

# **Fog**

**CSCI 4229/5229**

**Computer Graphics**

**Fall 2023**

# Justification

- Light is distorted with distance
  - Fog, haze, smoke, snow, dust, suspended particles and pollution limits visibility
  - Turbulence and other thermally driven effects cause refraction and distortion
- Primarily applies to outside scenes
  - Critical under water and during precipitation
  - Smoke filled room indoor example

# Implementation in Computer Graphics

- Blend object color with background color
  - More of background with greater distance
  - Distance measured from observer
  - Transition with distance generally nonlinear
  - Cutoff distance – objects beyond this are obscured
- Background color typically should match fog color (unless completely covered by objects)

# Fog Equations in OpenGL

- $C = f C_{\text{obj}} + (1-f) C_{\text{fog}}$
- $f = (d_{\text{end}} - d) / (d_{\text{end}} - d_{\text{start}})$  [ limited to 0-1 ]
- $f = \exp(-\gamma d)$
- $f = \exp(-\gamma^2 d^2)$ 
  - $d$  is the distance from the observer
  - $d_{\text{start}}$  and  $d_{\text{end}}$  is the range of linear fog
  - $\gamma$  is the fog density

# Fog in OpenGL

- glEnable(GL\_FOG)
- glFog\*
  - GL\_FOG\_MODE
    - GL\_LINEAR, GL\_EXP, GL\_EXP2
  - GL\_FOG\_COLOR (  $C_{\text{fog}}$  )
  - GL\_FOG\_DENSITY (  $\gamma$  in GL\_EXP & GL\_EXP2 )
  - GL\_FOG\_START (  $d_{\text{start}}$  in GL\_LINEAR )
  - GL\_FOG\_END (  $d_{\text{end}}$  in GL\_LINEAR )