Controlling outdoor and indoor spread of COVID-19

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Contents

1 Outdoor transmission of COVID-19

1.1 (a) Temporal evolution of the virus concentration at head height at platforms 1, 3, 7, and 13

To calculate the concentration of COVID-19 virus at each of the viewing platforms, the virus is considered to be released by the concert-goers in platform 13 as a **point, continuous, 3D release**. As a result, the concentration is obtained by using the following governing equations for point, continuous, 3D release:

$$\frac{\dot{M}}{4\pi D_t r} erfc(\frac{r}{\sqrt{4D_t t}}) \tag{1}$$

However, the virus paticles are also reflected when it hits the boundary, which is the ground surface (z=0). As a result, an image source needs to be introduced. Thus, the equation used to calculate the virus concentration at different viewing platforms are:

$$\frac{\dot{M}}{4\pi D_t r} erfc(\frac{r}{\sqrt{4D_t t}}) + \frac{\dot{M}}{4\pi D_t r_2} erfc(\frac{r_2}{\sqrt{4D_t t}}) \tag{2}$$

Where radius, r, of the viewing platforms calculated can thus be calculated by $\sqrt{x^2 + y^2}$, considering the x and y coordinates of the viewing platforms tabulated below and r_2 is radius from reflector surface (the ground).

In this scenario, M is taken as $\frac{98}{3600} * 4$, in line with the approximate Quanta emission rate of speaking loudly/singing, D_t is assumed to be 1 $m^2 s^-1$, and every concertgoers have the same height, thus dz = 0.

Viewing Platforms	Coordinates (x,y)
1	(-8,8)
3	(0,8)
7	(-4,4)
13	(1,1)

Applying equation 2 on coordinates of viewing platforms 1, 3, 7, and 13, the temporal evolution of the concentration of the virus can be obtained.

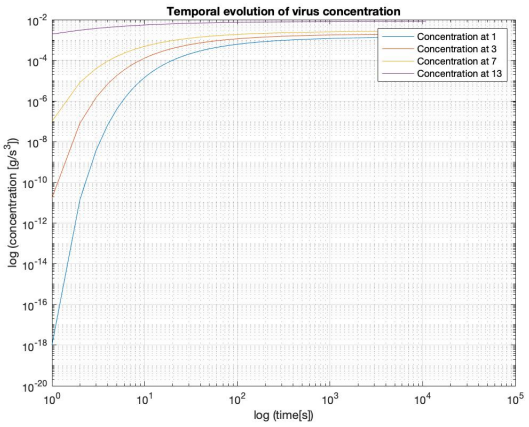

Figure 1: Temporal evolution of virus concentration

From the plot, it is shown the closer the viewing platforms are to the people infected by the SARS-CoV-2, the higher the concentration of the virus at all times. However, the difference decreases overtime as time goes to infinity...