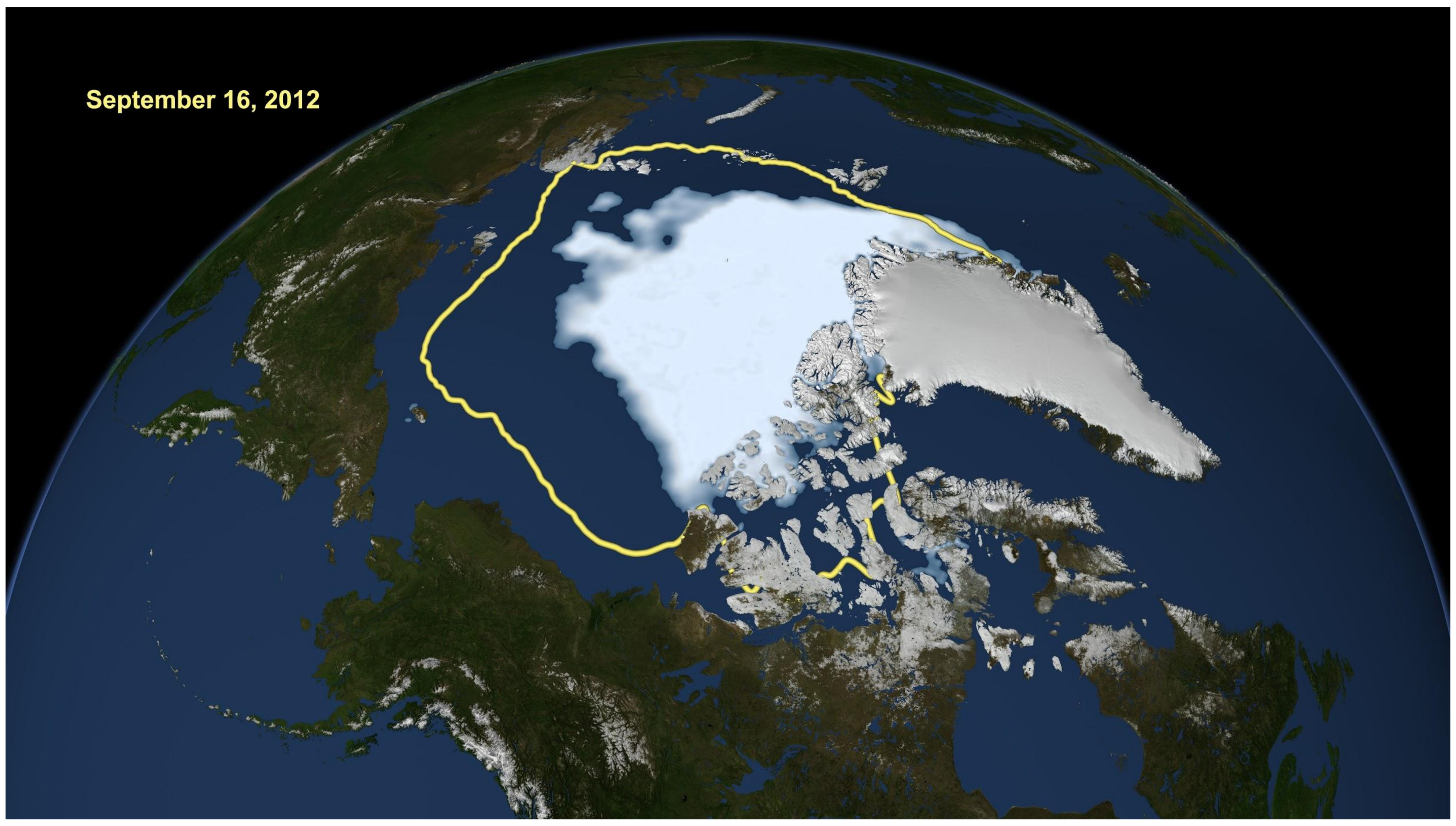
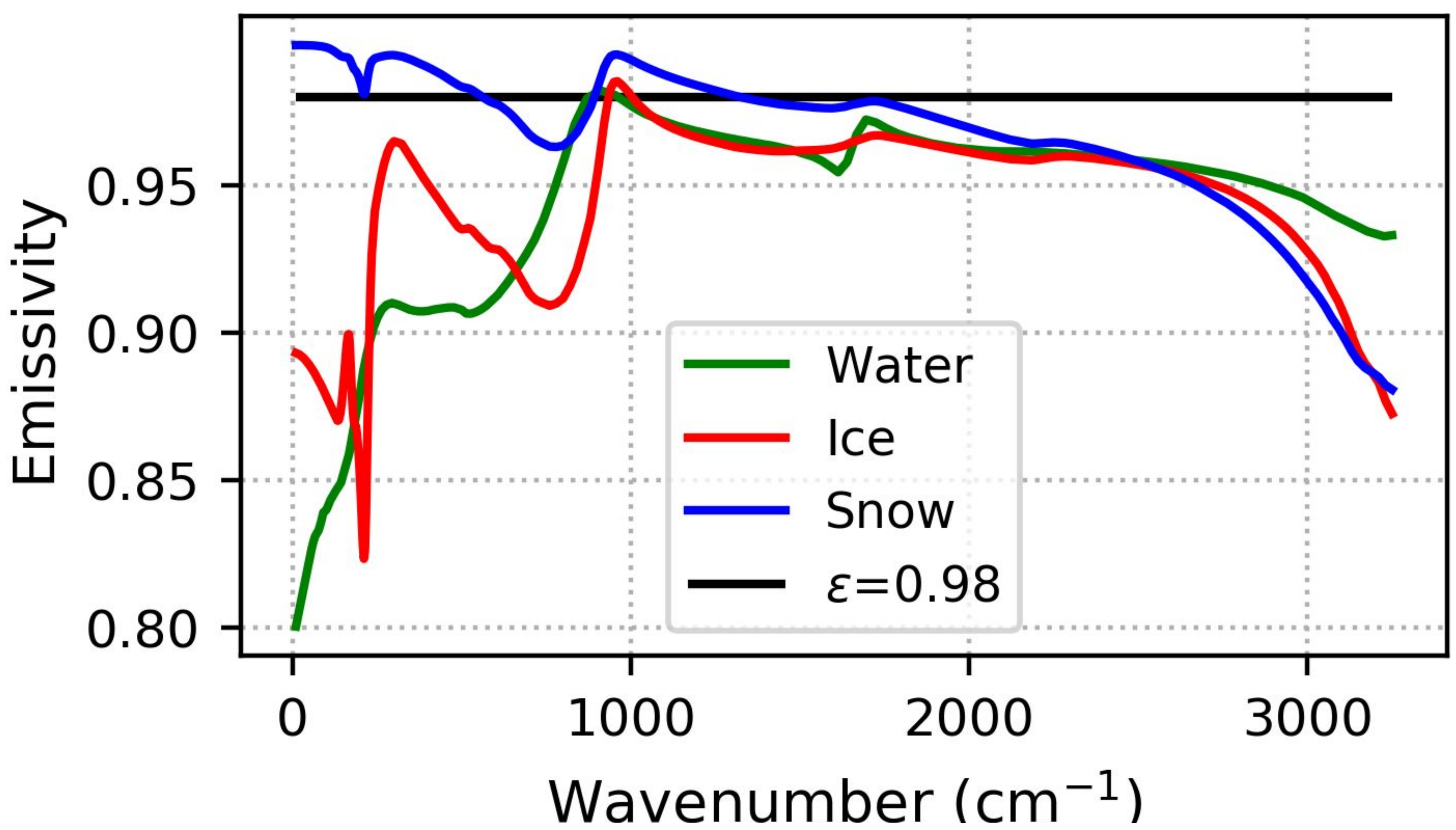
Medium-dependent sea-ice emissivity



Top: Sea ice extent during record minimum in September 2012. 30 year average minimum extent in yellow. Photo courtesy of NASA/Goddard Space Flight Center Scientific Visualization Studio.

Bottom: Emissivity of ice and water based on Fresnel's equations and snow emissivity computed by Huang et al (2016) (DOI: 10.1175/JAS-D-15-0355.1). Current greybody (0.98) emissivity shown for reference.



Polar warming alters the dominant sea-ice type by accelerating snowpack melt on sea ice, enhancing the coverage of melt ponds and exposing more bare ice. Such variations modify not only the surface albedo but also the surface emissivity.

The emissivity of snow, water, and ice vary independently across the infrared spectra. As we move from snow towards darker ponded and bare ice surfaces, we expect weaker sea-ice surface radiative cooling overall. To understand the energy balance over polar regions, it is thus crucial to represent spectrally resolved emissivity for each surface type.

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