

CLIMAS: Climate Assessment for the Southwest - October 2014 Southwest Climate Podcast

Recorded 10.22.2014, Published 10.23.2014 - <http://www.climas.arizona.edu/media/podcasts>

Oct 2014 SW Climate Podcast: Monsoon Recap & an El Niño Double Dip

In the October Southwest Climate Podcast, CLIMAS climate scientists Zack Guido and Mike Crimmins discuss the 2014 monsoon, focusing on the influence of tropical storm systems, record and near-record precipitation events, monsoon intensity and duration, and the ever-present promise of El Niño.

Suggested Source/Citation

CLIMAS: Climate Assessment for the Southwest, (2014). *Monsoon Recap and an El Niño Double Dip*. [podcast] CLIMAS Southwest Climate Podcast. Available at: <http://www.climas.arizona.edu/podcast/oct-2014-sw-climate-podcast-monsoon-recap-and-el-ni%C3%B1o-double-dip> [Accessed 30 Oct. 2014]

Zack: Welcome all those tuning into October's SW Climate Podcast. As usual I am here with Mike Crimmins, climate and coffee connoisseur. So today we are going to get to two topics, we are on the cusp of an El Niño, but lets first put a bow on the monsoon because we have been alluding to doing a monsoon wrap up

Mike: Monsoon, when did that happen? 00:37

Zack: It is now officially in the books. So we will get to El Niño, we are even going to speculate on the El Niño's appearance and duration. So there is some talk of perhaps an El Niño lasting a little bit longer than maybe we thought. 00:56

Mike: I feel like it owes us at this point. 00:58

Zack: So the monsoon Mike, in 144 characters or less, how would you describe the monsoon? 01:05

Mike: A-. It had a little bit of something for everyone I guess, you want a Haboob here, you want a heavy rainstorm over here, you want a tropical storm over here. I feel like it had something for everybody this year. 01:22

Zack: But it had pretty widespread coverage. 01:26

Mike: Yeah, I think that we did well. Not too many places got left behind when we talk about Arizona and New Mexico, which can often happen. You can have these monsoon seasons that can roll across here and some places will do amazing and there will be a lot of holes, but we did a lot of filling in with a lot of different types of events across both Arizona and New Mexico. 01:44

Zack: Right. So if you sort of aggregate all of Arizona and look at July, August and September, it was the 6th wettest for Arizona and 9th for New Mexico. And September in Arizona, in southern parts of Arizona, was the 3rd wettest.

Mike: 4th for the whole state. 02:06

Zack: So there was widespread coverage. Now New Mexico also experienced a pretty active monsoon season. It seemed in percent of average participation, to do even better than Arizona in a lot of places. 02:22

Mike: They did. New Mexico was on a tear right from the beginning, right from mid June to July. Arizona had a couple fits and starts where we picked up right around the 4th of July, and then we had a pretty long break towards the end of the month. At that time, New Mexico was clipping along, and then we kind of matched up in August. Arizona started having a couple more events. It slowed down in New Mexico. And

CLIMAS: Climate Assessment for the Southwest - October 2014 Southwest Climate Podcast

Recorded 10.22.2014, Published 10.23.2014 - <http://www.climas.arizona.edu/media/podcasts>

then we got into September, we started to both share some of these tropical storms that were moving across the region, or at least giving us moisture. 02:53

Zack: We talked about that last month, the sort of pretty active eastern tropical Pacific Ocean. To the tune of this entire year, if you look at total cyclonic energy, it is running at about 140 percent of average. So that is a measure of both, its intensity and duration. I think there has been 14 categorized hurricanes. 03:13

Zack: Yeah so there has been 14 hurricanes of some sort since the first of the year but mainly since May, actually when the hurricane season ramps up. Those hurricanes, at least two of which, influenced September precipitation in Arizona. Norbert, we talked about this last month, provided a lot of precipitation for Phoenix and also Tucson. I think Phoenix got around, at the Sky Harbor Airport, like around 5 inches. A large fraction of that came from Norbert. 03:45

Mike: We talked about this last month, creating a kind of unusual situation for Arizona, of incredibly deep tropical moisture setting up across the state and becoming fuel for some sustained heavy rain across first the Phoenix metro area and then down across the Tucson metro area. And it wasn't uncommon to actually see precipitation totals over about 6 hours, of over 6 inches in and around the Phoenix metro area. 04:11

Zack: You know it hasn't stopped actually. We have still have three other tropical storms since October 1st. We have had Simon, Rachel, Polo and Trudy as well. So Rachel was in late September, then there was Simon. Polo was in late September too. So it went Polo, September 16th-22nd, depending on where you were. Rachel was the last week of September and then Simon and Trudy have both been in October. 04:44

Mike: So yeah, super busy and all of them, we looked at with a weary eye to see if they were going to influence our weather and half of these in September have been players in our local weather systems in the SW. That is pretty impressive. 04:58

Zack: Looking at the numbers in terms of total precipitation, we have had some station across Arizona, have record setting or near record setting. Not by a slight margin, but by a wide margin. If you look at Phoenix, Phoenix tallied its 3rd wettest monsoon season on record. It tallied about 6.35 inches. Its average is about 2.5 inches. Prescott was the wettest on record. Its average is 8, it tallied about 18 inches. Flagstaff was the 4th wettest, it averages around 6 inches and it had more than twice that. So widespread precipitation, and according to Mike. Precipitation was pretty continuous if you look at some of the maps that we have looked at in terms of, there was on average rainfall then every other day. Half the time, maybe a little bit less than half of the time, depending. And the intensity for most of the stations was above average. 05:59

Mike: If we look at, I don't know if we can remember back to last summer, but Prescott and Flagstaff, some of our higher elevation station had an exceptionally wet summer as well. I think last summer was Flagstaff's record setting. They either exceeded it again or came close to it again. These are two wet summers in a row and I think what really makes a difference this year is that, if you remember to last summer too, Phoenix and Tucson had a terrible time with the monsoon last year. It was raining in the mountains almost exclusively and very little activity moving into the valleys. This year was, we kind of had a little bit of everything. We had some rain events, like Norbert in particular, which were actually valley rainers. Very little rainfall fell across the White Mountains or even in the sky islands during that event. Then you flip it around and we have had some really good high elevation rain events, where the valleys haven't got it. Then we have had events like Odile, which clipped the southeast part of the state, which just dumped a ton of water across Cochise and parts of Santa Cruz counties, in both the valleys and upper elevations. So yeah, a bunch of different pathways of getting to pretty heavy rain across different areas. 07:17

Zack: So what do you think was sort of the climate background this year in comparison to last year? 07:19

Mike: It must have been that we had good, decent moisture last year, but probably not a lot of good

CLIMAS: Climate Assessment for the Southwest - October 2014 Southwest Climate Podcast

Recorded 10.22.2014, Published 10.23.2014 - <http://www.climas.arizona.edu/media/podcasts>

mechanisms. Like sheer in the atmosphere, large scale disturbances like easterly waves or remnant tropical circulations to organize rain. So you get in those situations, storms form on the mountains in a really soupy atmosphere and they just rain out. You don't see much other activity moving off into the valleys. This year we had so many different ways of getting moisture in different places and triggering thunderstorms. It was just a nice popery of avenues to get precip. 08:01

Zack: Last year we didn't have the same number of tropical storms either. 08:08

Mike: Absolutely, it was very quiet last year if you remember. 08:11

Zack: What we have tallied since September, more or less from the tropical storms, that mechanism wasn't as present last year as it was this year. 08:17

Mike: Absolutely. I don't have the number at my fingertips but there were a fair number of named storms in the east pacific last year but they were very weak and very short lived in duration. Its just what you said with the accumulated cyclone energy index numbers here, we had storms that would pop up in the East Pacific, quickly go to hurricane status and then hang out, move around, travel long distances. The background state was just perfect. All that energy, all that moisture, all the sea surface temperatures related to that, it was just a great environment. Having all of that moisture at your doorstep, during our convective season down here, you just have that fuel ready at any moment. Last year, you really had to have very well orchestrated surges of gulf moisture to move up in here to do that. So here, the weather systems didn't have to be as careful. There is just so much more to work with this summer. 09:19

Zack: Right, so the tropical storm's influence was most felt in September. But it is worth saying that the monsoon was pretty darn good for most of the region. I am looking at your characterization, you've look at 20 stations. Mike has got some maps that he has put on his website. So I have just looked at those 20 stations from around Arizona and of those 20, 14 of them have above average precipitation prior to September 1st. Then after, if you look at the entire monsoon season, only one of them in Springerville was below average. So September helped those (6) increase in precipitation to either near average or above average. 10:05

Mike: I think it is important for us to sort of maybe pick this apart a little more. So the contribution of the tropical storms is really what pushed a lot of places to average or above average. So if September wouldn't of happened and say our monsoon shut down in late August, which sometimes it does, you get to early September or mid September and you are really looking at the retreat of the subtropical high. Things can shut down very easily and then the dew points drop and we are into that miserable hot, kind of dry-ish but not quite there yet conditions, and we didn't really have that. So a lot of our stations and a lot of Arizona, if we didn't have September on top of it, they would have fallen quite a bit behind in seasonal totals. Looking at Tucson, without that single contribution of Norbert, we would have ended up probably about an inch and a half or 2 inches behind. Same with Phoenix. The upper elevation parts of the state, when you get into the White Mountains, they needed that to kind of come up and over. They had a lot of activity, but they didn't actually see precip totals that were super wet like we saw last summer. Than you go even further up, to the NE part of the state, up at Hopi and Navajo, and it was pretty quiet up there. They actually didn't see a Blockbuster monsoon season. If you remember back to last September. They had a huge catch up with the flooding rains that turned into the flooding in Colorado. That just didn't happen this year. The Four Corners actually is coming in below average with this monsoon season. 11:34

Zack: So that is the dry spot in the SW. I want to add something to what you just said. So Phoenix in September received more than 5 inches of rain. It only received outside of that, a little but more than an inch. That was influenced by Norbert and a little bit from Odile. 11:55

Mike: Yeah, a little bit from Odile and then the wrap up event, which was actually more wind and severe

CLIMAS: Climate Assessment for the Southwest - October 2014 Southwest Climate Podcast

Recorded 10.22.2014, Published 10.23.2014 - <http://www.climas.arizona.edu/media/podcasts>

weather. Which was that last weekend in September, that's the one that shut down Sky Harbor with the storms running through. We got some flooding rains out of that. You can even trace it down that a large fraction of Phoenix's total precipitation, came in a couple of hours with Norbert. But again, is that unusual for the SW? No. That is how we do it out here. 12:23

Zack: But your point was well taken. Even though the monsoon season was fairly good in a lot of regions prior to September, had September shutdown, which it has in the past, we would be having a different conversation right now. 12:31

Mike: Absolutely. It was the tropical storm activity, which we cannot count on in any given year, showed up in earnest this year and was a completely different avenue of getting these contribution of precip totals. 12:45

Zack: Right just to put a bow on this one as well, there was Norbert, Odile, there was another tropical depression that wasn't named, I guess it was named 16-E, there was Polo, Rachel, Simon and Trudy. All since September 1st. It has been fairly active. Some of those, I don't know if you've been paying as much attention to New Mexico as you have to Arizona, did those tropical storms have the same sort of impact on New Mexico? Because if you look at New Mexico's maps, it also had a fairly active monsoon season. 13:24

Mike: Odile, which clipped the SE part of the state, there was a really big concern a couple days out with Odile was that it was going to track closed circulation right over Arizona and put down 6 inch totals across the Tucson metro area in particular. There was a subtle deviation in the final track of it and it tracked a little further south. It clipped SE Arizona, still caused some destructive flooding in the Chiricahua Mountains, blowing out a service road. The community of Cave Creek and Portal had sustained pretty heavy with that event. So by no means a busted forecast, it was just a little bit off to the south. But that track of Odile, clipped Southern New Mexico. And southern New Mexico over a multi-day period, with the residual moisture, picked up multiple inches of rain. Some pretty impressive catch up amounts across Southern New Mexico. 14:15

Zack: Okay so the monsoon is in our rear view mirror. 14:22

Mike: It is and its one of those things that at the end of the monsoon season, I was completely satisfied. I was to the point where I was; "I am okay with the dew point to drop back down into the 20's," which they have not. The dew points are still in the 40's and 50's. So we can't even dry out post monsoon now. Because there is so much moisture hanging around. It is still soupy in the East Pacific. The westerlies are in full effect, but they are dragging in unusually moist air off the Pacific and sort of fits and starts. We have had very little break down in that and very little dry out in between. It is very interesting, My first October here in Arizona, where we haven't had those completely cold evenings, where once the sun goes down it gets cold. It is still buggy out there, it is still humid. It is a really interesting fall, unusual in many respects. 15:25

Zack: Is it a harbinger for the winter? 15:24

Mike: I think a little bit. And the forecast models for the past 10 months now have been suggesting, "you know guys in the SW, you might be looking at an unusually wet fall." And here, that has already verified, just with the bit of rain we have had in Arizona, twice now in October. 15:46

Zack: What were they explain was the reason for that? 15:46

Mike: The models don't explain a lot. So you have to dig in a little bit, you have to shake them a little bit and poke at them. I think that they were picking up on the active tropical storms. I think that this idea of enhanced or moisture in the East Pacific, just at our doorstep, it too useful for any sort of passing storm system to not pick up and use to create precip down here. So I think that is the case we had with Simon early

CLIMAS: Climate Assessment for the Southwest - October 2014 Southwest Climate Podcast

Recorded 10.22.2014, Published 10.23.2014 - <http://www.climas.arizona.edu/media/podcasts>

this month. Which was a full on movement of a tropical storm across the SW. Some pretty good rains across Southern Arizona and then we had a cut off low even move across the SW this past weekend. I could not believe my eyes of seeing wet cold rain in Tucson this past weekend, in October. You know, picking up pumpkins and getting rained on are not two things I am used to weather wise down here. 16:47

Zack: So those models then were probably largely picking up on an El Niño signal. Because that would have influenced the likelihood of tropical storms forming. 17:01

Mike: It could be. It is a mess of things I think right now. The warm East Pacific is kind of a newish thing across the whole Eastern Pacific right now, which is a multiple year thing of warming related to the jet stream patterns. Then also, the warming in the East Pacific is related to those last couple of Kelvin waves, which came across earlier in the season. We were convinced that was going to be the actual lock in of the El Niño, and they certainly came by and went. But these Kelvin waves come along just below the surface and then immerse in the Eastern Pacific. They also stick to the coastlines and they resonate north and south up the coastlines. So that resonance of that wave traveling north is also part of the warming of the East Pacific up along the Mexico coast. So not a formal El Niño ocean atmosphere interaction, but these ocean waves that have been the harbinger of the El Niño, I think are creating that background condition that we are seeing change our weather right now, even if not having an official El Niño in the books. 18:03

Zack: It is probably worth redefining that Kelvin wave. But it is basically the anomalously strong westerly winds that sort of slow down the easterlies. Which allow the water to sort of slough back from the west to the east. If you have strong easterly winds, which are the typical prevailing winds, that water is being pushed in the East Pacific, westward. If you slow down those easterly winds, it allows that water to slough back. That is the Kelvin wave. It is bringing warmer water, from the west back to the east. 18:40

Mike: It is a physical wave of warm water in the ocean. Like super simplistically, if you had a slosh in your bathtub that was sloshing back, a slosh of warm water moving back across because it is not being held up by the easterly winds. So that is where we were talking last month. You did a really nice job at explaining this idea of westerly wind bursts releasing these little waves of energy. Literally warm water sloshing back. They have been moving across the East Pacific for months now. We have had a couple of these discreet waves. A very big one last spring, which we thought was going to be the absolute punch that the atmosphere would need to lock it in, easterlies would then fall apart, you would sustain El Niño and keep it moving. But for the most, the warm water has been there and the atmosphere has failed to respond. Most likely because there isn't a nice temperature gradient. When you have these Kelvin waves go from the West Pacific to the East Pacific, you typically have cool water then in the West Pacific and then warmer water, which is reverse of what it normally is. That temperature gradient is what the winds would respond to. But there is so much warm water across the whole Pacific, that the West Pacific has just been giving bursts of warm water and it is still warm enough that you aren't getting the gradient. It seems to be, it is running out of this warm water because it keeps giving up into the East. We are now probably in the next month or so, see that temperature gradient set up and really move into a formal ocean atmosphere dance between El Niño. 20:05

Zack: So officially we are still in sort of neutral conditions, but it is on the cusp of a weak and there is growing confidence, like you said offline, it's almost like a (?) forecast. 20:17

Mike: I think we said last month that we would say if El Niño was here or not. I will go on the record...it is coming. I think that this El Niño event, that this is a very unique situation. I think that we are going to have interesting weather to look at, watch and talk about for the next year or maybe two years now. 20:39

Zack: So why is it unique then? 20:41

Mike: Because it has all of these really interesting patterns across the Pacific Ocean. Really profound changes in ocean atmosphere. We use all of these indices, like Southern Oscillation Index and Niño 3.4,

CLIMAS: Climate Assessment for the Southwest - October 2014 Southwest Climate Podcast

Recorded 10.22.2014, Published 10.23.2014 - <http://www.climas.arizona.edu/media/podcasts>

which is just a very simple way of looking at a very specific part of the ocean and what its patterns are. If they are above or below average. Those are very very clunky ways of tracking El Niño. When you get into situations that aren't like the big ones of the past, but they are slightly different expressions, they kind of fail you. I think we are in a situation right now, where it is a different flavor of El Niño. It is late, the timing is different, the pattern is different. There have been some events that have occurred over the past 6 months that the models have been struggling with and that we have all been struggling to understand. I think it has been mentioned in past podcasts, that there are some ENSO experts who have said this looks a lot like 1986. That keeps coming up. 1986 was a very late forming El Niño event. But, it was a form of an El Niño event and interestingly enough, was part of a two year El Niño event that lingered throughout the spring and following summer, with a subsequent El Niño the following year. 21:59

Zack: So that thought, because 86, the year that I believe The New York Giants won the Super Bowl, just to put context because it is so far into the past. But in terms of winter precipitation, December through March, it was above average for about half of Arizona and for nearly all of New Mexico. The dividing line in Arizona, on the western side of that, all the way out to the coast of California, was dry. So if we are going to use 86 as an analog for what this winter may look like... 22:44

Mike: Super dangerous right. I think it is useful for thinking about that there have been late forming El Niño events. Will this be a perfect analog? I don't know, there are no perfect analogs. But I think it is a good thing. What you described is a pretty typical El Niño, where you get an above average precipitation signal across the SW. Again it is never perfect, it rains every single month and there is a break from north to south or east to west in it, but what it suggests to me...and you sort of use that analog situation, then we look at the dynamical forecast models. The dynamical forecast models, which have been suggesting wet conditions across the SW for 10 months, they actually picked up on the summer pretty well down here and they picked up on the early fall down here. So their track record is pretty good. They still suggest a wet or above average winter for Arizona and New Mexico all the way out through March. 23:49

Zack: And California? 23:49

Mike: Well this is interesting. There are two what we call multi-model ensembles, which is a bunch of models and a bunch of ensembles, just a giant bowl of spaghetti and you try to look for the pattern and you average them all out. 24:00

Zack: You average them all out because the average tends to do better than any one single model. 24:04

Mike: Yeah, some are better at some things in certain situations, so the idea is that putting them all together gives a better signal. The one suit of models, which are all the U.S. models, has a very hard break across California. With Arizona and New Mexico going wet and then maybe Southern California going wet and then Northern California going very dry. The international multi-model ensemble, which has the year European model in it, which is the gold standard, shows most of California, all the way through Arizona, New Mexico and Texas going wet for this winter season. So stakes are super high right now. 24:39

Zack: Stakes are high because particularly for California last year, which has been in a 3-year or slightly longer drought, I just read a report where they tallied the economic impact associated with 2014 drought on California and it is 2.2 billion dollars, 17,000 jobs were lost. So California will have the eye of the nation looking at it for this winter. 25:07

Mike: Right and California is a big, long state from north to south, so it's going to be really interesting to watch too, because what will most likely happen is that part of the state will do well and part of the state won't. It is so hard for the whole state to do well. 25:21

Zack: And that is pretty common during El Niño. There tends to be a sort of hinge line. 25:24

CLIMAS: Climate Assessment for the Southwest - October 2014 Southwest Climate Podcast

Recorded 10.22.2014, Published 10.23.2014 - <http://www.climas.arizona.edu/media/podcasts>

Mike: And that is what is interesting with the international model, which the big grand daddy suit of models, they have for the winter time season, the hinge point is through Oregon. So that a really far north hinge point typically and you see the --connection where the Pacific Northwest goes dry and then the SW goes wet. It will be really interesting to see how that plays out. The national multi-model ensemble has a much southern tier states and Arizona is even on the cusp of it too. So it has got more of Southern Arizona, Southern New Mexico, Mexico, Texas going wet and the SE going wet. Which you can certainly see because that subtropical jet, which is what we are looking for during these El Niño events, can be displaced south. If they set up just south of Arizona and New Mexico, we can have record dry winters here. You can see it out your window to the south. But if it is displaced a little bit north, we can be in the firehouse and it can lash up and down the California coast and they could actually do really well too. And again, it is going to be this mix of weather that is going to ebb and flow through the whole winter season. I doubt every month will go wet, but my guess is that we are going to get a couple of pretty good wet periods throughout the winter season. 26:42

Zack: But the bottom line in terms of El Niño is we are on the cusp of it. 26:53

Mike: I think weak to moderate. I don't think moderate is off the table. We haven't quite sorted it out and it will be quite interesting because now it is in real time. Some signs are across the Pacific, that it is really underway and we are just waiting for the indices. 27:10

Zack: And the indices take a while... 27:16

Mike: Yeah it isn't until you are well into it that you can declare it. 27:17

Zack: But the sea surface temperatures are currently hovering around... 27:30

Mike: they are in the warmish; they aren't quite above threshold (threshold is .5 Celsius above average). So yeah I think it is just a matter of time and waiting it out. You already are seeing weather patterns, what you call troughs, in the Eastern Pacific and West Coast now that are really encouraging to me anyways. You really don't see the copycat pattern we have had over the last couple of years of that ridiculous resilient ridge. You really see, I think anyway, a really different (rain)? 27:57

Zack: So that's the ridge that is set up that has been really persistent for a while that has been pushing storms away from California. 28:00

Mike: Yeah, so the Pacific NW going wet vs. Colombia going wet. 28:09

Zack: And it is a pattern that actually shows up repeatedly in history. I just read a paper from 1934, which produced the most intense drought for California, that same sort of weather pattern was present during that year as well. It is a sort of pattern that sets up that creates these drought conditions. But you are saying in the models that there is no indication that, that will persist. So I think that is good. 28:31

Mike: I think so too. You don't really see any hints of that in even short-term weather models... 28:37

Zack: Is that robust across those models or is that multi-model ensemble? 28:40

Mike: Again, you just couldn't really see a circulation pattern like that with an El Niño event and that is what it is coming down to. So everything is sort of converging on El Niño event, weak to moderate. It is very difficult to have a pattern like that so I think that is what we are seeing. 28:58

Zack: So there is some indication that this El Niño is sort of experiencing a longer life to it. 29:06

CLIMAS: Climate Assessment for the Southwest - October 2014 Southwest Climate Podcast

Recorded 10.22.2014, Published 10.23.2014 - <http://www.climas.arizona.edu/media/podcasts>

Mike: People will have fun going back through our past podcasts of... 29:10

Zack: This is all speculation. 29:10

Mike: So if this is anything like 1986, that was a double dipper. Some of the forecast models have suggested that typically an El Niño event will crash, with the temperatures going back to average in the spring time and a lot of them are sort of dragging out and extending through the spring and into the summer. Its way too early to tell. We have sort of been now casting this event, rather than forecasting it. It is a fun thing to think about! 29:34

Zack: We will keep our eyes on it. 29:39

Mike: And what does that even mean for a spring down here? I am not really sure what an El Niño spring looks like. I mean we just closed out the monsoon season, but you could play games in your mind, there is weakish potential of messing with the monsoon season next year. But at the same time, is that again another enhanced East Pacific tropical storm season. So there are all sorts of fun things you can think about. 30:01

Zack: Yeah and I think at least for me, although the monsoon is more exciting to think about in terms of weather and climate, it is really the winter where the impacts are most important. I am not discounting the sort of grasses and the importance for vegetation for ranching and ecosystem health, in terms of water however, it's all about the winter. 30:34

Mike: Oh yeah, we have no dug ourselves out of a drought with a couple of good summers here right. Again, short term drought condition improved by having rain in the summer. But we need to get a winter in here! We haven't had a winter in a long time now. 30:47

Zack: It is also interesting to note an El Niño signal for the upper Colorado River Basin isn't as robust as it is for the SW. So it can go either way. It isn't as good of a sort of forecasting device. 31:02

Mike: El Niño's can be a problem for the upper Colorado snowpack. If you get a focused storm track that is south of Colorado and Utah, you could end up with a pretty nice winter down here and be in a serious Colorado River situation by next spring. Maybe what we really needed a neutral winter, to make sure we got the water at the right spots. 31:30

Mike: But this is the game down here, there is no perfect situation here to make everyone happy. 31:40

Zack: So I think moving forward...we have spent a lot of time in the last 4 months talking about basically two phenomenon: El Niño, La Nina or ENSO for that matter and the monsoon season. But I think next episode we should talk about another pattern that influences our winter weather. Maybe not as much here in the southwest but certainly in the NE and other parts of the globe and that is the arctic oscillation. 32:05

Zack: There has been a lot interesting research on that and we will try to highlight that. So foreshadowing our next episode, we are going to talk a little bit about the arctic oscillation and obviously we will revisit the ENSO. 32:31

Mike: Monsoon I give it an A-, El Niño I give it a C+ at this point just because it is not showing the initiative that I would like it to show. 32:44

Zack: Okay well thanks for everybody tuning in...

CLIMAS: Climate Assessment for the Southwest - October 2014 Southwest Climate Podcast

Recorded 10.22.2014, Published 10.23.2014 - <http://www.climas.arizona.edu/media/podcasts>