Introduction: The existence of high-standing relatively young structures like Wright Mons and Picard Mons has been postulated to be the result of cryovolcanic activity [1-3]. The observation of entrained tholin materials in the base of troughs and channels like Virgil and Inanna Fossae has recently been suggested to be the result of material deposition from NH₃ laden H₂O cryovolcanic flow, both explosive and seeping [4]. Similarly, cryovolcanism has been invoked to explain both the remarkable smoothness and the occasional presence of several foundered crustal blocks observed of Charon’s Vulcan Planum [5].

Aims: In this study we consider the shape and scope of what cryovolcanic flow would look like for conditions typical of Pluto’s surface. We consider a series of theoretical calculations assuming cylindrically symmetric flow of NH₃ rich H₂O slurry with and without additional methanol based on published rheological studies [6]. We construct a simple flow model to assess the competing process times between cooling and flow front advance (see Fig. 1).

We assess various timescales associated with initial surface crusting driven by rapid NH₃ sublimation. We compare that against the time it takes the flow to extend before the flow head freezes (Fig. 2). We take these basic theoretical considerations and numerically construct cylindrically symmetric mounds and compare them with surface textures observed from New Horizons acquired data and subsequently derived Digital Elevation Models.

Some Results: We assess the distance over which flows can reach before freezing over surfaces of a given initial slope. We find that for conditions representative of Pluto’s surface NH₃ laden H₂O cryoflow over a surface with a mean slope angle of θ=1-10 degrees can extend between 1 and 3 km before the flow front freezes (e.g., Fig. 3). More general results will be presented at the meeting. If time permits, we will also present full landform evolution modeling of cryovolcanic seeping flow in a model channel configuration.

Figure 1 Simple theoretical model of surface cryolava flow. Various quantities involved include ammonium dihydrate (ADH). Various denoted levels correspond to transition levels from one state of flow to the other.

Figure 2 Cartoon depiction of idealized flow front and configuration. r_f is the flow extent before freezing. H_f is the thickness of the flow head at the point of freezing. θ is the mean basal slope angle.

Figure 3 Flow extent before freezing in a cylindrically symmetric configuration for different values of slurry viscosity μ. This particular result is shown for a mean slope angle of 1 degree. Injection rate for the recent Kilauea event shown.