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Looking for Climate Change : Email Exchange

Are our observations useful for understanding El Nino?

Question from St Andrew's School, RI

We are hearing again that there is another El Nino cycle in progress. Does the information you gather help understand this?

This is Alison responding having spoken to a few of the others onboard. El Nino (aka ENSO or the El Nino South Oscillation) is the pattern of warmer than average atmospheric and ocean conditions which occur periodically in the equatorial Pacific. La Nina is the opposite, when colder than normal conditions occur. The effects of a strong El Nino or La Nina are far reaching and can include floods in one part of the world and droughts in others. In the ocean, large temperature changes can have devastating effects on ocean life and, therefore, also fisheries.

We wouldn't necessarily expect to see direct effects of the current year's El Nino this far south. Although, it is likely that this year's El Nino is one component of the continuing drought that we saw in Brisbane. It is also possible, though I don't know this to be true, that we could see warmer than average surface temperatures in the southward flowing western boundary current (East Australia Current). If we were measuring closer to the tropics we would see the effects in the data, but because ENSO has period of 7 to 10 years, the length of time between the CLIVAR cruises is too great to allow much more than the recognition of the effects.

To be useful, measurements would have to be taken more often. The observation system designed to help us understand and predict ENSO is the TAO mooring system and the hydrography performed as part of mooring upkeep. These instruments give us a time series of ocean/atmosphere observations with resolution necessary to better understand El Nino.

Answer from Chris Measures: Trace Metals Group
I believe historically there is evidence that Australia suffers more significant droughts during El Nino years. Thus an El Nino might be a contributing factor to increased dust being blown off Australia into the Pacific. There was a notable dust event that covered this region in late September, 2009. However, the potential effect of El Nino may be masked by the long-term drought that has been affecting Australia in recent years. One of the measurements of the TM group is dissolved Al. The surface water concentrations can be used in combination with a model to calculate dust deposition to the surface ocean. Our current values indicate significant dust deposition near the Australian coast with values of ~ 1.4 g m-2 yr-1 at 155W decreasing to 0.6 g m-2 yr-1 by 172 W (our most recent results). Since this is the first time this kind of survey has been undertaken we have no previous data to compare these values to and thus it is not possible to say whether this gradient in dust deposition is larger than in non El Nino periods.
Cheers, Chris

El Nino and the weather events in England

Hello, I am writing from cape cod. I have noticed several historic and near historic weather events in England. These seem to travel across the atlantic from the east coast. Looking at the east pacific satellite images, there seems to be a lot of heat and moisture energy being transmitted across central america into the gulf of mexico and then the east coast of america.

These systems seem somehow related. I wondered if some of the climate scientists aboard had an opinion on possible teleconnection linkages between the current el nino and the weather events in England.
thank you, gordon p

Dear Gordon,
If I understand correctly, you are asking about the effect of ENSO (El Nino Southern Oscillation), and specifically the current El Nino, on the North Atlantic storm track. This question is likely related to the question: does El Nino affect the North Atlantic Oscillation (or vice versa)? El Nino in the Pacific is certainly known to affect the Atlantic tropics, and you are correct that much of the weather in New England originates in the western tropical Atlantic. One of our students on board has been studying the effect of El Nino on the New England storms, so she is going to try to look into your question too.

- Alison

More Detail from Liz Burakowski

The Impacts of the El Niño Southern Oscillation on European Climate: Interactions with the North Atlantic Oscillation and the Pacific Decadal Oscillation

During the warm phase of ENSO (El Nino), upper troposphere water vapor increases in the eastern Pacific, Gulf of Mexico and some areas of the North Atlantic, largely due to enhanced deep convection and vertical moisture fluxes (Wang and Fu 2000). The increase in tropospheric water vapor can contribute to increased storminess and rainfall in northern Europe. However, the climatological impacts of ENSO on northern Europe's climate are modulated by two lesser known modes of northern hemisphere climate variability- the North Atlantic Oscillation (NAO) and the Pacific Decadal Oscillation (PDO) (Zanchettin et al. 2008).

The North Atlantic Oscillation (NAO) is the dominant mode of winter climate variability in the North Atlantic and is defined as the sea level pressure anomaly between Reykjavík, Iceland and Azores, Portugal (Hurrell 1996). During the positive phase of the NAO, a strong sea level pressure gradient is observed and the jet stream tracks strongly from east to west, bringing increased storminess to northern Europe

and drier conditions to southern Europe. During the negative phase of the NAO, the pressure gradient weakens, leading to more frequent blocking of the jet stream and thus decreased storminess in northern Europe and wetter conditions in southern Europe. When the NAO signal is strong (either positive or negative) it acts to disperse ENSO signals. Only when El Nino events occur during weak or neutral NAO conditions does northern Europe experience the increased storminess and rainfall associated with the enhanced tropospheric water vapor (Zanchettin et al. 2008).

The Pacific Decadal Oscillation (PDO) is the leading pattern observed in North Pacific sea surface temperatures that shifts every 20-30 years (Mantua et al. 1997; Mantua and Hare 2002). The positive phase of the PDO is characterized by cool SSTs in the western North Pacific and warm SSTs in the eastern North Pacific. The opposite is true for the negative PDO phase. When an El Nino event occurs during a positive PDO phase, warmer waters in both the eastern North Pacific and Equatorial Pacific contribute to enhanced tropospheric water vapor content that is transported to Europe.

In short, one cannot say explicitly that El Nino events will always lead to increased storminess and rainfall in Europe. More accurately, ENSO impacts on European rainfall manifest when El Nino events coincide with positive PDO and weak to neutral NAO phases.

Sources:

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Mail: Woods Hole Oceanographic Institution, 266 Woods Hole Road, Woods Hole, MA 02543, USA.
E-Contact: info@whoi.edu; press relations: media@whoi.edu, tel. (508) 457-2000
Problems or questions about the site, please contact webdev@whoi.edu