Lab 2

Exercise 1:

In geology it is a very common practice to draw cross sections with the vertical scale enlarged relative to the horizontal scale; that is to stretch the section vertically while leaving the horizontal dimension unaltered. The degree of stretch is the vertical exaggeration V. Figure 1 shows the effect of vertical exaggeration on bedding dip ,δ, and thickness, t.

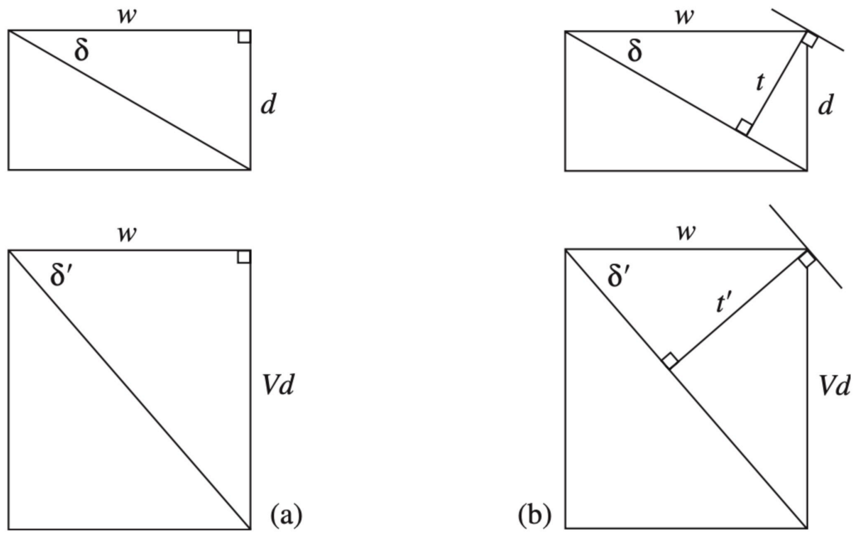

Figure 1. Effect of vertical exaggeration on bedding (a) dip and (b) thickness. δ and t are non-exaggerated dip and thickness. δ' and t' are exaggerated dip and thickness. From Ragan (2009).

These changes are expressed by the following equations (Ragan, 2009):

$$\tan \delta' = V \tan \delta$$

$$\frac{t'}{t} = \frac{\sin \delta'}{\sin \delta}$$

where δ' and t' are the exaggerated dip and thickness, respectively.

1. Using Python, draw a graph of unexaggerated dip versus exaggerated dip for vertical exaggeration 0.5, 1, 2, 3, 4, 6 and 10.

2. Using Python, draw a graph of unexaggerated dip versus normalised exaggerated thickness (t'/t) for vertical exaggeration 0.5, 1, 2, 3, 4, 6 and 10.

Your graphs should look like Figure 2.

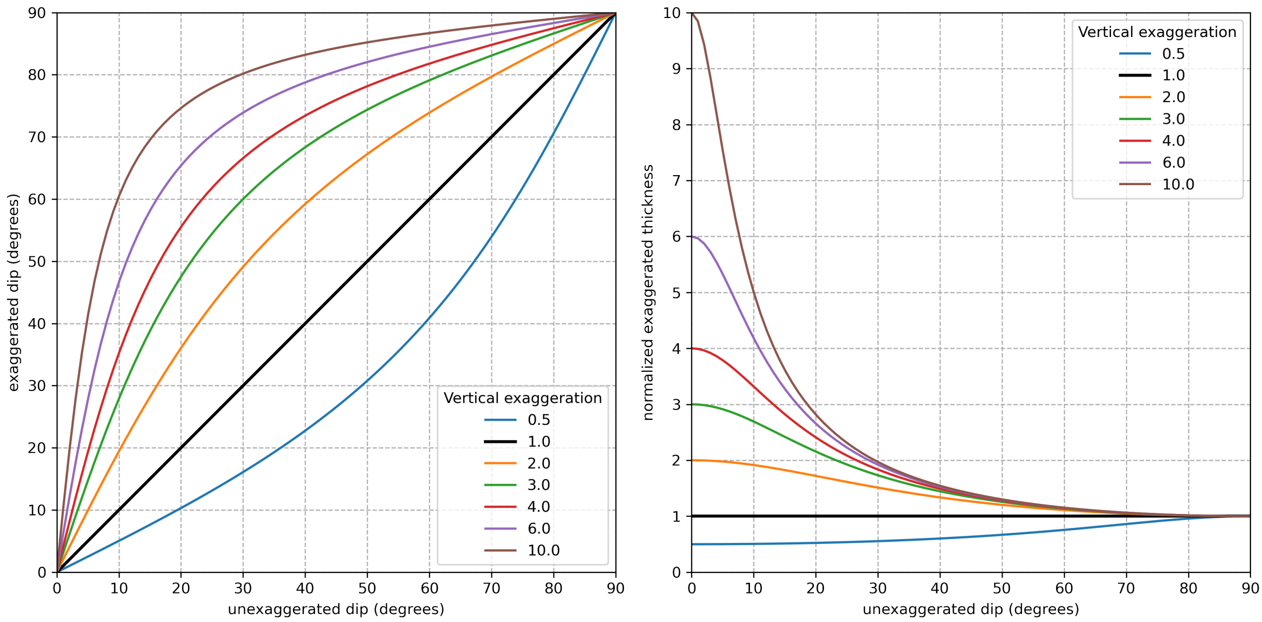

Figure 2. Unexaggerated dip versus exaggerated dip (left), and unexaggerated dip versus normalised exaggerated thickness (right), for several vertical exaggeration factors.

Exercise 2:

The file petroleum_production_Norway.xlsx in the data directory (from NPD FactPages) contains the statistics of petroleum production in Norway from 1971 to the present, for oil, gas, condensate, and NGL. Notice that 1000 Sm3 of gas is equal to 1.0 Sm3 o.e.

1. Using pandas make a graph similar to Figure 3. *Hint:* Look at the pandas.DataFrame.plot.bar function.
2. Add an additional axis to your graph and on this axis plot as a curve the water production over time.

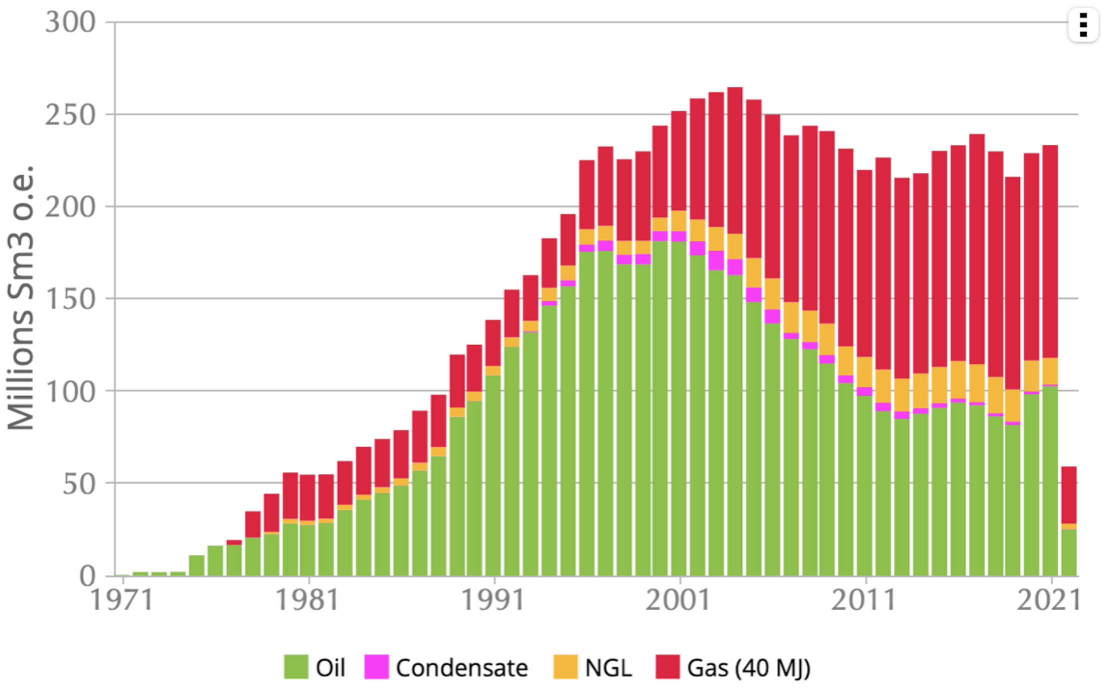

Figure 3. History of hydrocarbon production in the NCS (NPD FactPages)

Exercise 3:

The file global_temperature_record.xlsx in the data directory (from 2° institute) contains the Earth's global surface temperature anomalies (in °C) relative to the 1951-1980 average temperatures. Using pandas do the following:

1. Combine the sheets 800,000 yr and 20,000 yr to make a graph of temperature anomaly (y axis) over time (x axis) in the last 800,000 years. Notice that by convention time increases to the right and the present should plot on the right end of the x axis.
2. Color the figure in 1, so that the time periods with positive temperature anomaly are shown in red, and those with negative temperature anomaly are shown in blue.
3. Combine the sheets 2,000 yr and NASA to make a graph of temperature anomaly (y axis) over time (x axis) in the last 2,000 years.
4. Color the figure in 3, so that the time periods with positive temperature anomaly are shown in red, and those with negative temperature anomaly are shown in blue.

Notice that in 1 and 3, you need to combine the datasets. So in 1, you will use the 800,000 yr dataset to get the records from 800,000 to 20,000 yr ago, and the 20,000 yr dataset to get the records from 20,000 yr ago to the present. Likewise in 3, you will use the 2,000 yr dataset to get the records from 2,000 yr ago to 1880, and the NASA dataset to get the records from 1880 to the present.

Hint: To combine two DataFrame objects look at the pandas.concat method. To colour the age versus temperature plots, look at the matplotlib.pyplot.fill_between method.