

TREES UNDER CLOUDS

A conducting layer of clouds hangs over a broad flat valley at an altitude of 1 km above the ground, which is saturated with water and therefore also a conductor. The cloud layer carries a charge density σ C m⁻².

A hemispherical grove of wet, conducting trees of radius 20 m grows on the plain.

- a. Find the electrostatic potential $V(r)$ everywhere between the ground and the clouds. You may take the potential of the valley floor as $V = 0$.
- b. Find the field $\mathbf{E}(r)$ everywhere between the ground and the clouds. Where is the field greatest?
- c. Suppose the wet air between the trees and the clouds will spark when the electric field reaches $100\,000$ V m⁻¹. Find the charge density on the clouds which will cause the trees to spark.