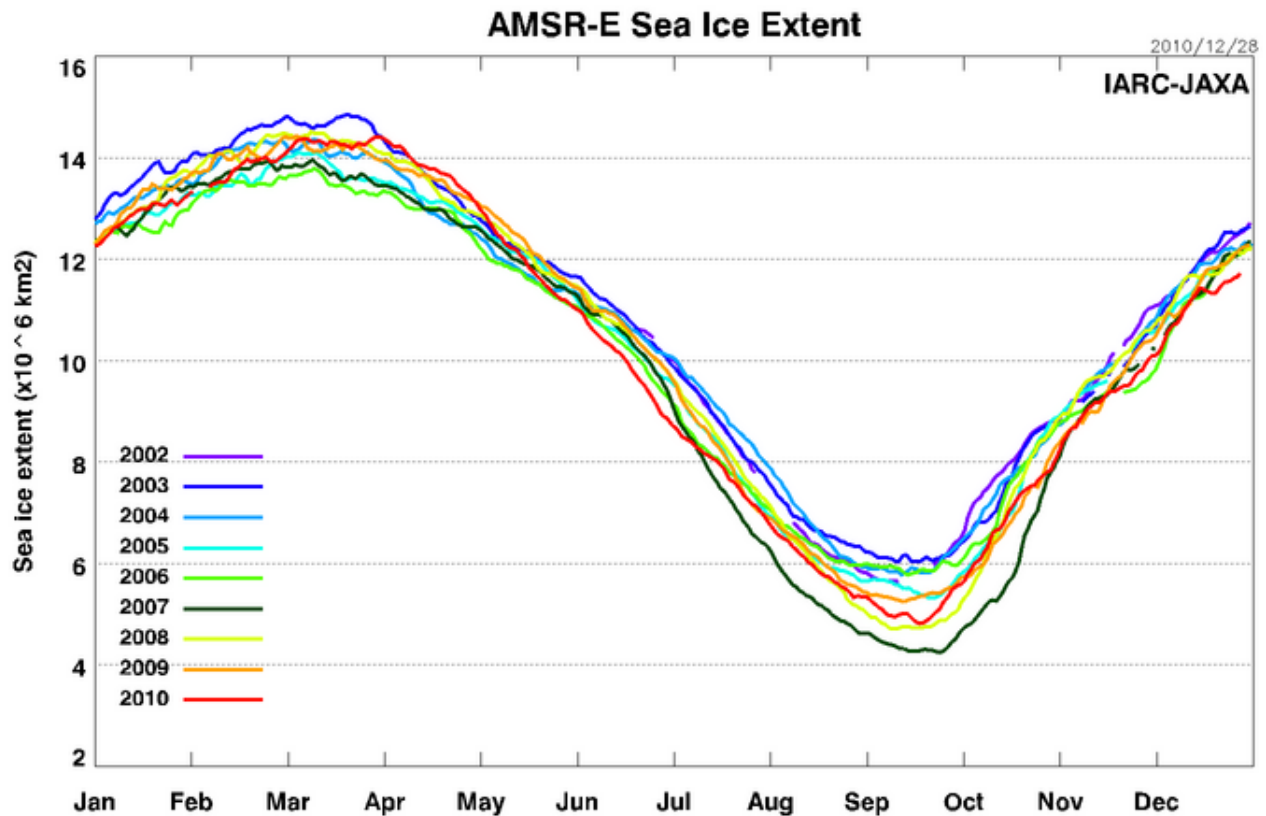


Average Value of a Function

Sea Ice extent has varied considerably over the past decade, as illustrated in Figure 1:

Figure 1: This image (source) is based on data (source) obtained from the Japan Aerospace Exploration Agency.



Here is the website's description of the data:

- Data from June 2002 to the present are included.
- The format is “month, day, year, extent (unit: square km)”.
- Number “-9999” represents that we couldn't conduct the observation during the period for the reason that the satellite went into constrained operation mode or stand-by mode to avoid harmful effects by meteor showers and solar flares.

The data is given almost daily for much of the period, but there are a fair number of missing values (as described). If you wish, visit http://www.ijis.iarc.uaf.edu/en/home/seaice_extent.htm to see how sea ice extent is defined.

In order to give us something to work with in this lab, I averaged the daily data over each month in a year, to give the results (Table 1) for three of the years:

Table 1: We might associate the following values with the midpoint of each month (since they're averages for all data values available for a given year and month).

	2003	2007	2010
January	1.35326E+7	1.29036E+7	1.28771E+7
February	1.43623E+7	1.36982E+7	1.37691E+7
March	1.47057E+7	1.37179E+7	1.42785E+7
April	1.36569E+7	1.30360E+7	1.38357E+7
May	1.21824E+7	1.19415E+7	1.19959E+7
June	1.09058E+7	1.04981E+7	1.00305E+7
July	8.84840E+6	7.66539E+6	7.90460E+6
August	6.77090E+6	5.30139E+6	5.96827E+6
September	6.12647E+6	4.38052E+6	5.09709E+6
October	7.54304E+6	6.00201E+6	6.91923E+6
November	9.91880E+6	9.25249E+6	9.24517E+6
December	1.18946E+7	1.14608E+7	1.11049E+7

Questions:

1. If we integrated over a given year, what would be the sense of the answer? What would it represent physically?
2. Which approximation techniques that we have described could be used to perform the integration?
3. How might one compute the **average** sea ice extent, using the methods of this section? Do so, and describe its meaning. What do you conclude about average sea ice extent for the three different years?
4. Did you consider the difference in month length in your calculations? Should you?