**Challenge Set 2**: Models and Ensembles

Sam Mogen / Chris W P

As you learned about earlier this week, model simulations are subject to great variability which is captured by different ensembles.

For this challenge, you will be looking at the Community Earth System Model (CESM) [Decadal Prediction Large Ensemble](https://www.cesm.ucar.edu/projects/community-projects/DPLE/) (DPLE). CESM-DPLE was created in part to look at predictability over the short-term, and was initialized and run five years out from November of each year.

Data for DPLE pH initialized in 1991 can be found in the folder for this day - dimensions correspond to year of initialization (S), month after initialization (L), and ensemble member (M). The start date for the data is 11/1991 (L).

You will also use the ‘new\_grid.nc’, which will provide the ocean grid needed for plotting…

Please answer the following question: **how does pH change in the Gulf of Alaska over the simulation period?**

Some steps that will be helpful in answering this question:

* Subset the data for a small region in the North Pacific near the Gulf of Alaska and use pd.date\_range() to give the ‘L’ dimension date-time values.
* Weight the data using TAREA values (found in the ‘new\_grid.nc’ file)
  + Hint: both grids have the same dimensions. To weight something → pH \* TAREA / mean(TAREA)
* Create a time series showing the the ensemble mean and all ensemble members from the 1991 initialization
  + Hint: ensemble mean should be darker/thicker line; ensemble members can be lighter
* Create a spatial plot of the Gulf of Alaska showing the ensemble mean using Cartopy (hint: use TLAT and TLONG from the grid file when plotting) in various years
* Remember to label your plots, axes, and include colorbars
* Save figures and be ready to share what you have created!!