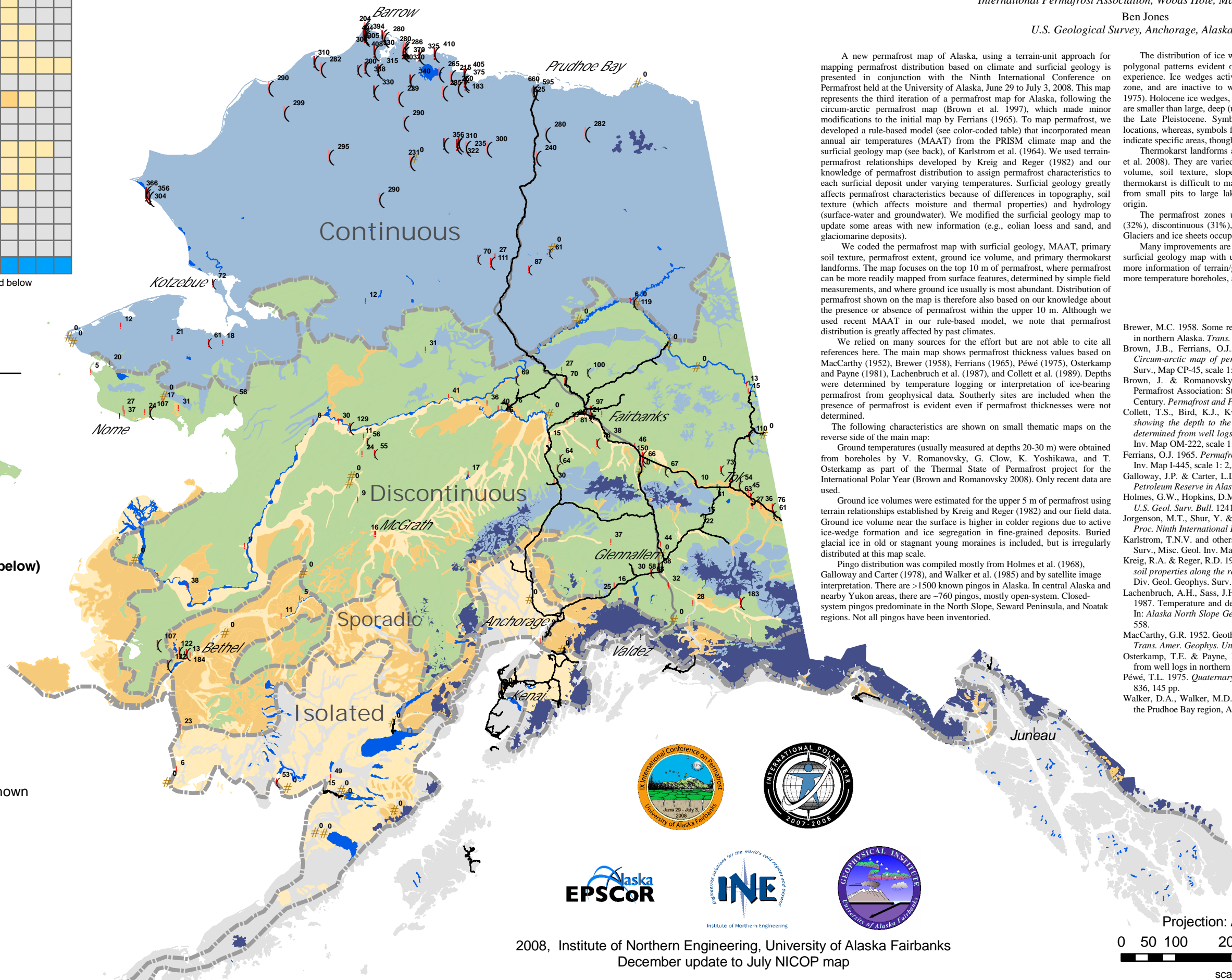
Permafrost\_Zones Generalized

### Permafrost Depth (m)

- 5 - 50
- 51 - 100
- 101 - 200
- 201 - 300
- 301 - 500
- 501 - 600
- # Permafrost present but depth unknown

### Other Features

- Major Roads
- Trans-Alaska Pipeline



2008, Institute of Northern Engineering, University of Alaska Fairbanks  
 December update to July NICOP map

Projection: Albers Alaska, NAD 83

