Old Wind Element Revamp

So this revamp consists of fixing old wind element if the target player is at approximately the same height (y) as the player.

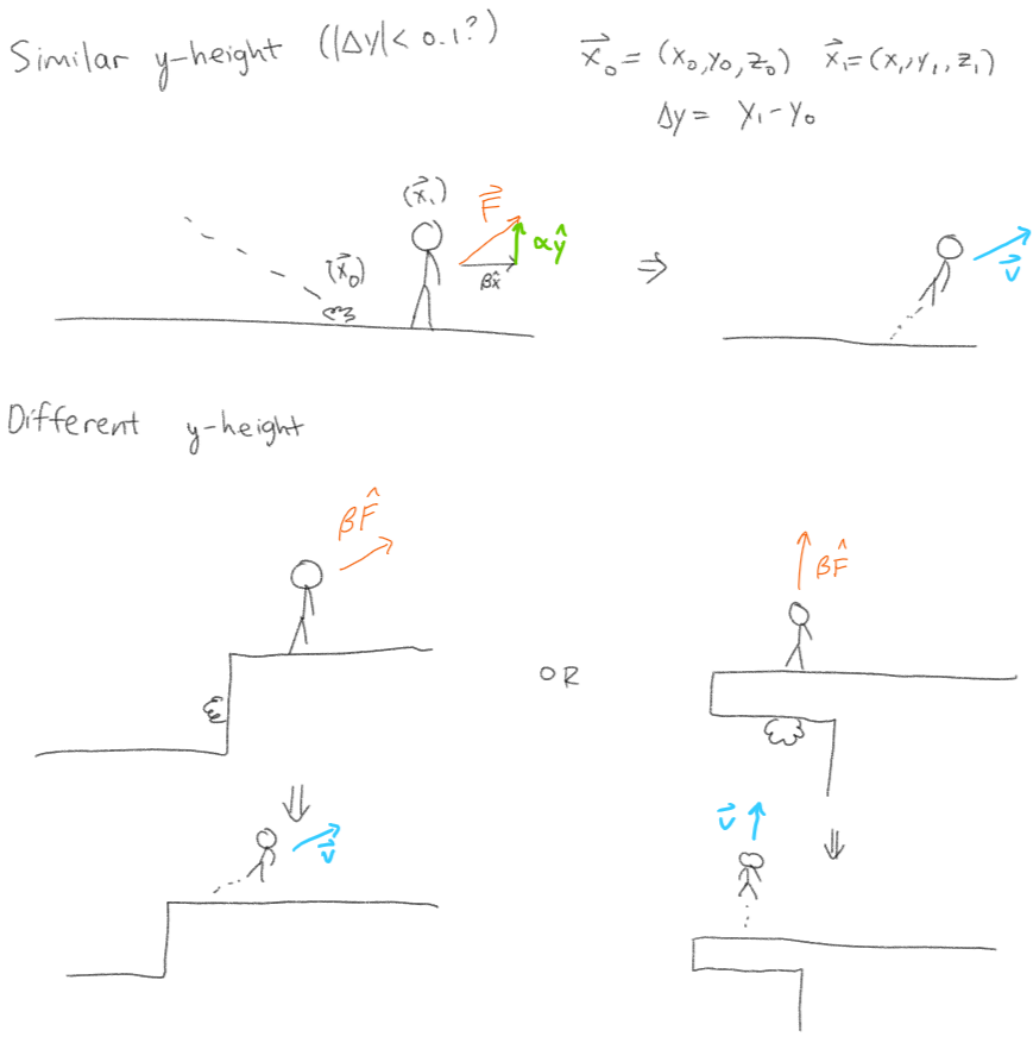

Figure 1: New wind element mechanics.

The problem was that wind element would always act in the $\hat{\boldsymbol{F}}$ direction. First, let's define the vector that points from the impact location to the player,

$$\boldsymbol{r} = \boldsymbol{x_1} - \boldsymbol{x_0} \tag{1}$$

We can then define $\hat{\boldsymbol{F}}$ as

$$\hat{\boldsymbol{F}} = \frac{\boldsymbol{r}}{||\boldsymbol{r}||} \tag{2}$$

The wind element could then be defined as having a force of

$$\boldsymbol{F} = \beta(\boldsymbol{r})\hat{\boldsymbol{F}} \tag{3}$$

where β is the strength of the force, varying with distance. The problem here is that if the player and the wind element are approximately on the same plane (perhaps $|(\boldsymbol{x_1} - \boldsymbol{x_0})_y| = |\Delta y| < 0.1$), then $\boldsymbol{F}_y \approx 0$. For most purposes this is fine, but if the player is on the ground, then they will encounter ground friction and basically go nowhere, giving rise to the complaints that old wind element was useless. Here's a few solutions to this:

1 Upwards Force

One solution is to simply add a vertical component to the force if $|\Delta y| < \delta$, where δ is the threshold for being "in the same plane." This would be accomplished by varying α in Figure 1. The algorithm would look something like:

$$\boldsymbol{F} = \begin{cases} \beta(\boldsymbol{r})\hat{\boldsymbol{F}} + \alpha\hat{\boldsymbol{y}} & |\Delta y| < \delta \\ \beta(\boldsymbol{r})\hat{\boldsymbol{F}} & \text{otherwise} \end{cases} \tag{4}$$

where α is some tuneable parameter.

2 Force Magnification

Another main problem is if the person was on the ground, hitting them directly with the wind element also did essentially nothing. This could be fixed with a slight tweak to equation (4).

$$\boldsymbol{F} = \begin{cases} c\beta(\boldsymbol{r})\hat{\boldsymbol{F}} & |\Delta y| < \delta \\ \beta(\boldsymbol{r})\hat{\boldsymbol{F}} & \text{otherwise} \end{cases} \tag{5}$$

where c is another tuneable parameter that determines the strength of the force magnification (e.g. $c = 1.1$).

3 Hitbox modification

Finally, a third solution which I think fixes both of these is to slightly change the point at which the player's location is calculated. Minecraft hitboxes give the player's coordinates at their feet, but if we change $\boldsymbol{x_1}$ such that the effective point of calculation is at the middle of the player, then both issues will be solved. Hitting the actual player beneath their midpoint will launch them, and hitting

the ground beneath them will also launch them, making much more realistic physics. This is simply done with

$$\boldsymbol{x_1} = (x_1, y_1 + 1, z_1) \tag{6}$$