Assignment 1

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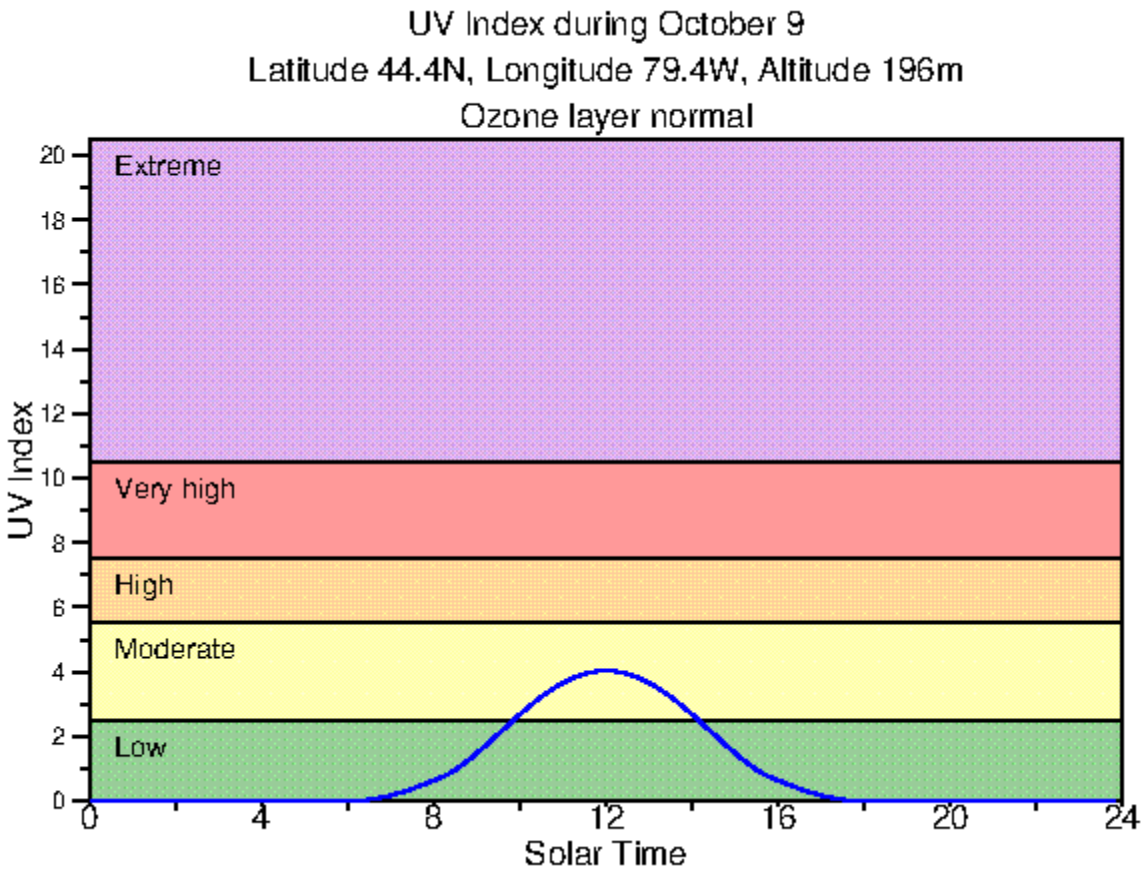
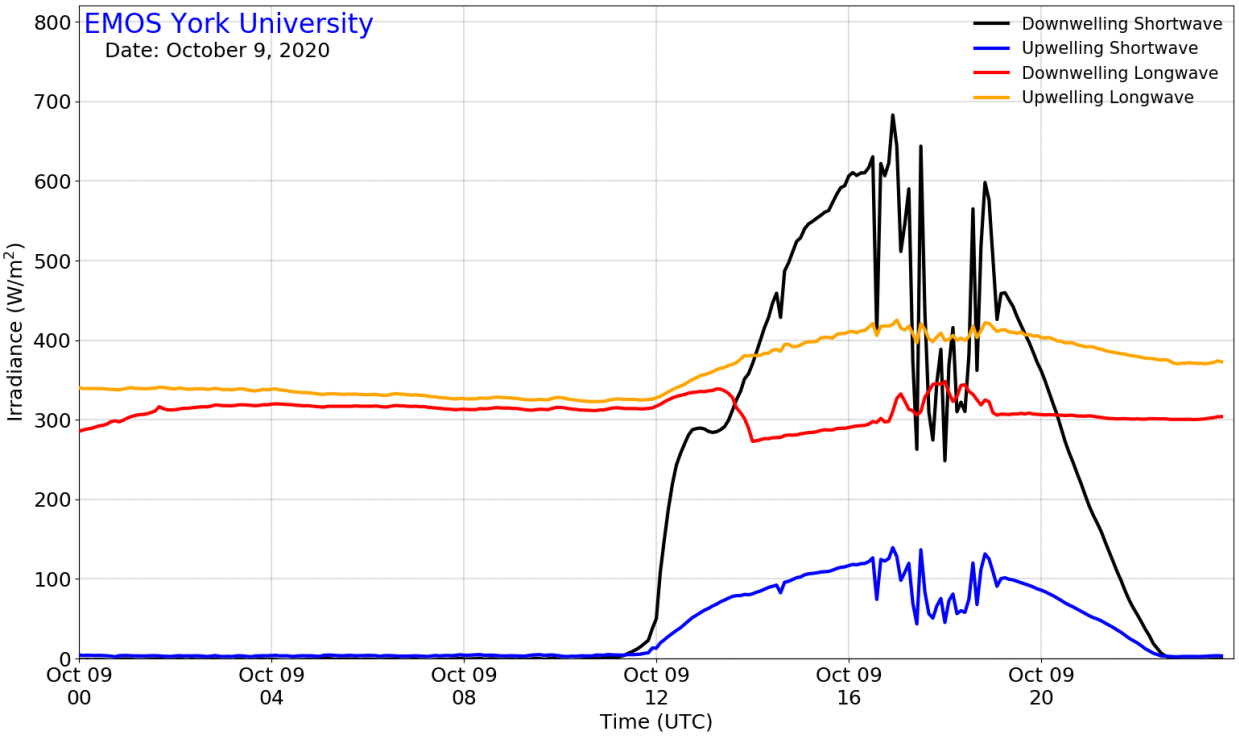
NATS 1780

latitude 44.4N Longitude 80.0W Attitude 196m

Question 1.

a. I. maximum value of the uv index calculator for October 9th is 4.2.
II. The time of day this maximum is reached is 12:00 solar time on October 9th.





b.

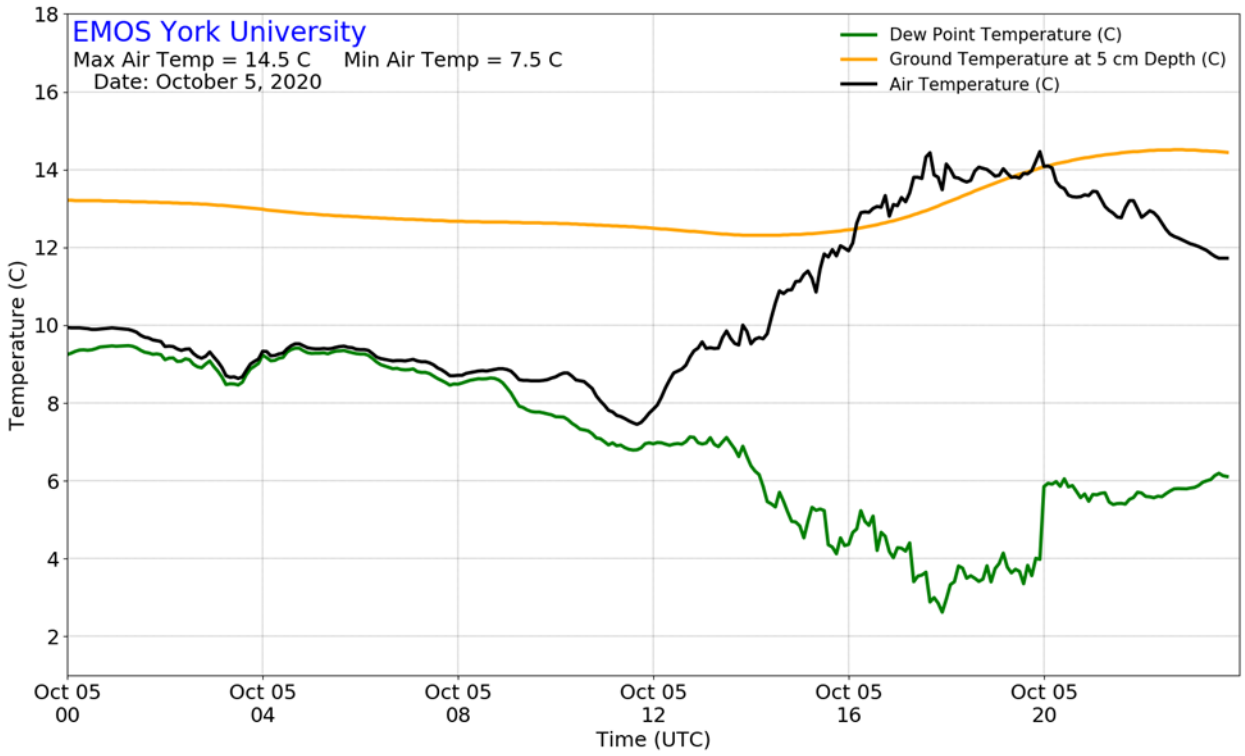
I. Maximum value of the downwelling shortwave irradiance is 680W/m^2, this time is about 16:50UTC.

II. For the Toronto's solar time, 12:00 solar time means 16:00 UTC, so the difference of those two time is about 50 minutes.

III. The UV index measures the strength of the sunborn-producing ultraviolet (UV). EMOS measures the downwelling shortwave irradiance, it includes UV and the visible light.

IV. Maximum value of the upwelling longwave irradiance is 430 W/m^2. This time is about 19:00 UTC. (There is one that is same data during 17:00 pm but I will take the later one)

V. Three times that the downwelling shortwave irradiance equals to upwelling longwave irradiance:
1: 18:40 UTC 410 W/m^2
2: 18:50 UTC 420 W/m^2
3: 19:40 UTC 420W/m^2



c. I. The maximum value of temperature is 14.5℃, at 19:50 UTC.
II. The difference of time for downwelling shortwave irradiance and time for maximum temperature is 19:50-16:50=3 hours
III. The difference of time for upwelling longwave irradiance and time for maximum temperature is 19:50-19:00= 50 minutes
IV.
1: 19:50-18:40= 1 hour 10 minutes
2: 19:50-18:50= 1 hour
3: 19:50-19:40= 10 minutes

v. I expect the value of 1(c)(iv) can be as smaller as possible. Because the moment when maximum temperature is happening is when the input energy = output energy. Also, the minimum shortwave irradiance happening at local noon time and the maximum longwave irradiance generates at 4 pm local time. This shows that it takes 4 hours to transform the input shortwave into output longwave irradiance according to this formula. At the same time, the input energy equals output energy which satisfy the factors to reach the maximum temperature.

VI. According to the previous questions, the time when the maximum temperature and maximum upwelling longwave irradiance happened is same. So, from my viewpoint I think the earth's atmosphere heating method is through absorbing the upwelling longwave. The idea is that the sun sends the solar radiation, which is the downwelling shortwave to the earth and been absorbed, and then the earth surface and living orgasms reflect the upwelling longwave to the earth's atmosphere so that it can be heated.

d.

I. Percentage of the reduction: (570-360)/570=36.84%

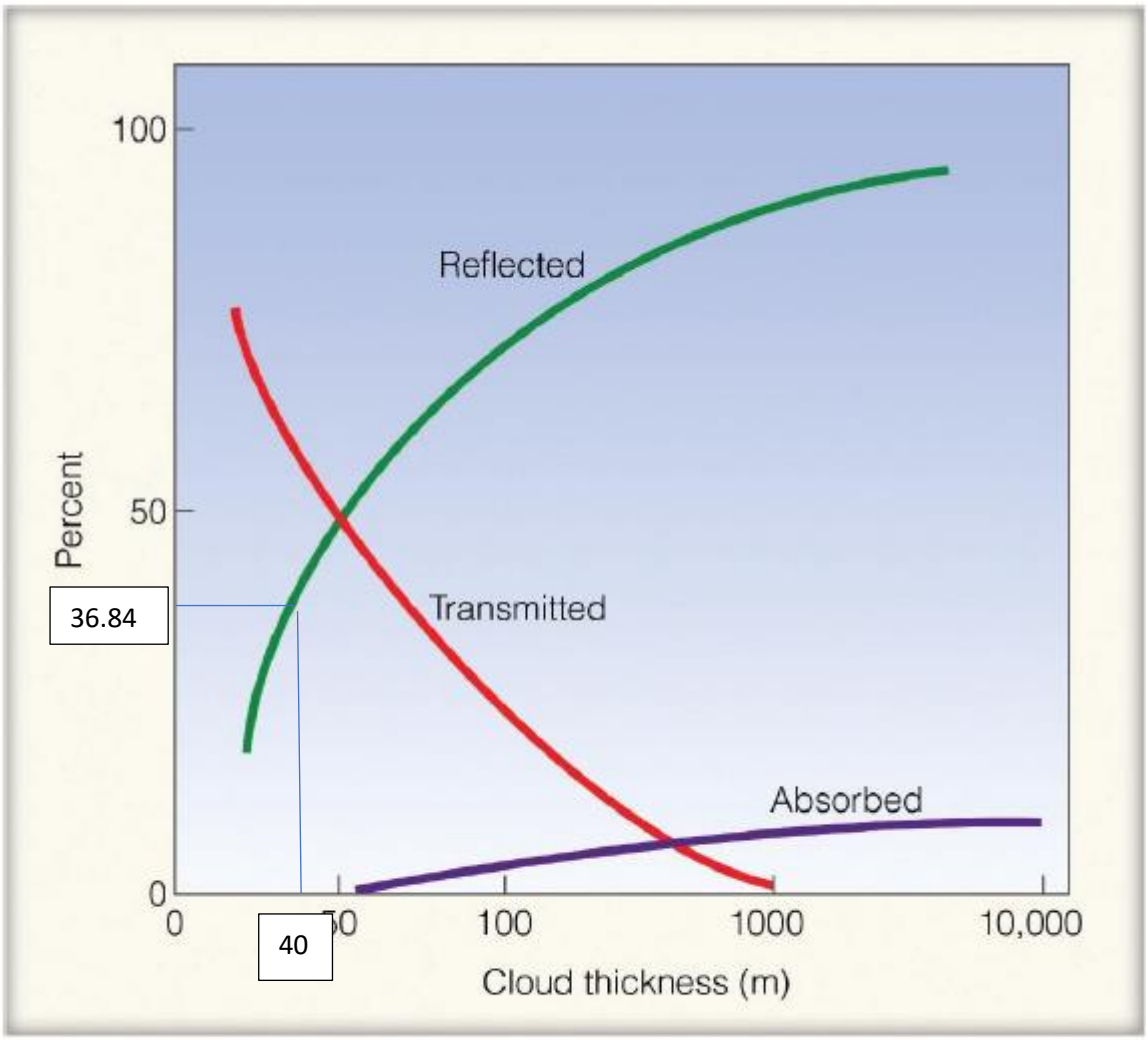
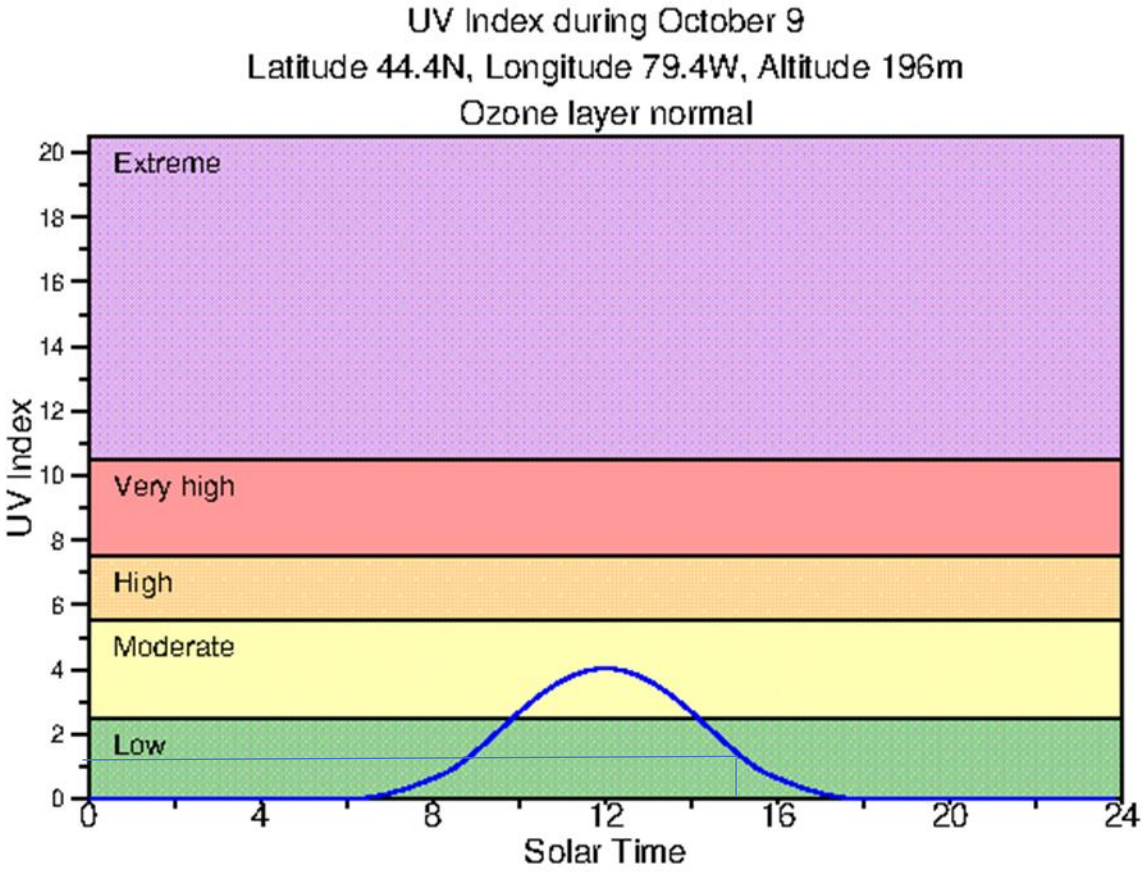


FIGURE 19.3 The average percentage of radiation that is reflected, absorbed, and transmitted by clouds of various thicknesses.

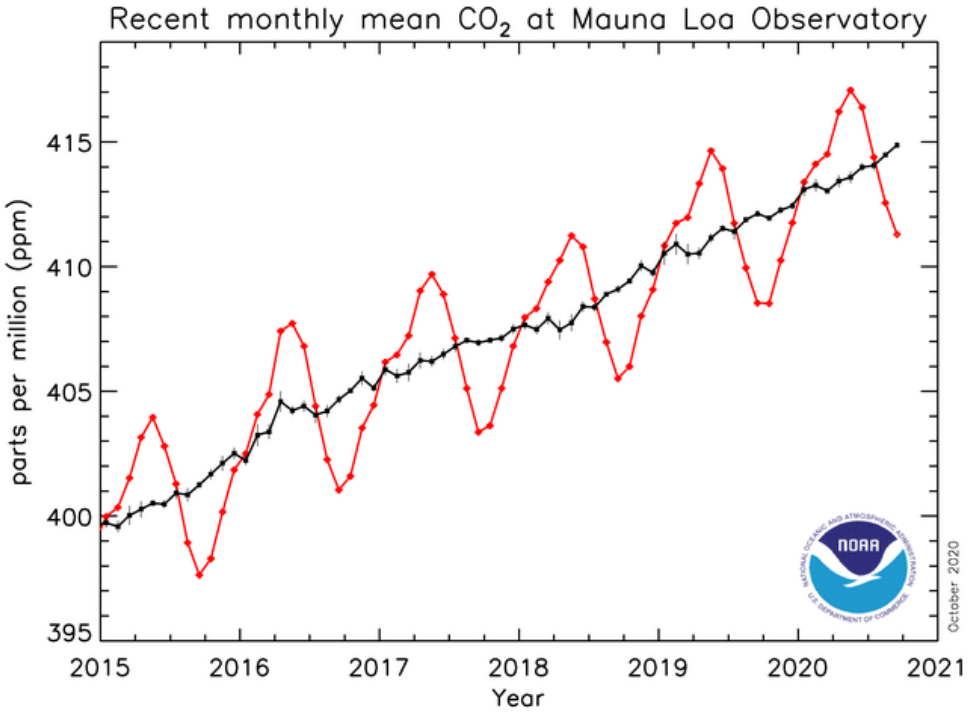
II.

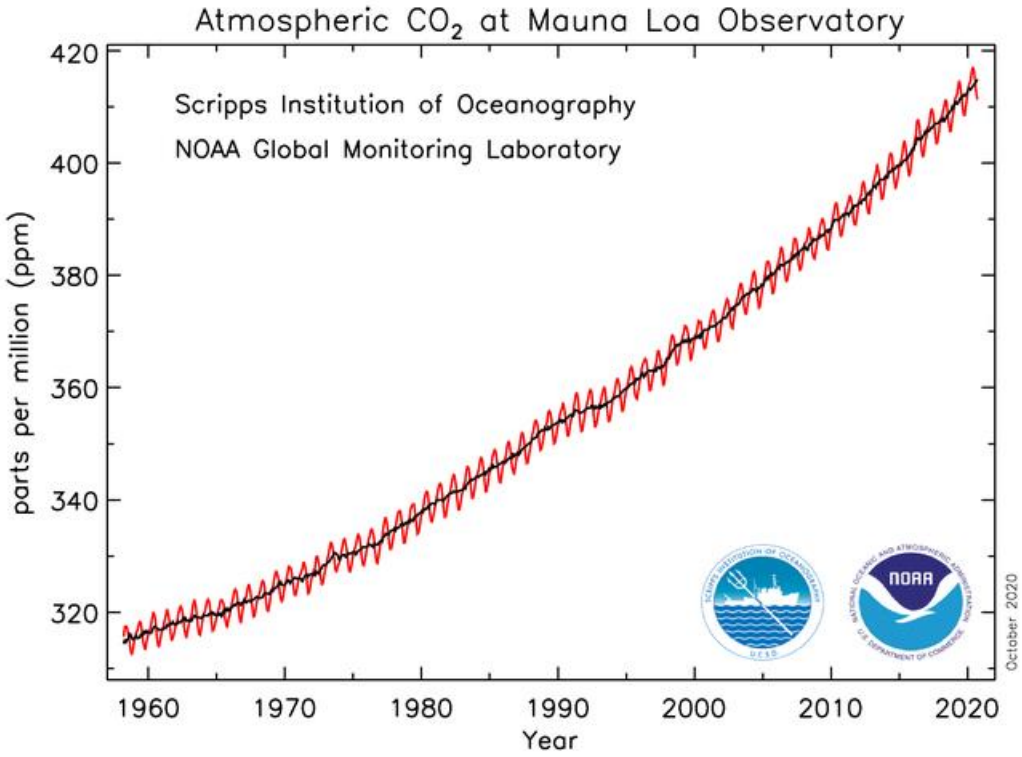
By using the figure of 19.3, the cloud thickness is about 40 meters since my reduction of downwelling shortwave irradiance is about 36.84%.

III. 19:00 UTC means 15:00 local time in the uv index. Therefore, the value of uv index at 16:00 local time is about 1.


UV Index during October 9
Latitude 44.4N, Longitude 79.4W, Altitude 196m
Ozone layer normal
Extreme
Very high
High
Moderate
Low
UV Index
Solar Time
0
2
4
6
8
10
12
14
16
18
20
0
4
8
12
16
20
24

2.





a.

I. Slope for 1965 to 1975=(332PPM-321PPM)/10 years= 1.1 PPM/year

II. Slope for 1985 to 1995= (362PPM-347PPM)/10 years= 1.5PPM/year
III. Slope for 2005 to 2015= (401PPM-380 PPM)/10 years= 2.2 PPM/year

b. The slope of the previous question is to measure the annual change of the CO2 during these three time periods of ten years each.

c. I.

1. 1965 to 1975: (2100-2020) *1.1PPM/year+411.29PPM =499.29 PPM

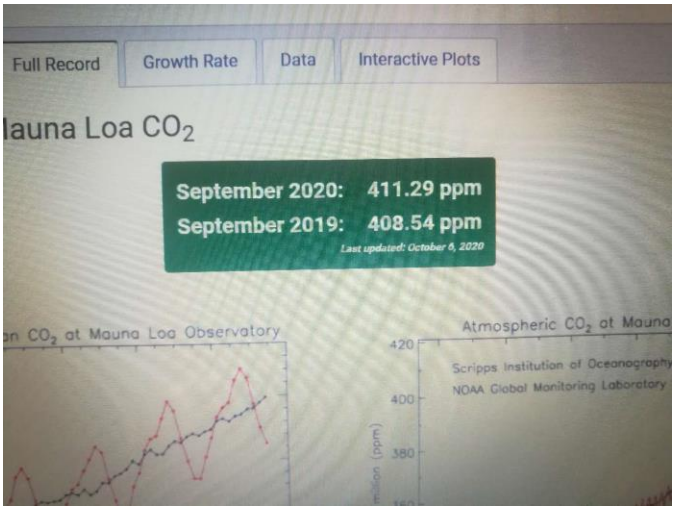
2. 1985 to 1995: (2100-2020) *1.5PPM/year +411.29PPM= 531.29 PPM

3. 2005 to 2015: (2100-2020) *2.2PPM/year +411.29PPM= 587.29 PPM

II.
1965 to 1975:(499.29PPM-411.29PPM)/80*1.12=1.23℃
1975 to 1985:(531.29PPM-411.29PPM)/80*1.12=1.68℃
1985 to 1995:(587.29PPM-411.29PPM)/80*1.12=2.46℃

III.
According to question c, the slopes from 1965 to 1975 and from 1975 to 1985 increase below 2℃. During this time the target can be meet. But the slope from year 2005 to 2015 grows above 2℃, so the target will not be met.

d.



2100-2020=80 years
1965 to 1975: (1.1PPM/year*80 years)/411.29PPM *100%=21.40%
1985 to 1995: (1.5PPM/year *80 years)/411.29 PPM*100%=29.18%
2005 to 2015: (2.2PPM/*80 years)/411.29PPM *100% = 42.79%

e.

I. (1.5PPM/year)/(1.1PPM/year) = 1.36
II. (2.2 PPM/year)/ (1.5 PPM/year) =1.47

III.(2.2 PPM/year)/(1.1PPM/year) =2

f.

The slope change is to measure the annual change of CO_2 during a ten-year time period compare with another annual change of CO_2 during another ten-year time period.

g. slope means the change of speed and the slopes changes means the acceleration, which is the difference of changes between two events. According to question e, the three slopes increases as the time period moves forward. Which can show the compelling representation of the trends emerging from this data set more likely.

h. (2.1PPM/year)/(2.1PPM/year) =100%
There is no change if two slopes are same.