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Geog 133 - Tropical Meteorology

Lab 5: Seasonal Variations in Regional Circulation Systems: The Monsoons

1. Explain why the difference in seasonal heating between oceans and continents is an essential factor for the existence of monsoons (i.e. why is differential heating of the ocean and continents a general factor that accounts for the existence of monsoons?). (3pts)

   Seasonal changes in surface temperatures drive atmospheric pressure change, resulting in reversals of the pressure gradient force. The reversal in the PGF produces major wind reversals which factor into the existence of monsoons.

2. How do moisture processes add to the magnitude of the monsoons? (3pts)

   When moist air rises, it eventually condenses and releases latent heat energy. The heating effect raises land and ocean pressure differences, increasing the magnitude of monsoons.

3. The goal of the present question is to provide an overview of the seasonal cycle of the American Monsoons. Go to the CDC NOAA website (http://www.esrl.noaa.gov/psd/cgi-bin/data/composites/printpage.pl) and plot the **seasonal** average of precipitation and OLR for the last 30 years.

   QUANTITATIVELY discuss the **seasonal** differences in the magnitude of precipitation and OLR over three particular locations: **Arizona, Southern Mexico, and the Amazon region**. (THAT IS, *COMPARE* VALUES, *DISCUSS* CHANGES IN MAGNITUDES OF THE VARIABLES AND *RELATE* THESE CHANGES TO THE SEASONAL CYCLE OF THE MONSOON IN THE AMERICAS.) **These plots you need to answer this question are pasted below for you to use. You do not need to include the plots in the write up, you will get these points automatically whether you include these plots in the write up or not. (4pts per seasonal description; 2 free points for each set of plots; 24pts total)**

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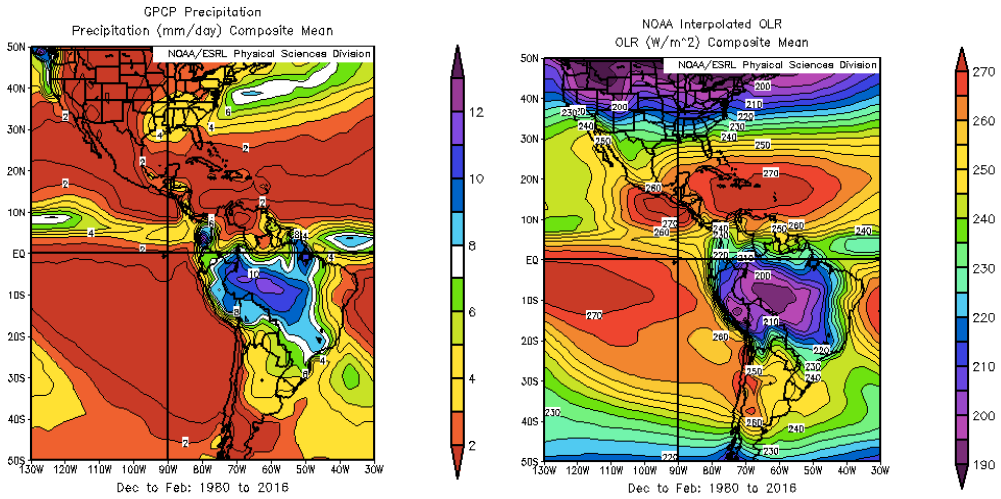
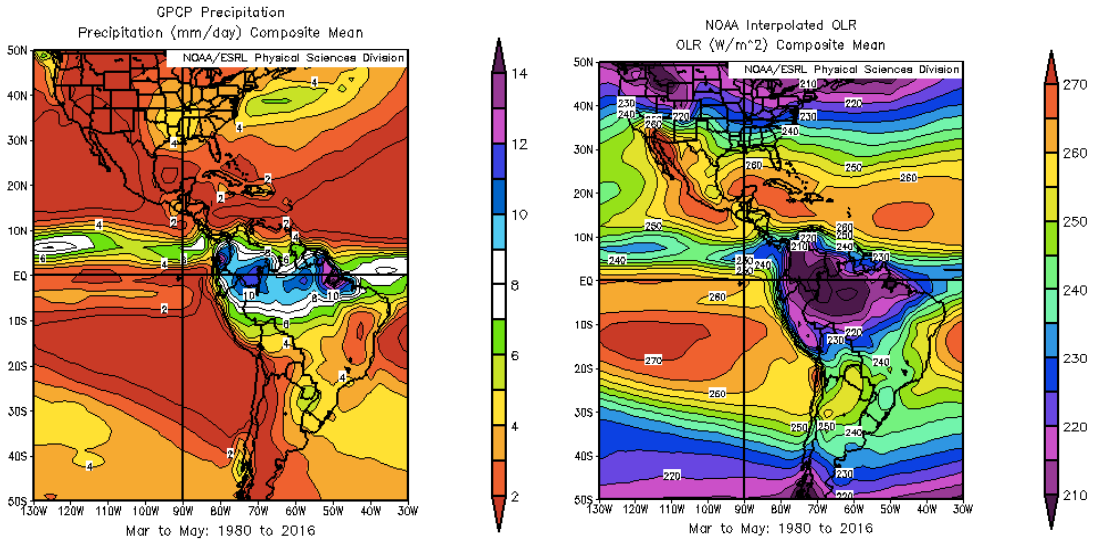


From Dec-Feb, the northern hemisphere is experiencing winter, and the southern hemisphere is experiencing summer. Arizona and Southern Mexico (NH) both experience low values of precipitation (0-2 mm/day) and moderate to high amounts of Outgoing longwave radiation (OLR) respectively (240-270 W/m^2). The Amazon region (SH) experiences much higher amounts of precipitation (8-12+ mm/day) and lower amounts of OLR (190-210 W/m^2), representing convective cloud coverage and higher atmospheric heat/moisture values.



From Mar-May, the northern hemisphere is experiencing spring, and the southern hemisphere is experiencing fall. Arizona and Southern Mexico (NH) continue to experience low values of precipitation (0-2 mm/day) and low to moderate amounts of OLR respectively (210-260 W/m^2). The Amazon region (SH) experiences less amounts of precipitation (8-12+ mm/day) over the region and maintain low amounts of OLR (190-210 W/m^2), representing convective cloud coverage and high atmospheric heat/moisture values. The northward transition of precipitation values represents the seasonal change from Dec-Feb and Mar-May, as well as the movement of warm and moist atmospheric air.

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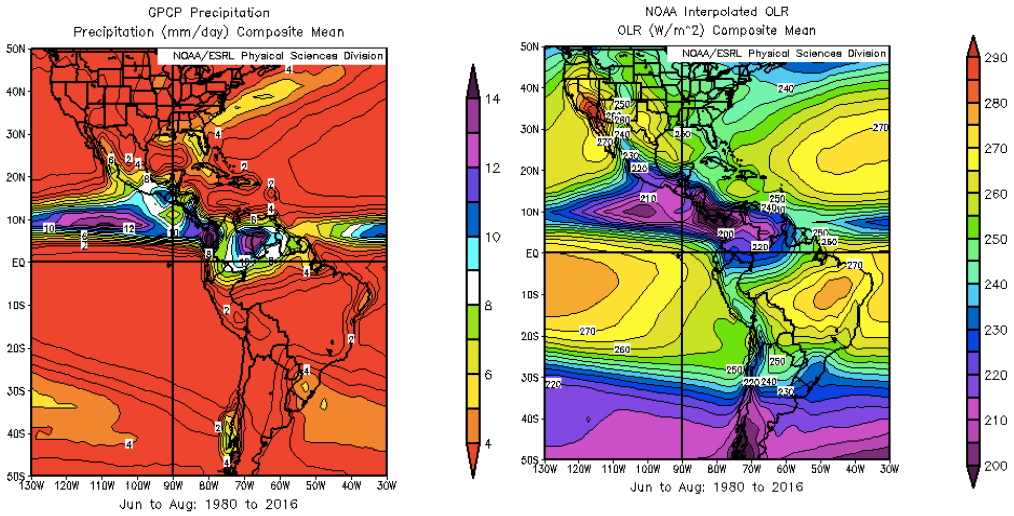
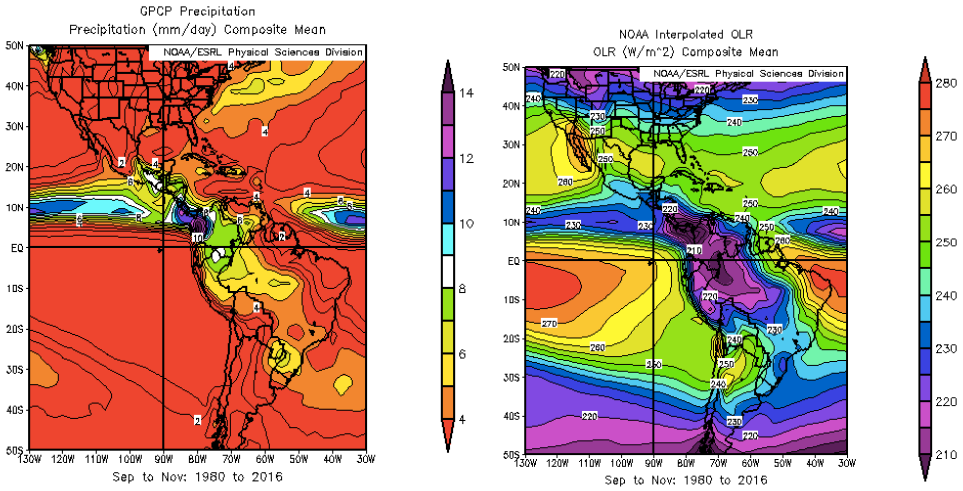


By Jun-Aug, NH summer and SH winter is present, keeping warm/moist air north of the equator. Arizona experiences little to no precipitation, but southern Mexico greatly increases precipitation values. Precipitation decreases in the Amazon region, and low OLR values move to concentrate on southern Mexico.



Finally, Sep-Nov is NH Fall and SH Spring. This period is the transition of low OLR and high precipitation regions southward, due to warm and moist air moving south. Mexico starts to receive less rain than in the summer, and the Amazon remains drier, but redevelops lower OLR values. Arizona remains relatively dry in Fall and OLR values do not dramatically change.

The Annual monsoon cycle is visible within these precipitations and OLR plots. As seasonal changes occur, the magnitude of monsoons may increase, and create very low values of OLR and high amounts of precipitation in critical areas. As land and ocean heating changes by season, so do atmospheric conditions, and the cycle of change characterizes monsoon occurrence and intensity.

If you are interested, this is how the plots are created
Variable? ____ (**Choose GPCP Precipitation**)
Beginning month of season: ____ Ending month: ____ (**Choose June to August**)
OR Enter range of years: ____ (**Choose 1980 to 2009**)
Color? (Choose Color) Shading (**Choose shaded with overlying contours**)
Reverse colorbar? ____ (**Choose Yes**)
Map projection: (**Choose Custom**)
Lowest lat: (-90 to 90): ____ highest lat: ____ (**Choose -50 to 50**)
Western-most longitude (0 to 360): ____ Eastern-most longitude: ____ (**Choose 230 to 330**)
CUSTOM projection:____ (**Choose Cylindrical equidistant**)
Now, repeat the procedure using the variable "**NOAA Interpolated OLR**"

Finally, generate similar figures for both precipitation and OLR for the other three seasons: September to November; December to February; and March to May.