

Seasons on Pluto

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In the cold outer solar system Pluto and Triton have nitrogen atmospheres in vapor pressure equilibrium with surface frosts (Stern and Trafton, 1984; Elliott *et al.*, 1989; Hubbard *et al.*, 1990; Owen *et al.*, 1992; Owen *et al.*, 1993). Nitrogen sublimates from the pole experiencing spring and condenses on the pole in autumn. This seasonal transport affects the pressure of the atmosphere, the location of polar cap boundaries (thus the albedo seen from the earth), and the surface temperatures.

Hansen and Paige (1992, 1996) developed a finite-element parameterized thermal model that balances and conserves energy across the body while tracking locations and quantities of N₂ sublimation and condensation in and out of the atmosphere. The model successfully predicted the increase in pressure of Pluto's atmosphere even as it moved away from perihelion.

In 2011 Hansen and Paige succeeded in getting an OPR grant approved to get their code running again. Once that is done predictions of observables such as disk-integrated albedo and atmospheric pressure can be compared to the new data collected in the past 15 years. This comparison will constrain parameter space more than was possible in the 1990's, giving us a better sense of the climate and surface and frost properties on Pluto. This poster talk will cover previous, and the status of future, lines of investigation.

The pressure of Pluto's atmosphere is of keen interest to the New Horizons team. One might expect that as Pluto moved away from perihelion its atmospheric pressure would drop steadily. The H&P model however predicts a boost in atmospheric pressure, with the expected drop delayed to 2025. The reason for this is illustrated in figure 1 – Pluto's obliquity matters! The subsolar point crossing the equator coincided approximately with perihelion in 1989. Since then the frost-covered north polar regions have been increasingly illuminated and solar insolation is causing the frost to sublime. Sublimation in the north is occurring more rapidly than condensation of frost in the south polar region.

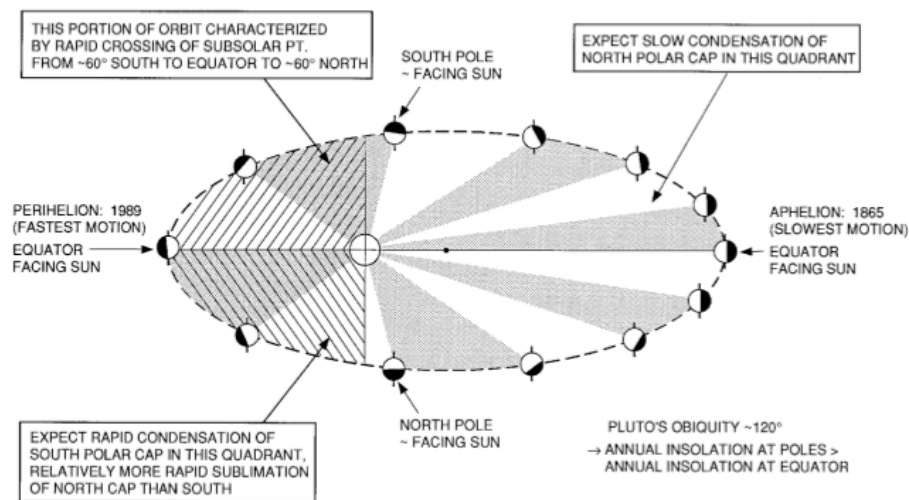


Figure 1. The seasons of Pluto.