Data Exercise 4

Assigned 2/28/18; Due 3/16/18 by 5PM

In this data exercise we’re going to explore the relationship between winds and precipitation in monsoon systems. We’ll be using three data sets, [meridional winds](http://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP-NCAR/.CDAS-1/.MONTHLY/.Intrinsic/.PressureLevel/.v/), [zonal winds](http://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP-NCAR/.CDAS-1/.MONTHLY/.Intrinsic/.PressureLevel/.u/) and [precipitation rate](http://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP-NCAR/.CDAS-1/.MONTHLY/.Diagnostic/.surface/.prate/). **The wind datasets have layers throughout the atmosphere, throughout this exercise, restrict your analysis to only the 1000 mb layer.**

1. One of the features that characterizes monsoon systems is a seasonal switch in the direction of meridional (north-south) winds. **Make a global map** of the **difference** between average Jun-Aug and Dec-Feb meridional winds.
	1. The easiest way to calculate Jun-Aug and Dec-Feb averages is to use: *yearly-climatology* **and** *T (Jun-Aug) RANGEEDGES*
	2. For the colormap, use:

*startcolormap*

 *-10.0 10.0 RANGE*

 *black navy blue*

 *-10.0 VALUE*

 *cyan*

 *-1 VALUE*

 *white white*

 *1 bandmax*

 *yellow*

 *1 VALUE*

 *red*

 *10.0 VALUE*

 *firebrick endcolormap*

* 1. What do the positive and negative values on this map represent?
	2. Compare and contrast the Northern and Southern Hemisphere - why does the observed pattern occur?
	3. Does this analysis do a good job of identifying monsoon regions?
1. Now let’s look at the relationship between **meridional wind speed** and **precipitation**. To do this we’re going to calculate a new kind of correlation map. Instead of correlating a timeseries against a field of timeseries, we’re going to correlate two full fields (maps of timeseries!), so each point will be the r-value between the two timeseries **at that point*.*** To calculate these correlations, we’re still going to use the ***[T] correlate*** command, you just need to load up both datasets in your stack, and make sure they’re on the same grid first. To get them on the same grid, you may want to use the ***[X Y]regridAverage*** function. [And take a moment to bask in the power of regridding the entire dataset in Ingrid: HOW GREAT IS THIS?!]
	1. What do the positive and negative values on this map represent?
	2. Compare and contrast the Northern and Southern Hemisphere - why does the observed pattern occur?
	3. Does this analysis do a good job of identifying monsoon regions?
2. Let’s now expand on the seasonal differences that characterize monsoon regions. For this question, you’re going to make **5 maps,** one for each of the major monsoon regions in the world **(Asia, Africa, Australia, North America, South America)**. Each maps will show the difference between summer and winter (choose appropriate months for each continent {e.g., use JJA= summer for Africa and DJF = summer for Australia}), **for precipitation, with wind vectors superimposed.**
	1. You’ll need your final stack to be in this order: 1 - precip differences; 2 - zonal wind differences; 3- meridional wind differences
	2. Use a better colorscale for precip differences, like the precip scale from previous homeworks with the range changed appropriately. To do this, include the colorscale after you load in precipitation, but right before you load in any wind data.
	3. ***You’ll need to restrict the spatial ranges appropriately within each dataset, you can’t do it at the end.***
	4. Once everything is all loaded up, use *X Y fig: colors vectors coasts :fig*
	5. For ***each*** monsoon system:
		1. Describe the relationship between seasonal differences in precipitation and winds.
		2. Is it consistent with monsoonal theory we discussed in class?
	6. In which regions do monsoon dynamics seem most important for summer-winter precipitation changes?

**Deliverables:**

**1 global meridional-wind seasonal difference map**

**1 global meridional-wind, precipitation correlation map**

**5 wind vector/precipitation seasonal difference maps, one for each monsoon region**

**Answers to the questions in purple**