Homework problems on Fluid Dynamics

(1.63J/2.21J)

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12-radome.tex

Radome in the rain. Radar instruments in communication with satellites are often housed in a spherical dome. When it rains, a thin water film is formed on the dome (the radome) and the transmission of radio signals is affected. Let the rainfall rate be P cm/s and the radius of the radome by R . which is thousands times greater than the film thickness. Assume that the raindrops are so fine(drizzle) that their downward momentum is negligible, and the film flow is laminar. Derive an approximate formula for the thickness $h(\theta)$ valid away from the top, as a function of the polar angle θ, P, R and physical constants ν and g. What is the thickeness of the film at the equator if $R = 100$ m and $P = 0.2$ cm/hour?

Hint: Use the 1D result of uniform flow down an incline as a local approximation.

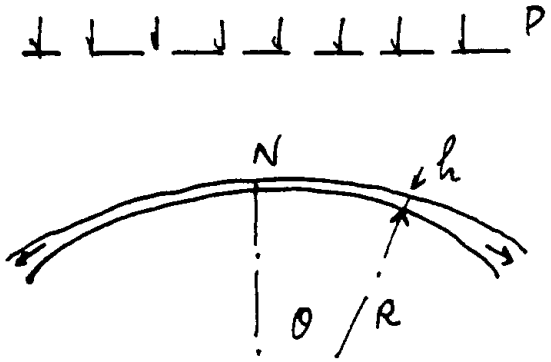

Figure 1: Radome in the rain