



Ozone Over Time



Name _____ Class _____

One mission of NOAA's **Global Monitoring Laboratory** is to monitor the amount of ozone in the stratosphere. Every year in October there is a dramatic decrease of ozone over the South Pole. This is called the **Ozone Hole**. Today you will look at ozone data from a Dobson Ozone Spectrometer. NOAA has Dobson instruments at many locations around the world. You will be looking at data from the Dobson located at the South Pole.



Dobson Ozone Spectrometer in Boulder, CO

For this activity you will be using Dobson data from 1980-2020. For updated information, you can go to <https://gml.noaa.gov/dv/data/> and choose "ozone", "remote sensing" and "SPO" for the South Pole.

Overview of the Data

This is a large dataset. Don't worry, you won't be using all of it in your analysis. First, let's understand the data better.

First, notice the dataset is arranged in rows and columns. You see labels in the very top row:

UTC_Date

UTC = Coordinated
Universal Time

Total_Ozone

Total Ozone is measured in Dobson Units, this
tells us how much ozone is in the atmosphere

Second, use a ruler to draw a line between December and January of each year. This will help you see where each year begins and ends.

Third, choose two highlighter colors. Use one color to highlight the SMALLEST total ozone amount in each year. Use your other color to highlight the LARGEST total ozone amount in each year. Write the highest and lowest ozone amounts here:

Year	Low	High
1980		
1981		
1982		
1983		
1984		

Year	Low	High
1985		
1986		
1987		
1988		
1989		

Year	Low	High
1990		
1991		
1992		
1993		
1994		

Year	Low	High
1995		
1996		
1997		
1998		
1999		

Year	Low	High
2000		
2001		
2002		
2003		
2004		

Year	Low	High
2005		
2006		
2007		
2008		
2009		

Year	Low	High
2010		
2011		
2012		
2013		
2014		

Year	Low	High
2016		
2017		
2018		
2019		
2020		

What is the **lowest** amount of ozone in the dataset?

Amount _____

Year, Month _____

What is the **highest** amount of ozone in the dataset?

Amount _____

Year, Month _____

Graphing the Data

Prepare to create two graphs using some of the dataset. You can choose the type of graph, for example a line graph or bar graph. Answer the questions on a separate piece of paper.

First Graph: Lowest Ozone between 1980-2000

Graph the lowest amount of ozone from each year.

- 1) What is on your X axis?
- 2) What is on your Y axis?
- 3) What year has the lowest ozone amount? (most significant ozone hole)
- 4) Describe the lowest ozone amounts between 1980-2000. How does the lowest amount of ozone change in these years?

Second Graph: One Year of Ozone

Choose one year from the dataset. Graph the ozone amounts from that year.

- 1) What is on your X axis?
- 2) What is on your Y axis?
- 3) What is the lowest amount of ozone in this year? What date did it occur?
- 4) What is the highest amount of ozone in this year? What date did it occur?
- 5) How do you think a graph of other years would compare to the year you choose?

Thinking like a Scientist

Write three additional questions about ozone. You don't need to answer the questions, so dream big. What data would you need to learn more about ozone?

UTC_Date	Total_Ozone
1980/01/30	308.0
1980/10/15	201.0
1980/10/20	212.0
1980/10/25	213.0
1980/10/30	214.0
1980/11/15	275.0
1980/11/30	367.0
1980/12/30	301.0
1981/01/30	305.0
1981/10/17	219.0
1981/10/20	229.0
1981/10/25	223.0
1981/10/30	238.0
1981/11/15	272.0
1981/11/30	325.0
1981/12/30	309.0
1982/01/30	303.0
1982/10/15	229.0
1982/10/20	230.0
1982/10/25	250.0
1982/10/30	230.0
1982/11/15	240.0
1982/11/30	340.0
1982/12/30	302.0
1983/01/30	300.0
1983/11/05	250.0
1983/11/15	316.0
1983/11/26	371.0
1983/12/28	305.0
1984/01/30	271.0
1984/10/15	200.0
1984/10/20	211.0
1984/10/25	194.0
1984/10/30	245.0
1984/11/15	273.0
1984/11/30	249.0
1984/12/30	301.0
1985/01/30	272.0
1985/10/15	158.0
1985/10/20	156.0
1985/10/25	157.0
1985/10/30	182.0
1985/11/15	235.0
1985/11/30	257.0
1985/12/30	301.0
1986/01/30	265.0
1986/10/15	172.0
1986/10/20	181.0
1986/10/25	179.0
1986/10/31	197.0
1986/11/15	386.0
1986/11/30	320.0
1986/12/30	299.0

UTC_Date	Total_Ozone
1987/01/30	258.0
1987/10/14	128.0
1987/10/19	137.0
1987/10/25	149.0
1987/10/30	145.0
1987/11/15	182.0
1987/11/30	268.0
1987/12/30	307.0
1988/01/30	252.0
1988/10/15	230.0
1988/10/20	223.0
1988/10/25	215.0
1988/10/30	324.0
1988/10/31	335.0
1988/11/15	379.0
1988/11/30	345.0
1988/12/30	299.0
1989/01/30	278.0
1989/10/15	143.0
1989/10/20	147.0
1989/10/25	178.0
1989/10/30	171.0
1989/11/15	272.0
1989/11/30	277.0
1989/12/30	296.0
1990/01/30	269.0
1990/10/16	132.0
1990/10/20	150.0
1990/10/25	149.0
1990/10/30	153.0
1990/11/15	173.0
1990/11/30	222.0
1990/12/29	291.0
1991/01/28	270.0
1991/10/15	153.0
1991/10/20	139.0
1991/10/25	155.0
1991/10/30	197.0
1991/11/15	307.0
1991/11/29	317.0
1991/12/30	281.0
1992/01/30	272.0
1992/10/15	140.0
1992/10/20	222.0
1992/10/25	153.0
1992/10/30	190.0
1992/11/15	163.0
1992/11/30	179.0
1992/12/30	302.0
1993/01/30	275.0
1993/10/15	104.0
1993/10/20	115.0
1993/10/25	131.0
1993/10/31	157.0
1993/11/15	161.0
1993/11/30	239.0
1993/12/29	278.0

UTC_Date	Total_Ozone
1994/01/30	262.0
1994/10/15	126.0
1994/10/20	189.0
1994/10/26	136.0
1994/10/31	136.0
1994/11/15	282.0
1994/11/30	361.0
1994/12/30	297.0
1995/01/29	284.0
1995/10/15	121.0
1995/10/20	142.0
1995/10/26	122.0
1995/10/31	134.0
1995/11/15	199.0
1995/11/30	257.0
1995/12/30	272.0
1996/01/30	251.0
1996/10/15	114.0
1996/10/20	138.0
1996/10/25	156.0
1996/10/30	160.0
1996/11/15	157.0
1996/11/30	186.0
1996/12/30	289.0
1997/01/30	273.0
1997/10/15	144.0
1997/10/20	129.0
1997/10/26	139.0
1997/10/31	132.0
1997/11/15	194.0
1997/11/27	263.0
1997/12/30	279.0
1998/01/30	272.0
1998/10/16	121.0
1998/10/20	131.0
1998/10/25	130.0
1998/10/30	155.0
1998/11/15	179.0
1998/11/30	147.0
1998/12/30	295.0
1999/01/30	245.0
1999/10/15	108.0
1999/10/20	124.0
1999/10/25	124.0
1999/10/30	137.0
1999/11/15	158.0
1999/11/30	173.0
1999/12/30	272.0

UTC_Date	Total_Ozone
2000/01/30	262.0
2000/10/16	129.0
2000/10/21	213.0
2000/10/26	159.0
2000/10/31	257.0
2000/11/15	304.0
2000/11/30	314.0
2000/12/30	290.0
2001/01/30	255.0
2001/10/15	121.0
2001/10/20	139.0
2001/10/25	134.0
2001/10/30	155.0
2001/11/15	158.0
2001/11/29	183.0
2001/12/30	256.0
2002/01/30	253.0
2002/10/15	163.0
2002/10/20	155.0
2002/10/25	229.0
2002/10/29	318.0
2002/11/15	346.0
2002/11/30	303.0
2002/12/30	285.0
2003/01/30	256.0
2003/10/15	150.0
2003/10/19	129.0
2003/10/25	186.0
2003/10/30	130.0
2003/11/15	232.0
2003/11/30	252.0
2003/12/30	255.0
2004/01/30	254.0
2004/10/17	211.0
2004/10/20	241.0
2004/10/25	226.0
2004/10/30	184.0
2004/10/31	176.0
2004/11/15	257.0
2004/11/30	280.0
2004/12/30	280.0
2005/01/29	256.0
2005/10/12	143.0
2005/10/20	136.0
2005/10/25	140.0
2005/10/30	154.0
2005/11/16	329.0
2005/11/30	234.0
2005/12/30	284.0
2006/01/30	263.0
2006/10/13	107.0
2006/10/20	153.0
2006/10/25	138.0
2006/10/30	147.0
2006/11/14	154.0
2006/11/30	195.0
2006/12/30	248.0

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2007/12/30	284.0
2008/01/30	297.0
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2009/10/15	168.0
2009/10/20	183.0
2009/10/25	150.0
2009/10/30	150.0
2009/11/14	185.0
2009/11/30	277.0
2009/12/30	320.0
2010/01/30	277.0
2010/10/15	140.0
2010/10/20	141.0
2010/10/25	191.0
2010/10/30	152.0
2010/11/15	163.0
2010/11/30	176.0
2010/12/30	292.0
2011/01/30	246.0
2011/10/15	123.0
2011/10/25	126.0
2011/10/30	134.0
2011/11/15	256.0
2011/11/30	254.0
2011/12/30	298.0
2012/01/30	273.0
2012/10/15	233.0
2012/10/20	228.0
2012/10/25	181.0
2012/10/30	248.0
2012/11/15	327.0
2012/11/30	330.0
2012/12/28	284.0
2013/01/30	271.0
2013/10/15	193.0
2013/10/20	216.0
2013/10/25	205.0
2013/10/30	193.0
2013/11/30	332.0
2013/12/30	316.0

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2014/01/30	277.0
2014/10/15	152.0
2014/10/22	155.0
2014/10/25	148.0
2014/10/30	174.0
2014/11/30	299.0
2014/12/30	300.0
2015/01/30	264.0
2015/10/15	112.0
2015/10/20	119.0
2015/10/25	114.0
2015/10/30	132.0
2015/11/15	161.0
2015/11/30	182.0
2015/12/31	286.0
2016/01/30	260.0
2016/10/15	152.0
2016/10/20	174.0
2016/10/25	183.0
2016/10/30	182.0
2016/11/15	282.0
2016/11/30	336.0
2016/12/30	296.0
2017/01/30	292.0
2017/10/18	148.0
2017/10/21	173.0
2017/10/25	169.0
2017/10/30	214.0
2017/11/15	269.0
2017/11/30	286.0
2017/12/30	278.0
2018/01/30	275.0
2018/10/15	111.0
2018/10/20	122.0
2018/10/25	116.0
2018/10/30	142.0
2018/11/15	202.0
2018/11/30	216.0
2018/12/30	271.0
2019/01/30	280.0
2019/10/15	182.0
2019/10/20	233.0
2019/10/25	208.0
2019/10/30	312.0
2019/11/15	332.0
2019/11/30	300.0
2019/12/30	297.0
2020/01/28	280.0
2020/10/15	114.0
2020/10/20	121.0
2020/10/25	123.0
2020/10/30	128.0
2020/11/15	152.0
2020/11/30	167.0
2020/12/30	272.0