



WHAT MAUNA LOA CAN TELL US ABOUT CLIMATE CHANGE

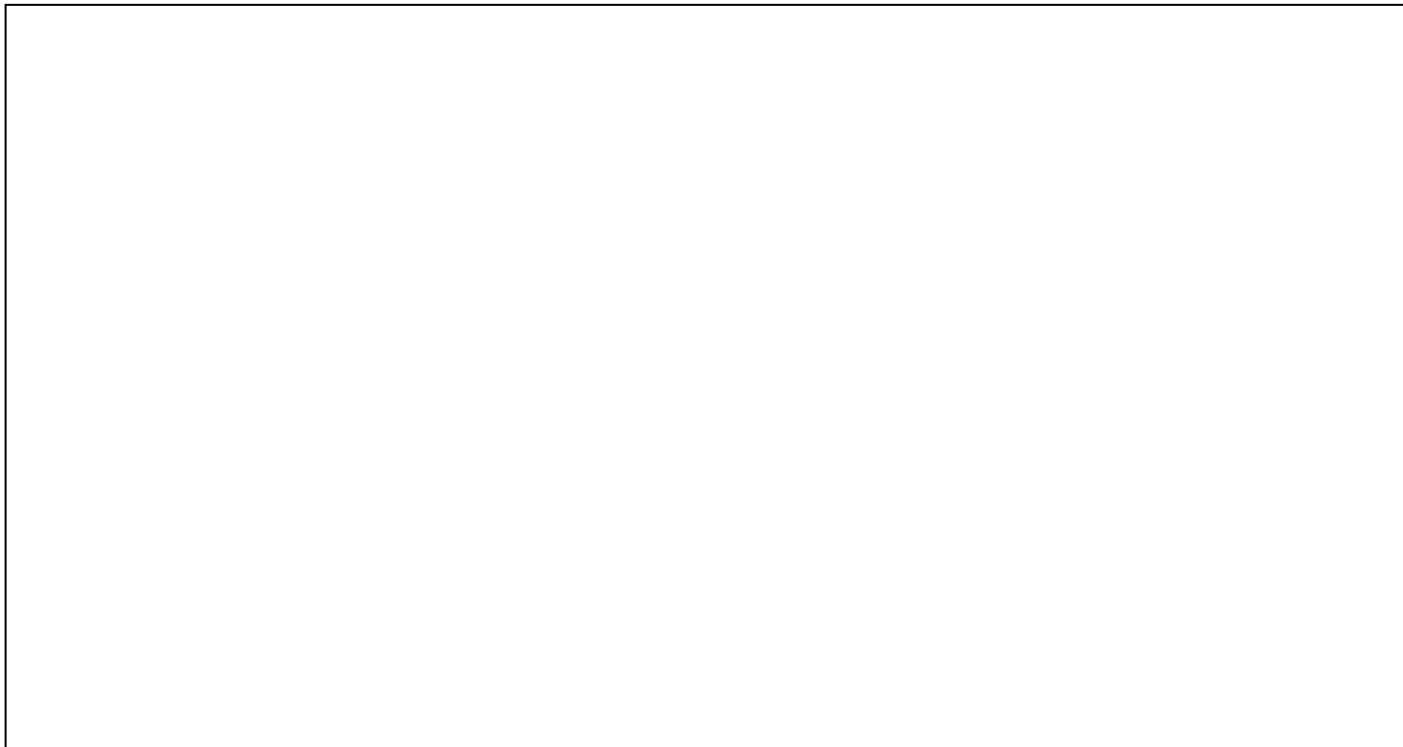
Lesson 5 Teacher Resources

Comparing CO₂ Data by Location

Background

On the web (<http://cdiac.esd.ornl.gov/trends/co2/sio-keel.htm>), you can find datasets from collection sites in both the northern and southern hemispheres. Southern hemisphere locations will show the opposite sense of positive and negative slopes to the seasonal cycles (i.e., they will be "out of phase" with the northern hemisphere sites) because the seasons are reversed in the southern hemisphere. Southern hemisphere records exhibit a smaller amplitude in the seasonal cycle because there are fewer forests in the southern than in the northern hemisphere.

Data locations:





Lesson 5—Student Assignment

Graph 1 Annual data trends

1. Have students graph the 1985, 1990, 1995, and 2000 annual fitted data for each location A-F. Locations are indicated on student sheet by letter only. Where missing data, marked on the charts as “-99.99”, have students omit this point.
2. Have students draw a best-fit straight line on the trend of each location.
3. Do students note any trends at the particular location? Any worldwide trends over time?

The graphs will show lines trending upward for all locations, rising from the mid-340 range to above 370.

Graph 2 Monthly data trends

4. Have students graph the monthly data for 1985, 1990, 1995, and 2000 at each location. Clearly mark the year and location of each line. Where missing data, marked on the charts as “-99.99”, have students omit this point. Lines cannot be connected where one or more month’s data is missing. It is helpful to color key each location. Each location might also be graphed separately.
5. Have students assess the shapes of each location’s lines. Are there locations that seem to have similar shapes?
6. Have students discuss the causes of rising or falling CO₂ and what they think might be the cause at each location.

The graphs will show that locations A and D data look nearly flat, although both locations are missing data in all years grafted. Locations B, C, E and F show declines in August and September, and rises into April. A and D, Bare Head and Kermadec Islands, respectively, are both in the Southern Hemisphere, while B, C, E, and F-- La Jolla Pier, Alert, Cape Kumukahu, and Mauna Loa are in the Northern Hemisphere.

Have students find the data locations on a map or use the location map provided. Discuss how location may influence data collection, and geographic influences at the locations.

The following tables provide the complete data available for each location. The student data sheet shows only the selected data years.



For each table: Monthly values are expressed in parts per million (ppm) and reported in the 2003A SIO manometric mole fraction scale. The monthly values have been adjusted to the 15th of each month. Missing values are denoted by -99.99. The "annual" average is the arithmetic mean of the twelve monthly values. In years with one or two missing monthly values, annual values were calculated by substituting a fit value (4-harmonics with gain factor and spline) for that month and then averaging the twelve monthly values.

Location A Baring Head

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Annual-Fitted
1977	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	332.74	-99.99	332.52	332.34	-99.99	332.77	-99.99	-99.99
1978	333.39	333.26	332.84	-99.99	333.26	333.77	334.90	334.11	-99.99	-99.99	334.39	-99.99	-99.99	333.79
1979	333.60	-99.99	-99.99	-99.99	334.61	-99.99	335.68	336.34	336.28	-99.99	334.88	335.47	-99.99	335.16
1980	-99.99	335.78	336.29	336.35	337.05	336.99	-99.99	337.40	-99.99	337.40	337.78	337.55	-99.99	336.85
1981	-99.99	337.20	337.30	337.65	338.85	338.69	-99.99	-99.99	-99.99	337.89	-99.99	-99.99	-99.99	338.26
1982	-99.99	-99.99	338.61	339.08	-99.99	339.73	339.49	340.42	339.81	-99.99	340.02	-99.99	-99.99	339.39
1983	-99.99	-99.99	340.31	-99.99	-99.99	341.11	341.27	342.05	-99.99	-99.99	341.48	-99.99	-99.99	340.95
1984	341.42	341.50	341.44	341.00	341.90	-99.99	342.96	-99.99	342.75	-99.99	342.90	-99.99	-99.99	342.19
1985	-99.99	342.59	342.54	342.94	343.20	-99.99	344.10	-99.99	-99.99	343.76	-99.99	343.99	-99.99	343.48
1986	343.23	-99.99	344.86	-99.99	345.02	-99.99	345.40	345.47	345.97	-99.99	-99.99	-99.99	-99.99	345.10
1987	-99.99	346.38	345.61	-99.99	346.83	346.70	347.19	347.32	348.21	347.36	347.19	-99.99	-99.99	346.82
1988	347.92	347.82	347.96	348.11	348.94	348.47	348.89	-99.99	-99.99	349.56	349.01	-99.99	-99.99	348.72
1989	349.56	348.83	350.13	350.58	350.34	350.03	-99.99	-99.99	350.83	-99.99	351.43	350.46	-99.99	350.37
1990	350.59	-99.99	350.93	349.76	-99.99	351.49	352.27	351.97	352.93	351.35	352.34	352.10	(351.48)	351.58
1991	351.99	351.76	352.15	-99.99	352.64	354.18	353.59	-99.99	352.99	352.90	352.94	-99.99	-99.99	352.84
1992	352.21	-99.99	-99.99	353.40	353.53	354.90	354.74	355.25	354.82	354.76	354.22	-99.99	-99.99	354.04
1993	353.84	353.62	355.35	354.41	355.05	354.57	355.84	355.49	356.04	355.13	355.63	355.14	355.01	354.97
1994	354.76	355.14	356.11	355.96	355.88	356.13	357.06	357.40	357.61	357.73	-99.99	-99.99	(356.46)	356.44
1995	356.50	356.19	-99.99	357.09	357.07	-99.99	358.66	358.97	358.86	358.17	358.88	358.46	(357.83)	357.95
1996	-99.99	358.98	-99.99	358.68	359.78	-99.99	359.98	360.45	-99.99	359.26	359.85	360.67	-99.99	359.63
1997	-99.99	-99.99	360.18	360.00	360.33	-99.99	-99.99	361.76	-99.99	-99.99	-99.99	-99.99	-99.99	361.13
1998	362.32	362.51	362.77	363.00	363.00	-99.99	364.09	364.55	364.86	-99.99	-99.99	364.32	-99.99	363.61
1999	364.96	365.43	-99.99	363.89	365.10	365.34	366.19	-99.99	-99.99	366.54	366.07	365.82	-99.99	365.40
2000	365.66	-99.99	366.18	-99.99	366.13	-99.99	367.59	366.24	-99.99	366.98	367.34	-99.99	-99.99	366.61
2001	-99.99	-99.99	367.04	367.20	368.15	-99.99	-99.99	-99.99	368.57	368.99	-99.99	-99.99	-99.99	368.17
2002	-99.99	-99.99	-99.99	-99.99	369.91	373.28	371.14	-99.99	-99.99	371.60	371.68	-99.99	-99.99	370.56
2003	371.55	-99.99	-99.99	372.26	372.71	373.28	-99.99	373.41	-99.99	373.41	-99.99	-99.99	-99.99	-99.99
2004	-99.99	-99.99	374.42	374.37	-99.99	375.04	-99.99	374.94	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99



Location B La Jolla Pier

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Annual-Fitted
1969	-99.99	326.48	-99.99	328.05	-99.99	326.29	-99.99	-99.99	-99.99	324.70	-99.99	-99.99	-99.99	-99.99
1970	-99.99	-99.99	-99.99	329.15	331.70	328.09	-99.99	-99.99	322.34	-99.99	-99.99	327.30	-99.99	326.86
1971	329.73	328.93	330.41	330.59	329.98	324.53	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	327.49
1972	-99.99	-99.99	-99.99	330.95	332.21	-99.99	326.45	-99.99	322.71	325.37	328.28	329.76	-99.99	328.15
1973	330.19	331.14	331.84	333.21	333.67	332.84	329.25	324.91	325.13	328.62	329.87	331.28	330.16	330.20
1974	331.90	333.49	333.47	334.42	335.24	333.82	330.09	326.66	326.29	328.62	331.32	332.22	331.46	331.49
1975	333.99	333.62	333.99	335.19	336.17	333.56	330.35	326.53	327.54	329.00	-99.99	333.91	(332.16)	332.14
1976	-99.99	334.93	-99.99	-99.99	-99.99	334.80	-99.99	328.71	326.62	-99.99	-99.99	334.30	-99.99	333.16
1977	336.33	335.51	336.84	-99.99	338.52	-99.99	333.25	-99.99	-99.99	334.21	-99.99	-99.99	-99.99	334.79
1978	-99.99	-99.99	-99.99	339.70	339.18	336.37	-99.99	331.49	330.08	-99.99	336.64	-99.99	-99.99	336.30
1979	338.61	339.76	341.11	341.36	-99.99	-99.99	-99.99	333.47	-99.99	-99.99	-99.99	-99.99	-99.99	338.02
1980	-99.99	-99.99	341.13	-99.99	341.62	-99.99	-99.99	333.92	-99.99	337.78	-99.99	341.01	-99.99	339.58
1981	342.24	343.85	-99.99	-99.99	345.34	-99.99	337.96	336.57	-99.99	339.19	340.13	342.30	-99.99	341.08
1982	343.97	-99.99	343.83	-99.99	346.45	342.32	340.15	-99.99	335.75	-99.99	341.62	343.08	-99.99	341.88
1983	344.49	344.55	345.49	347.16	347.92	344.75	340.74	337.00	338.93	341.39	342.89	345.04	343.36	343.48
1984	345.88	347.56	347.49	349.02	349.44	347.19	342.85	339.80	340.62	343.03	344.88	347.65	345.45	345.36
1985	348.03	348.74	349.17	348.39	350.15	349.21	344.74	340.03	340.37	343.33	346.28	-99.99	(346.37)	346.51
1986	-99.99	350.86	349.73	351.51	351.75	349.76	345.43	-99.99	341.84	-99.99	346.80	350.53	-99.99	347.74
1987	350.25	351.35	351.15	352.35	353.10	352.51	347.70	342.74	345.58	347.25	350.06	352.28	349.69	349.64
1988	352.73	352.56	353.52	355.15	356.65	354.37	351.48	346.61	347.17	350.26	352.40	354.71	352.30	352.35
1989	355.66	355.57	356.23	357.05	357.88	354.90	350.87	347.18	346.87	350.85	353.80	354.36	353.44	353.56
1990	356.33	357.17	357.17	357.78	359.07	355.89	352.01	348.19	349.53	353.18	354.80	355.97	354.81	354.86
1991	-99.99	358.49	359.79	359.66	360.59	358.06	354.79	350.17	350.31	353.97	357.86	357.66	(356.59)	356.38
1992	359.45	358.86	359.58	360.53	360.96	359.23	352.86	350.41	350.01	353.86	-99.99	358.35	(356.72)	356.80
1993	359.61	359.81	360.08	361.28	362.12	359.88	354.96	351.04	351.50	354.95	357.11	359.93	357.69	357.66
1994	360.33	361.44	361.89	362.76	363.66	361.67	356.79	352.89	352.57	357.13	359.69	362.66	359.46	359.38
1995	362.24	362.71	363.51	364.68	364.32	363.65	358.89	354.07	356.59	359.19	360.83	-99.99	(361.16)	361.26
1996	364.50	365.21	365.81	366.54	367.53	365.08	359.36	357.32	357.18	360.26	363.11	-99.99	(363.03)	363.02
1997	365.48	366.41	367.08	368.10	368.44	365.80	360.85	356.89	358.27	361.26	364.44	366.39	364.12	364.12
1998	366.85	368.05	367.98	370.42	370.30	367.80	364.99	360.69	361.91	366.09	-99.99	370.21	(366.92)	366.89
1999	369.45	371.64	371.85	373.53	373.92	370.57	364.91	362.69	361.26	365.98	368.35	369.94	368.67	368.75
2000	370.10	372.41	373.42	373.90	374.31	371.41	366.04	362.86	363.07	368.11	370.66	371.43	369.81	369.85
2001	372.35	373.88	374.29	375.85	376.52	373.39	367.24	364.81	364.13	368.26	372.71	373.31	371.40	371.40



Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Annual-Fitted
2002	375.03	375.18	376.58	376.24	377.26	374.24	370.77	364.09	368.02	371.29	373.11	376.02	373.15	373.29
2003	-99.99	377.99	378.27	380.08	379.98	378.40	373.23	368.70	368.96	373.91	377.38	378.78	(376.06)	375.97
2004	380.01	380.25	380.87	381.80	381.82	379.61	375.57	369.71	370.40	375.60	-99.99	380.09	(377.82)	377.83

Location C Alert

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Annual-Fitted
1985	-99.99	-99.99	-99.99	-99.99	352.62	348.19	343.36	-99.99	338.63	342.77	347.10	349.44	-99.99	-99.99
1986	351.12	351.66	352.84	353.11	353.71	351.80	347.00	340.55	339.40	344.28	348.70	349.50	348.64	348.47
1987	351.61	352.26	354.04	353.72	354.68	352.95	348.36	341.18	340.53	346.20	349.41	352.67	349.80	349.94
1988	354.19	355.56	356.29	357.30	357.00	356.29	348.54	344.18	-99.99	349.58	354.89	357.54	(352.98)	352.71
1989	356.38	358.94	360.14	359.59	359.61	357.76	351.63	345.79	346.22	349.89	354.78	358.32	354.92	355.05
1990	359.35	360.18	360.84	360.66	360.27	357.76	351.33	346.28	347.13	350.85	355.82	358.49	355.75	355.86
1991	360.53	362.12	361.00	361.93	361.52	359.93	354.19	347.61	348.71	352.99	357.61	359.97	357.34	357.30
1992	362.16	362.22	363.80	362.65	363.19	361.65	353.95	347.02	347.85	352.23	356.87	361.08	357.89	357.91
1993	361.90	361.94	362.77	363.52	-99.99	360.97	354.18	348.13	348.46	353.40	357.01	360.34	(357.97)	358.15
1994	363.05	364.18	364.87	364.47	364.32	362.13	356.72	350.88	350.69	356.06	360.09	363.27	360.06	359.84
1995	363.49	364.94	366.72	366.33	365.75	364.32	358.59	352.06	353.45	357.27	362.34	365.65	361.74	361.83
1996	366.93	366.71	367.63	368.15	369.14	367.33	361.53	356.11	354.51	360.12	363.85	365.52	363.96	363.77
1997	367.72	369.08	368.17	368.83	369.49	367.57	360.79	355.16	356.01	360.71	364.77	367.81	364.67	364.73
1998	369.40	370.12	370.88	370.53	371.56	369.28	364.50	357.46	360.54	364.04	368.74	371.58	367.39	367.27
1999	372.60	373.85	373.75	374.10	374.50	372.04	364.81	359.11	359.65	364.94	369.82	372.62	369.31	369.34
2000	373.23	375.13	374.83	375.42	376.18	374.01	366.54	360.78	361.77	367.51	370.58	373.37	370.78	370.78
2001	375.49	375.94	376.42	377.48	377.67	374.78	367.38	361.67	363.39	367.74	373.18	374.41	372.13	372.11
2002	376.68	377.42	378.27	378.73	379.01	375.95	370.78	364.07	365.36	370.25	374.04	377.99	374.04	374.11
2003	379.03	379.36	380.90	381.39	382.38	381.02	373.78	367.97	368.55	372.28	377.75	379.99	377.03	377.01
2004	382.44	382.36	381.58	383.21	383.58	382.59	374.58	368.69	368.55	373.39	378.49	381.62	378.42	378.60



Location D Kermadec Islands

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Annual-Fitted
1982	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	340.32	-99.99	-99.99
1983	-99.99	-99.99	-99.99	314.06	341.19	-99.99	341.57	-99.99	-99.99	341.74	342.21	342.13	-99.99	341.39
1984	-99.99	-99.99	342.35	343.13	-99.99	342.57	342.15	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	342.86
1985	-99.99	-99.99	-99.99	343.99	342.87	343.22	344.38	344.37	344.72	344.34	344.42	-99.99	-99.99	344.10
1986	-99.99	-99.99	-99.99	-99.99	345.01	344.93	-99.99	345.86	-99.99	346.19	-99.99	-99.99	-99.99	345.54
1987	346.42	-99.99	-99.99	346.64	347.14	-99.99	-99.99	347.39	348.02	348.58	348.71	-99.99	-99.99	347.57
1988	349.63	349.56	349.11	349.15	348.69	348.75	-99.99	349.42	349.89	-99.99	-99.99	-99.99	-99.99	349.52
1989	351.11	-99.99	350.26	350.18	-99.99	350.75	350.86	350.51	-99.99	351.38	-99.99	352.02	-99.99	350.86
1990	-99.99	-99.99	-99.99	351.25	351.80	352.59	-99.99	352.19	352.97	352.53	352.73	353.24	-99.99	352.26
1991	353.60	-99.99	-99.99	353.35	-99.99	352.79	353.60	353.68	353.64	-99.99	-99.99	354.81	-99.99	353.55
1992	354.16	354.00	-99.99	354.01	354.25	-99.99	354.93	355.05	354.98	-99.99	-99.99	355.35	-99.99	354.71
1993	-99.99	-99.99	355.13	-99.99	354.61	355.05	355.20	-99.99	355.68	356.46	356.66	356.69	-99.99	355.56
1994	-99.99	356.62	356.69	-99.99	-99.99	356.45	356.69	357.21	357.61	357.64	-99.99	-99.99	-99.99	357.08
1995	358.28	-99.99	-99.99	-99.99	358.62	-99.99	-99.99	359.09	-99.99	-99.99	-99.99	-99.99	-99.99	358.89
1996	-99.99	360.21	359.68	-99.99	359.51	-99.99	359.91	360.69	360.42	-99.99	360.91	361.81	-99.99	360.27
1997	361.35	-99.99	-99.99	361.27	360.79	361.55	-99.99	-99.99	362.01	362.22	-99.99	362.77	-99.99	361.82
1998	-99.99	-99.99	-99.99	363.70	364.05	-99.99	363.78	-99.99	364.41	-99.99	-99.99	-99.99	-99.99	364.23
1999	366.69	-99.99	365.67	365.82	-99.99	365.47	366.20	366.63	-99.99	-99.99	366.90	367.69	-99.99	366.29
2000	367.40	-99.99	366.75	-99.99	366.28	365.80	366.83	367.73	-99.99	367.90	368.44	-99.99	-99.99	367.19
2001	-99.99	-99.99	368.52	367.47	367.73	-99.99	369.52	-99.99	-99.99	369.05	369.54	-99.99	-99.99	368.78
2002	-99.99	-99.99	-99.99	-99.99	-99.99	371.15	371.31	371.21	372.57	371.98	372.45	-99.99	-99.99	371.34
2003	-99.99	373.12	-99.99	373.08	373.74	373.40	-99.99	-99.99	373.74	373.33	-99.99	-99.99	-99.99	373.58
2004	-99.99	375.29	-99.99	-99.99	-99.99	374.73	375.34	375.13	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99



Location E Cape Kumukahi

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Annual-Fitted
1979	-99.99	-99.99	338.86	339.75	-99.99	339.99	-99.99	-99.99	333.64	334.67	-99.99	337.97	-99.99	-99.99
1980	-99.99	340.64	340.65	342.82	343.33	341.57	337.85	336.65	335.10	336.27	338.01	339.09	(339.27)	339.10
1981	339.80	340.99	342.80	342.61	-99.99	-99.99	338.15	336.90	336.45	337.76	339.02	341.46	(340.17)	340.27
1982	342.13	341.84	343.48	344.32	345.02	343.79	340.76	338.33	-99.99	337.52	340.02	341.31	(341.30)	341.32
1983	341.98	343.67	344.96	345.41	346.24	344.98	342.45	339.64	338.52	340.39	342.48	343.79	342.88	342.84
1984	344.65	345.70	345.97	348.18	348.06	346.84	344.08	341.26	340.28	341.73	343.02	344.61	344.53	344.58
1985	346.27	346.37	347.83	348.45	350.10	348.88	345.90	342.85	341.09	343.09	344.40	346.41	345.97	345.91
1986	347.06	348.16	348.57	350.00	350.45	350.16	347.28	344.68	343.85	344.83	346.69	347.89	347.47	347.45
1987	349.23	349.35	350.83	351.73	352.34	352.24	348.91	346.55	345.13	346.76	348.36	350.07	349.29	349.33
1988	351.03	352.11	352.99	354.57	355.08	354.13	351.67	349.41	347.42	349.24	350.85	351.70	351.68	351.67
1989	353.44	353.17	354.18	356.18	356.86	355.86	352.75	349.63	349.09	350.01	351.84	354.06	353.09	353.14
1990	354.49	356.59	356.81	357.37	357.73	356.95	354.69	352.74	350.88	351.86	353.76	355.07	354.91	354.87
1991	356.00	356.97	358.13	358.98	360.26	358.15	355.64	353.25	351.34	353.04	354.58	355.54	355.99	356.04
1992	357.16	358.49	359.07	360.06	360.34	358.87	354.19	354.07	352.28	353.39	355.11	356.97	356.67	356.73
1993	357.69	359.17	358.96	360.24	361.49	359.92	356.65	354.22	352.70	354.42	356.08	358.43	357.50	357.53
1994	359.43	360.52	361.48	361.84	362.52	361.32	358.37	356.46	354.77	356.23	358.64	360.96	359.38	359.30
1995	360.82	362.81	362.77	364.46	364.26	362.88	360.45	357.73	357.53	359.24	359.77	361.23	361.16	361.18
1996	362.60	364.12	364.47	365.13	365.61	366.66	362.66	360.14	358.62	360.02	361.94	363.66	362.97	362.90
1997	364.33	365.52	365.48	366.83	368.43	366.74	362.92	361.63	359.63	360.58	362.95	366.22	364.27	364.34
1998	366.31	368.26	369.19	369.59	369.84	368.31	366.21	364.30	361.30	364.67	366.16	367.74	366.82	366.92
1999	369.72	369.88	370.68	372.00	372.03	370.56	367.45	364.46	362.94	364.95	367.36	369.18	368.43	368.44
2000	369.97	371.12	372.55	373.18	373.42	373.20	368.74	366.62	366.45	366.90	369.06	370.39	370.13	370.12
2001	371.90	372.85	375.04	374.23	375.36	373.61	371.10	367.94	367.29	368.45	370.68	372.01	371.70	371.64
2002	372.70	374.70	375.41	376.40	376.79	374.63	372.84	370.24	367.89	370.74	372.32	375.10	373.31	373.40
2003	375.67	377.71	377.73	378.38	379.17	379.17	375.84	371.45	371.25	373.24	375.74	376.42	375.98	375.98
2004	377.84	378.76	379.20	381.27	380.99	380.61	377.49	374.05	374.71	375.52	376.89	378.44	377.98	377.93



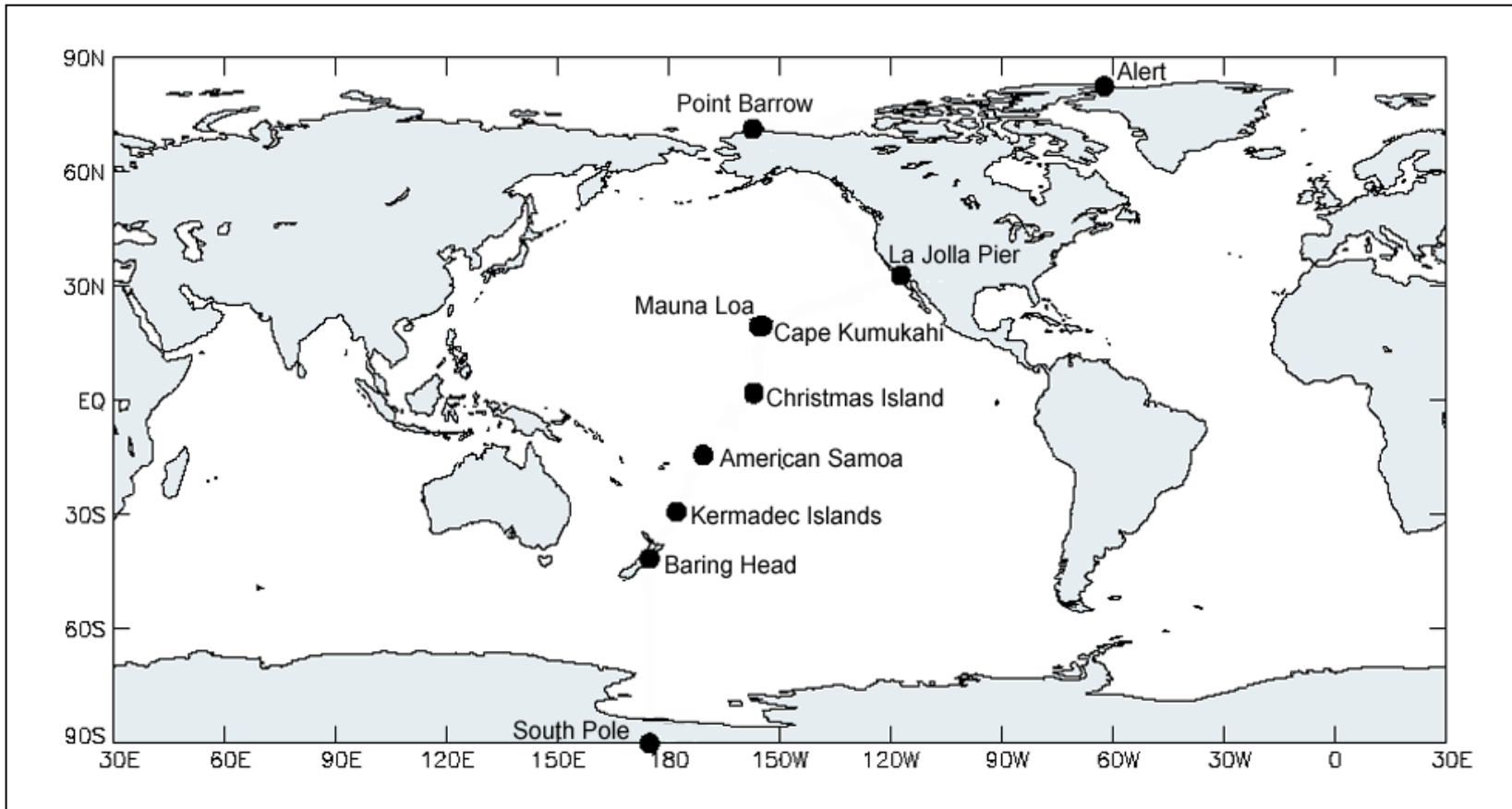
Location F Mauna Loa

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Annual-Fit
1958	-99.99	-99.99	315.71	317.45	317.50	-99.99	315.86	314.93	313.19	-99.99	313.34	314.67	-99.99	-99.99
1959	315.58	316.47	316.65	317.71	318.29	318.16	316.55	314.80	313.84	313.34	314.81	315.59	315.98	316.00
1960	316.43	316.97	317.58	319.03	320.03	319.59	318.18	315.91	314.16	313.83	315.00	316.19	316.91	316.91
1961	316.89	317.70	318.54	319.48	320.58	319.78	318.58	316.79	314.99	315.31	316.10	317.01	317.65	317.63
1962	317.94	318.56	319.69	320.58	321.01	320.61	319.61	317.40	316.26	315.42	316.69	317.69	318.45	318.46
1963	318.74	319.08	319.86	321.39	322.24	321.47	319.74	317.77	316.21	315.99	317.07	318.36	318.99	319.02
1964	319.57	-99.99	-99.99	-99.99	322.23	321.89	320.44	318.70	316.70	316.87	317.68	318.71	-99.99	319.52
1965	319.44	320.44	320.89	322.13	322.16	321.87	321.21	318.87	317.81	317.30	318.87	319.42	320.03	320.09
1966	320.62	321.59	322.39	323.70	324.07	323.75	322.40	320.37	318.64	318.10	319.79	321.03	321.37	321.34
1967	322.33	322.50	323.04	324.42	325.00	324.09	322.55	320.92	319.26	319.39	320.72	321.96	322.18	322.13
1968	322.57	323.15	323.89	325.02	325.57	325.36	324.14	322.11	320.33	320.25	321.32	322.90	323.05	323.11
1969	324.00	324.42	325.64	326.66	327.38	326.70	325.89	323.67	322.38	321.78	322.85	324.12	324.62	324.60
1970	325.06	325.98	326.93	328.13	328.07	327.66	326.35	324.69	323.10	323.07	324.01	325.13	325.68	325.65
1971	326.17	326.68	327.18	327.78	328.92	328.57	327.37	325.43	323.36	323.56	324.80	326.01	326.32	326.32
1972	326.77	327.63	327.75	329.72	330.07	329.09	328.05	326.32	324.84	325.20	326.50	327.55	327.46	327.52
1973	328.54	329.56	330.30	331.50	332.48	332.07	330.87	329.31	327.51	327.18	328.16	328.64	329.68	329.61
1974	329.35	330.71	331.48	332.65	333.09	332.25	331.18	329.40	327.44	327.37	328.46	329.58	330.25	330.29
1975	330.40	331.41	332.04	333.31	333.96	333.59	331.91	330.06	328.56	328.34	329.49	330.76	331.15	331.16
1976	331.74	332.56	333.50	334.58	334.87	334.34	333.05	330.94	329.30	328.94	330.31	331.68	332.15	332.18
1977	332.92	333.42	334.70	336.07	336.74	336.27	334.93	332.75	331.58	331.16	332.40	333.85	333.90	333.88
1978	334.97	335.39	336.64	337.76	338.01	337.89	336.54	334.68	332.76	332.54	333.92	334.95	335.50	335.52
1979	336.23	336.76	337.96	338.89	339.47	339.29	337.73	336.09	333.91	333.86	335.29	336.73	336.85	336.89
1980	338.01	338.36	340.08	340.77	341.46	341.17	339.56	337.60	335.88	336.01	337.10	338.21	338.69	338.67
1981	339.23	340.47	341.38	342.51	342.91	342.25	340.49	338.43	336.69	336.85	338.36	339.61	339.93	339.95
1982	340.75	341.61	342.70	343.56	344.13	343.35	342.06	339.82	337.97	337.86	339.26	340.49	341.13	341.09
1983	341.37	342.52	343.10	344.94	345.75	345.32	343.99	342.39	339.86	339.99	341.16	342.99	342.78	342.75
1984	343.70	344.51	345.28	347.08	347.43	346.79	345.40	343.28	341.07	341.35	342.98	344.22	344.42	344.44
1985	344.97	346.00	347.43	348.35	348.93	348.25	346.56	344.69	343.09	342.80	344.24	345.56	345.90	345.86
1986	346.29	346.96	347.86	349.55	350.21	349.54	347.94	345.91	344.86	344.17	345.66	346.90	347.15	347.14
1987	348.02	348.47	349.42	350.99	351.84	351.25	349.52	348.10	346.44	346.36	347.81	348.96	348.93	348.99
1988	350.43	351.72	352.22	353.59	354.22	353.79	352.39	350.44	348.72	348.88	350.07	351.34	351.48	351.44
1989	352.76	353.07	353.68	355.42	355.67	355.13	353.90	351.67	349.80	349.99	351.30	352.53	352.91	352.94
1990	353.66	354.70	355.39	356.20	357.16	356.22	354.82	352.91	350.96	351.18	352.83	354.21	354.19	354.19



Location F Mauna Loa (continued)

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Annual-Fit
1991	354.72	355.75	357.16	358.60	359.34	358.24	356.17	354.03	352.16	352.21	353.75	354.99	355.59	355.62
1992	355.98	356.72	357.81	359.15	359.66	359.25	357.03	355.00	353.01	353.31	354.16	355.40	356.37	356.36
1993	356.70	357.16	358.38	359.46	360.28	359.60	357.57	355.52	353.70	353.98	355.33	356.80	357.04	357.10
1994	358.36	358.91	359.97	361.26	361.68	360.95	359.55	357.49	355.84	355.99	357.58	359.04	358.88	358.86
1995	359.96	361.00	361.64	363.45	363.79	363.26	361.90	359.46	358.06	357.75	359.56	360.70	360.88	360.90
1996	362.05	363.25	364.03	364.72	365.41	364.97	363.65	361.49	359.46	359.60	360.76	362.33	362.64	362.58
1997	363.18	364.00	364.57	366.35	366.79	365.62	364.47	362.51	360.19	360.77	362.43	364.28	363.76	363.84
1998	365.32	366.15	367.31	368.61	369.29	368.87	367.64	365.77	363.90	364.23	365.46	366.97	366.63	366.58
1999	368.15	368.87	369.59	371.14	371.00	370.35	369.27	366.94	364.63	365.12	366.67	368.01	368.31	368.30
2000	369.14	369.46	370.52	371.66	371.82	371.70	370.12	368.12	366.62	366.73	368.29	369.53	369.48	369.47
2001	370.28	371.50	372.12	372.87	374.02	373.30	371.62	369.55	367.96	368.09	369.68	371.24	371.02	371.04
2002	372.43	373.09	373.52	374.86	375.55	375.40	374.02	371.49	370.71	370.24	372.08	373.78	373.10	373.08
2003	374.68	375.63	376.11	377.65	378.35	378.13	376.62	374.50	372.99	373.00	374.35	375.70	375.64	375.61
2004	376.79	377.37	378.41	380.52	380.63	379.57	377.79	375.86	374.06	374.24	375.86	377.48	377.38	377.43





Extension Worksheet

After graphing the location data for sites A-F, decide where you think each data set may have been measured. Fill in each of the 6 boxes on the world map with the letter you feel best fits with what you know about carbon dioxide and that location.

