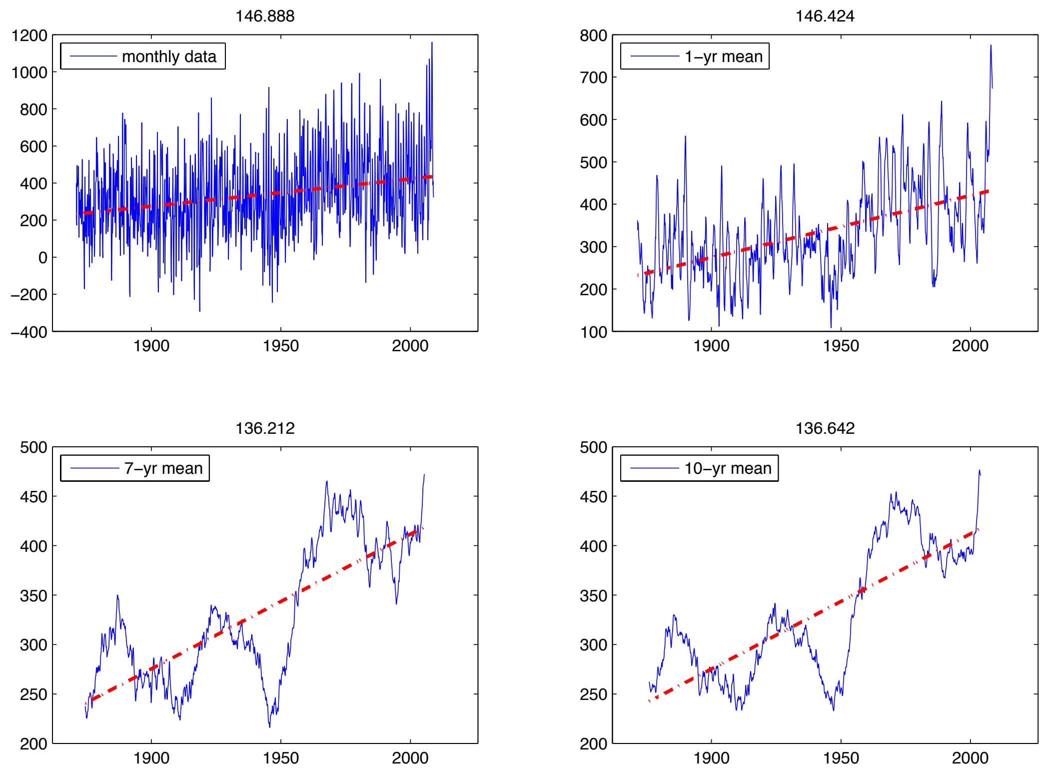
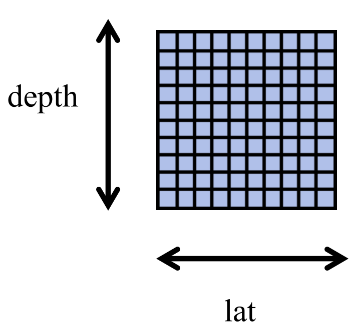
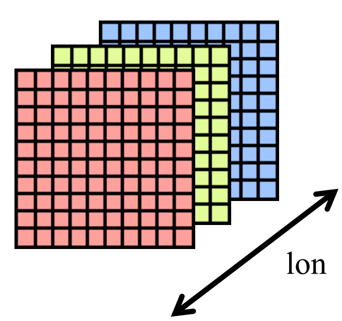
Change in Volumetric Flow of SODA Domain: all lon, all depth -1<=lat<=1
Title indicates change in Sverdrup per century; positive values indicate eastward flow



How I (think) I calculated this:
Generated a grid of depth x lat area and multiplied it by eastward velocity (u) for all longitudes at all times. I then summed volume flux (m^3/s) over latitude (-1<lat<1) all depth and all longitude and converted to Sverdrups.





$$\text{Eastward volume flux at time t} = \sum_{lon=120}^{lon=280} (eastwardflux(lon,t))$$

```matlab
% EUC SODA analysis

close all
    ncid = netcdf.open ('u_eqpac_SODA_extended.nc','NC_NOWRITE');

    % get variable ID
    varid_lat = netcdf.inqVarID(ncid,'lat');
    varid_lon = netcdf.inqVarID(ncid,'lon');
    varid_time = netcdf.inqVarID(ncid,'time');
    varid_u = netcdf.inqVarID(ncid,'u');
    varid_depth = netcdf.inqVarID(ncid,'depth');

    % get variables
    time = netcdf.getVar(ncid,varid_time);
    lat = netcdf.getVar(ncid,varid_lat);
    lon = netcdf.getVar(ncid,varid_lon);
    u = netcdf.getVar(ncid,varid_u);
    depth = netcdf.getVar(ncid,varid_depth);

 % lon x lat x depth x time

 % eliminate missing value fill value (-9.99e+33)
 u(u<-10) = NaN;
%% Determining EUC Current Flux Across -1<=Lat<=1
close all
% calculating area of grid box:
% depth dimension
 I_lat = find(lat<=1 & lat>=-1);

depth_int = diff([0;depth]);
height = zeros(length(depth),1);

for j = 2:length(depth)
    height(j-1) = 0.5*(depth_int(j) + depth_int(j-1));
end
height(1) = height(1)+ 0.5*depth_int(1);
height(end) = depth_int(end);

% latitudinal dimension: always about 0.5 degrees apart, assume 110.574 km
% per degree lat
% ASSUMPTION: distant between latitudes is constant - not actually true

y_dim = 0.5*110.574*100; %in meters

% calculate grid of areas (square meters)

grid_area_1 = repmat(height*y_dim,1,numel(find(I_lat)));
grid_area_2 = repmat(grid_area_1,[1 1 length(lon)]);
grid_area_3 = permute(grid_area_2,[3 2 1]);
grid_area_4 = repmat(grid_area_3,[1 1 1 length(time)]);

% apply to all SODA velocities between -1<=Lat<=1

flux_1 = grid_area_4.* u(:,(lat<=1 &lat>=-1),:,:);

% looking at net transport in domain -1<=Lat<=1

domain_flux = squeeze(squeeze(squeeze(nansum(nansum(nansum(flux_1))))));

% only interested in integrating positive values

time_2 = zeros(1,length(time));

 timen = time-.5;
 for j = 1:length(time)
    time_2(j) = addtodate(datenum(1960,1,1),double(timen(j)),'month');
 end
```

```
titles = {'monthly data','1-yr mean','7-yr mean','10-yr mean'};
 win_i = [0,1,7,10]; % number of years in running mean

  for j = 1:4

      % get running mean
      win = win_i(j)*12+1;
      avg_flux = runmean(domain_flux,win)/(10^6);timeser = avg_flux;

      % calculate trend
      trend= timeser((1+floor(win/2)):(end-floor(win/2)))-
detrend(timeser((1+floor(win/2)):(end-floor(win/2))));

     subplot(2,2,j)

     % plot data or running mean
     plot(time_2,avg_flux)
     hold on
     % plot trendline
     plot(time_2((1+floor(win/2)):(end-floor(win/2))),trend,'-
.r','LineWidth',2)

     %plot details
     legend(char(titles(j)),'Location', 'northwest')
     title((trend(2)-trend(1))*12*100); % this calculates the trend per century
if the data are daily
     datetick('x','yyyy','keeplimits')

 end
```