# Operation O-Regen

New Mexico

Supercomputing Challenge

Final Report

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# Executive Summary

Operation O-Regen is a project to determine the outcome of the reduction in the production of harmful chemicals that damage the O-zone environment. We will be using a Net Logo 3D Preview 5 model to show this happening. In our power point presentation we will be describing in explicit detail the process of O-zone destruction and recreation and the molecules involved in them. We will give details on where these compounds come from and what they are comprised of. Finally, we will tell our plan for replenishing the O-zone layer.

# Problem Statement

The O-zone layer is comprised of O-zone ($O_3$) molecules; it regenerates itself when UV radiation reacts with $O_2$ molecules that float into the O-zone layer by breaking them into individual oxygen atoms. When a single oxygen combines with an $O_2$ it creates O-zone. Unfortunately, it is destroyed by the same process but with different materials. When compounds such as CFCs, methane, sulfur dioxide, and dinitrogen monoxide float into the O-zone the UV radiation breaks them apart releasing toxic elements such as carbon, nitrous oxide, sulfur, and chlorine. The original compounds that carry the destructive ones into the O-zone are produced by volcanoes, fecal matter, cars, refrigerators, aerosols cans, pesticides, and other everyday appliances.

# Method

First, we started out by researching the process in which o-zone is created and destroyed. After we processed the data that we had we began to implement the data into a model. At first we had problems deciding which programming language to write our model in so we agreed to disagree and Spenser did a StarLogo TNG model and Brendyn did a NetLogo model. Spenser's StarLogo TNG model focused directly on the atomic properties and relationships of the O-zone cycle. It doesn't focus on the production rate of the destructive molecules themselves nor does it depict the actual ratios of bad to good. Brendyn's NetLogo model focuses on the production rate and the atomic relationships, but doesn't accurately depict the actual ratios of bad to good. We decided to go with the NetLogo model because Spenser was having trouble finding the right code for the StarLogo TNG model to get working and Brendyn's model was friendlier to the eyes.

# Results

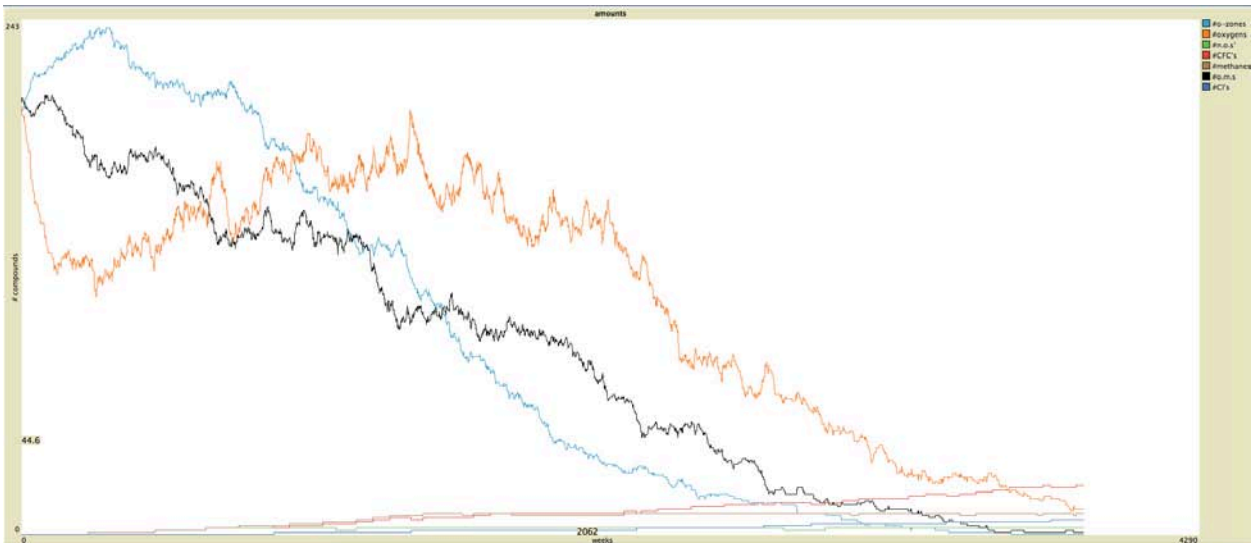
The results that we have come up with by using our model are that because we cannot reduce the amount of harmful chemicals that are already in the O-zone at this point in time the O-zone would most likely regenerate at a slow pace and be back at its full health in a matter of a few millennia. If the speed at which the harmful chemicals were being produced was to increase it would start to die off very fast once that rate hit a certain number. Also we found that if that rate were to stay at the same rate as it is today then the O-zone would deplete and probably be gone in around one millennia. Spenser hypothesizes that it would take 50 – 60 years for the O-zone to regenerate if production of the harmful chemicals ceased.

## Conclusion

The conclusion that we came to is that at the current rate of production of the destructive molecules the O-zone would continue to deteriorate until it ceased to exist. If this rate increased it would continue to accelerate the depletion. However, even from there it could still grow back if the rate decreased and the O-zone would continue to grow because of the constant stream of oxygen and $O^2$ combining.

## Achievement

Brendyn's greatest achievement is that he was successfully able to model the O-Zone depletion cycle using NetLogo. He did this using as accurate of numbers that we could without having the model overload and crash. This is a great achievement on his part. Spenser's greatest achievement for this year is successfully completing his second year of the Supercomputing Challenge. This is a giant step in the right direction for him.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#o-zones
#oxygens
#n.o.s
#CFC's
#methanes
#o.m.s
#Cl's
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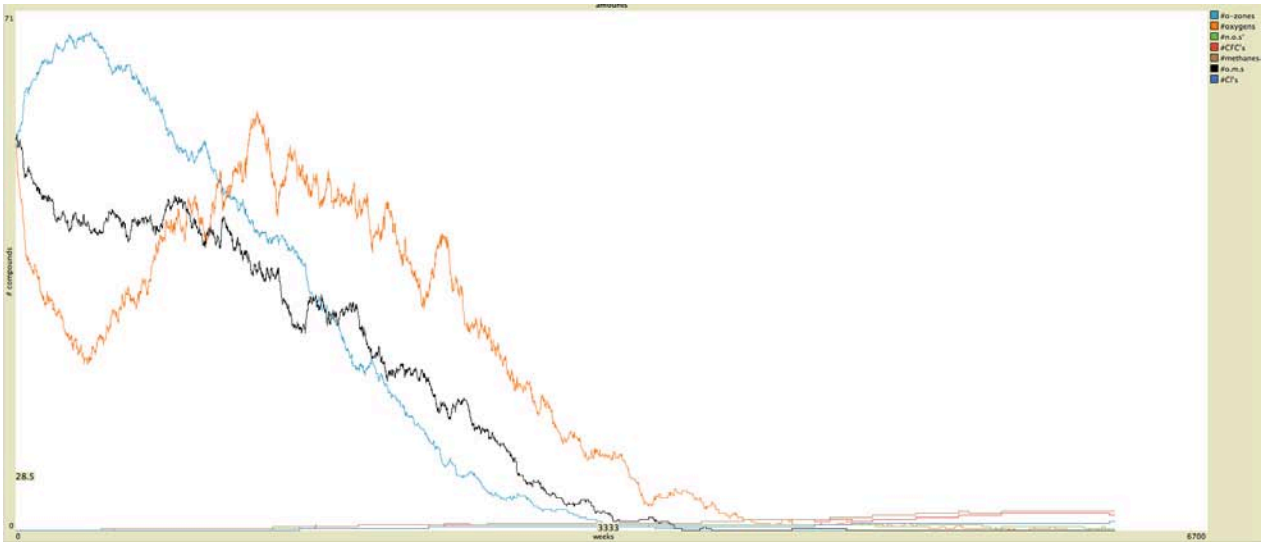
# compounds
44.6
0
2062
0
weeks
4290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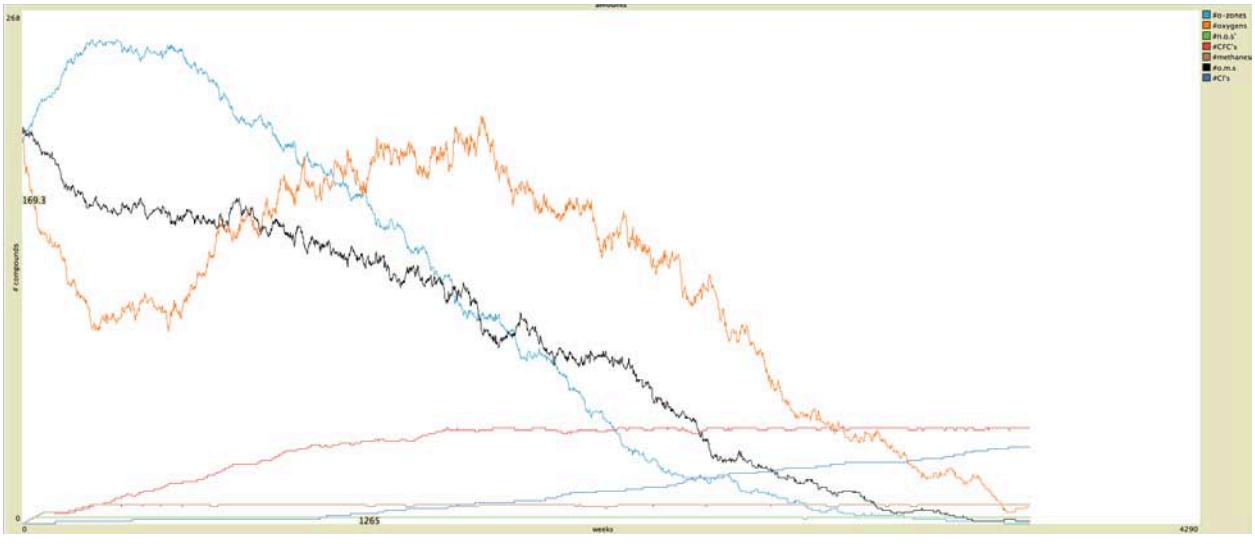
#oxygens
#n.o.s
#CFC's
#methanes
#o.m.s
#Cl's
71
# compounds
28.5
0
3333
0
weeks
6700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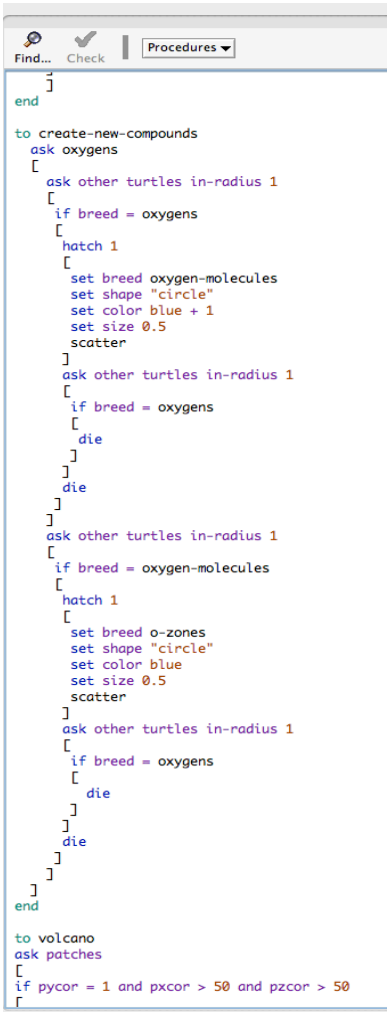
#oxygens
#n.o.s
#CFC's
#methanes
#o.m.s
#Cl's
268
# compounds
169.3
0
1265
0
weeks
4290

```
Find... Check | Procedures

to building
  ask patches
  [
   if pycor > 0 and pycor < 15 and pxcor > 5 and pxcor < 25 and pzcor > 29 and pzcor < 61 ; main building
   [
    set pcolor gray
   ]
   if pycor > 14 and pycor < 27 and pxcor > 8 and pxcor < 13 and pzcor > 35 and pzcor < 39 ; right tower
   [
    set pcolor gray - 1
   ]
   if pycor > 14 and pycor < 27 and pxcor > 9 and pxcor < 12 and pzcor = 37 ; right tower hole
   [
   set pcolor black
   ]
   if pycor > 14 and pycor < 36 and pxcor > 15 and pxcor < 22 and pzcor > 41  and pzcor < 48 ; big tower
   [
    set pcolor gray - 1
   ]
   if pycor > 14 and pycor < 36 and pxcor > 17 and pxcor < 20 and pzcor < 46 and pzcor > 43 ; big tower hole
   [
   set pcolor black
   ]
   if pycor > 14 and pycor < 27 and pxcor > 8 and pxcor < 13 and pzcor < 55 and pzcor > 51 ; left tower
   [
    set pcolor gray - 1
   ]
   if pycor > 14 and pycor < 27 and pxcor > 9 and pxcor < 12 and pzcor > 52 and pzcor < 54 ; left tower hole
   [
   set pcolor black
   ]
   if pycor > 0 and pycor < 10 and pxcor > 24 and pxcor < 30 and pzcor > 39 and pzcor < 51 ; office part
   [
    set pcolor gray
   ]
   if pycor > 0 and pycor < 4.6 and pxcor > 29 and pxcor < 31.4 and pzcor = 43 ; door
   [
    set pcolor gray - 1
   ]
   if pycor > 0 and pycor < 4.6 and pxcor = 29 and pzcor > 43 and pzcor < 45.4 ; door hole
   [
   set pcolor black
   ]
   if pycor > 0 and pycor < 4.6 and pxcor = 28 and pzcor > 43 and pzcor < 45.4 ; color differation in door hole
   [
   set pcolor gray + 1
   ]
   if pycor = 9 and pxcor > 29 and pxcor < 70 and pzcor > 39 and pzcor < 51 ; awning
   [
    set pcolor gray
   ]
   if pycor > 1 and pycor < 10 and pxcor = 44 and pzcor = 40 ;  first right column
   [
   set pcolor gray
   ]
   if pycor > 1 and pycor < 10 and pxcor = 44 and pzcor = 50 ; first left column
   [
   set pcolor gray
```

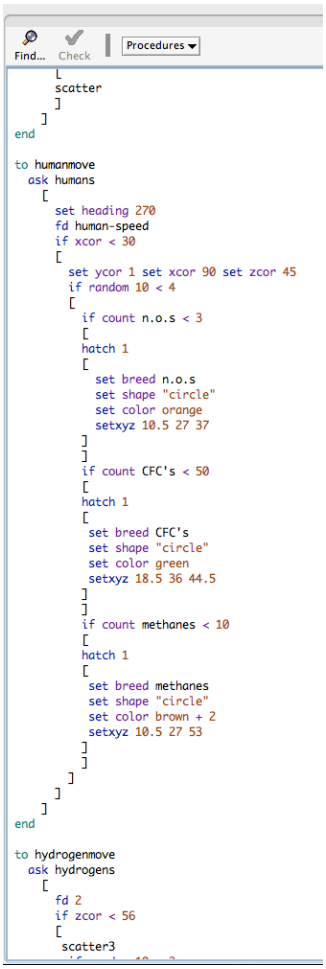


```
Find... Check | Procedures

    ]
end

to create-new-compounds
  ask oxygens
  [
    ask other turtles in-radius 1
    [
     if breed = oxygens
     [
      hatch 1
      [
       set breed oxygen-molecules
       set shape "circle"
       set color blue + 1
       set size 0.5
       scatter
      ]
      ask other turtles in-radius 1
      [
       if breed = oxygens
       [
        die
       ]
      ]
      die
     ]
    ]
    ask other turtles in-radius 1
    [
     if breed = oxygen-molecules
     [
      hatch 1
      [
       set breed o-zones
       set shape "circle"
       set color blue
       set size 0.5
       scatter
      ]
      ask other turtles in-radius 1
      [
       if breed = oxygens
       [
         die
       ]
      ]
      die
     ]
    ]
  ]
end

to volcano
ask patches
[
if pycor = 1 and pxcor > 50 and pzcor > 50
[
```



```
Find... Check | Procedures

      [
      scatter
      ]
    ]
end

to humanmove
  ask humans
    [
      set heading 270
      fd human-speed
      if xcor < 30
      [
        set ycor 1 set xcor 90 set zcor 45
        if random 10 < 4
        [
          if count n.o.s < 3
          [
          hatch 1
          [
            set breed n.o.s
            set shape "circle"
            set color orange
            setxyz 10.5 27 37
          ]
          ]
          if count CFC's < 50
          [
          hatch 1
          [
           set breed CFC's
           set shape "circle"
           set color green
           setxyz 18.5 36 44.5
          ]
          ]
          if count methanes < 10
          [
          hatch 1
          [
           set breed methanes
           set shape "circle"
           set color brown + 2
           setxyz 10.5 27 53
          ]
          ]
        ]
      ]
    ]
end

to hydrogenmove
  ask hydrogens
    [
      fd 2
      if zcor < 56
      [
       scatter3
```

# We would like to thank

Nick Bennett

For helping us with our model.

Karen Glennon

For allowing us to participate in the supercomputing challenge.

James Hoebing

For driving us to events.

Christopher Alme

For being our mentor.

And

Jackson Middle School PTA

For funding our participation.