Activity S3_A1: Assess Inter-annual Climate Variability over South America

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Objective: To learn to examine climatology and variability of surface temperature and rainfall over south America

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There are two parts to this exercise:

1) Learn to access IRI Map Room for Climate-related Information
2) Learn to Access and Analyze El Niño Southern Oscillation (ENSO) Information

Part 1: Learn to access IRI Map Room for Climate-related Information

The IRI Map Room provides ready-made maps and animations for monitoring climate

AccessClimatological Information (Precipitation, Precipitation Frequency, and Surface Air Temperature)

a) Go to (http://iridl.ldeo.columbia.edu/maproom/index.html).
   ● On the top find "Region" and from the drop-down menu choose "South America". Take a few minutes to explore and note down the options available on this page.
   ● Choose "Climate: Analysis, Monitoring and Forecasts" – first section in the left column.
   ● Scroll down and choose "Climatologies" .
   ● Scroll down again and choose "Monthly Climatological Precipitation" – you will see a map of rainfall climatology. **To the left of the map "Description", "Dataset Documentation" and "Dataset" provide information about the data product**
   ● Hover the cursor over the map and a "Time" option will appear on top of the map. Use the arrows to examine the rainfall climatology each month.

[Using the computer mouse to draw a box on any area of interest will zoom on that area. To zoom out and go back to the South America Map, go to Region at the top and choose "South America"]

Learn about the map download options:
On top of the map window you will see:

Click here to see the image download options:

Answer the following questions:

1)   What are the rainfall units ? Write down the annual range of rainfall observed over Colombia.

2)   Which month has the maximum rainfall over Colombia? Does this agree with your results from the TRMM rainfall analysis from this morning?

b)   Click on the "Climatologies" menu at the top and choose "Monthly Climatological Precipitation Frequency"
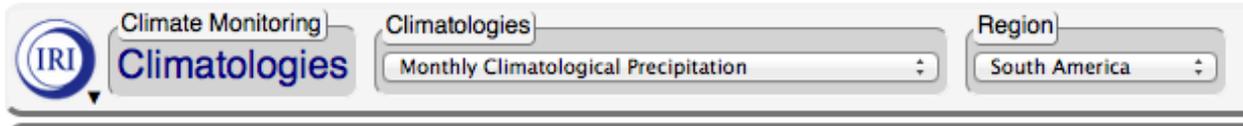
Hover the cursor over the map and a "Time" option will appear on top of the map.
Use the arrows to examine the Precipitation Frequency for each month.

Answer the following questions:

1)   Which country in South America has the highest number of rainy days in January?

2)   Which country in South America has the highest number of rainy days in September?

c)   Click on the "Climatologies" menu at the top and choose "Monthly Climatological Surface Air Temperature".

   Hover the cursor over the map and a "Time" option will appear on top of the map.
   Use the arrows to examine the Precipitation Frequency for each month.

   Answer the following questions:

1)   During which month(s) are the climatological temperatures above 20°C over most of the continent?

2)   Which areas of the continent experience the least annual variation in temperature? (Answer in terms of countries/regions).

Part 2: Learn to Access and Analyze El Niño Southern Oscillation (ENSO) Impact on Precipitation over South America

a)   Use the IRI logo at the top left to go back to the Map Room Home page or go to (http://iridl.ldeo.columbia.edu/maproom/index.html).

On the top find "Region" and from the drop-down menu choose "South America".
Scroll down and choose "El Niño, La Niña, and the Southern Oscillation".
Select "Monitoring ENSO".
You will see the following options at the top:

| Longitude x Time | SST Plots | Surface Wind | Thermocline | Time Series | Tropical Atmospheric Circulation |

Select the "Time Series" option.

In the right column column scroll down to "Niño 3.4 SST Anomaly and Equatorial Central/Eastern Pacific 925 hPa Zonal Wind Anomaly"

You will see a time series of monthly SST and zonal (east-west) wind anomalies from 1992-2014. Download the time series as a gif or jpeg (use the same procedure as in Section 1-a to download the image)

Note down the following Information. **You will be using this information in the next hands-on exercise.**

1) Write down the two El Niño years (between 1998 – present) with the warmest SST anomalies.

2) Write down the two La Niña years with the coldest SST anomalies.

b) Using the browser's back arrow, go back to "El Niño, La Niña, and the Southern Oscillation".

- Choose the section "ENSO Impacts"
- Make sure that the "Region" on top the menu is set to "South America"
- Go to "Historical Probability of Seasonal Gridded Precipitation Tercile Conditioned on ENSO". You will see a map with the probability of precipitation (click on description at the top and then go to the bottom of the map to see the details).
- Click on the map and the following will appear at the top:

Tercile	wet	←	wet	→	dry
ENSO	nino	←	nino	→	nina
Time	Dec - Feb	←	Jan–Mar	→	Nov - Jan
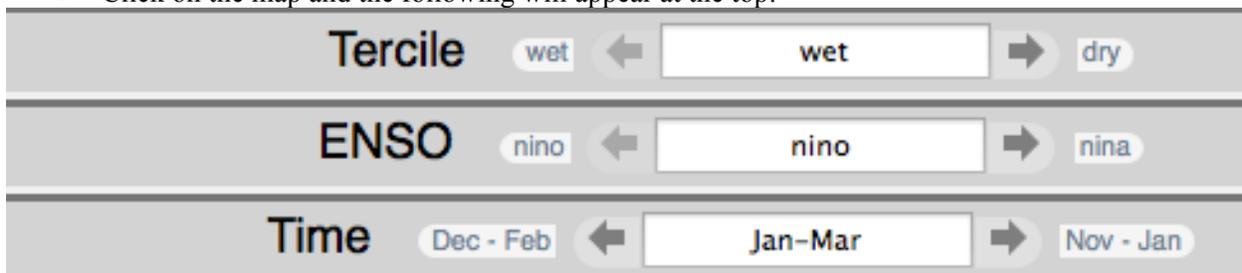
i) Use the arrows and choose: Tercile: "wet"
                                   ENSO: "nino"
Use the arrows to choose different seasons: Time: "Jan-Mar", "May-Jul" ----- "Nov-Jan"

You will get seasonal maps showing the probability of above-normal ("wet") precipitation for el "nino" – warm phase.

ii) Next, repeat the above steps **but** with Tercile: "dry" (use the right   arrow)

You will get seasonal maps showing the probability of below-normal ("dry") precipitation for el "nino" – warm phase.

iii) Now Use the arrows to choose: Tercile: "wet"
                                           ENSO: "nina"
Use the arrows to choose different seasons: Time: "Jan-Mar", "May-Jul" ----- "Nov-Jan"

You will get seasonal maps showing the probability of above-normal ("wet") precipitation for la "nina" – cold phase.

iv) Next, repeat the above steps **but** with Tercile: "dry" (use the right   arrow)
You will get seasonal maps showing the probability of below-normal ("dry") precipitation for la "nina" – cold phase

Examine the map over Colombia and answer the following questions:

1)   Is there a higher probability of precipitation being 'below normal' or 'above normal '
        during El Niño ? In which season is there a maximum probability of anomalous
        precipitation ?

2)   Compare the probability of precipitation during El Nino to that during La Niña condition