TRANSCRIPT

NOAA U.S./global June 2023 global climate media telecon

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Lisa (Operator):

For standing by. At this time, all participants are in a listen-only mode. I would also like to inform all participants that today's conference is being recorded.

If you have any objections, you may disconnect at this time. During the question and answer session, please press star one on your touch-tone phone. I would now like to turn the call over to Mr. John Bateman. Thank you, sir. You may begin.

John Bateman:

All right. Thank you. Good morning everyone, and thanks for joining this monthly climate update call, part of the suite of climate services that NOAA provides to government, business, academia, the media and the public, to support informed decision-making. I'm John Bateman with NOAA Communications and I will be facilitating the call today. If you have any additional questions after the conclusion of today's call, my colleague, John Leslie, and I can both be reached by email at, and I will spell it, N-E-S-D-I-S.P-A@N-O-A-A.G-O-V. That's NESDIS.pa@NOAA.gov.

Today's update will feature three short presentations, followed by an operator-assisted question and answer session at the end. A copy of the presentation our speakers will follow, can be downloaded from the link in the media advisory. With that, I will introduce our speakers. The first presenter is Ahira Sanchez-Lugo, a climatologist with NOAA's National Centers for Environmental Information, who will provide a summary of the June 2023 US and Global Climate Report, as well as the latest drought monitor update.

Our second presenter is John Nielsen-Gammon, director of the Southern Regional Climate Center, who will provide a review of the extreme heat that has covered much of the southern US. Our third speaker is Matt Rosencrans, a meteorologist at NOAA's Climate Prediction Center, who will provide the latest El Nino update, as well as the US temperature, precipitation, and drought outlook for August, September and October. Our first speaker will be Ahira from NOAA NCEI.

Ahira Sanchez-Lugo:

Thank you, John, and thanks to everyone who joined in today. I'm going to go ahead and start on slide two to look at the global temperatures for the month of June. The global surface temperature for June 2023, was 1.05 degrees Celsius or

1.89 degrees Fahrenheit above the 20th century average. This was the warmest June in NOAA's record that extends back to 1850. Also, it was the first time a June global surface temperature departure was one degree Celsius, which is 1.8 degrees Fahrenheit or higher.

During the month, we saw warmer than average conditions across much of the world surfaces, as you can see from both maps, with record-warm June temperatures across parts of North America, Central America, northern South America, Africa, but also across a large area in the eastern Atlantic Ocean, the southern Indian Ocean, and across parts of the western Pacific Ocean. The global ocean sea surface temperature was 0.92 degrees Celsius or 1.66 degrees Fahrenheit above average.

Not only was it record high for June, it was also the highest monthly surface temperature normally of any month in NOAA's 174-year record. This surpassed the previous monthly record that was set back in January 2016, by .05 degrees Celsius or .09 degrees Fahrenheit. There were some locations that did experience cooler than average June temperatures. This included Greenland, parts of the contiguous US, Alaska, western Russia, southern parts of Asia, as well as parts of eastern and southeastern Pacific Ocean, and the northwestern Atlantic Ocean.

Regionally, Africa, South America, Europe, and Asia had a top-five warm June. Moving now to slide three to look at the year to date for the globe. The global surface temperature for January through June, was the third-highest on record at 1.01 degrees Celsius or 1.82 degrees Fahrenheit above the 20th century average. Only the January through June periods of 2016 and 2020 were warmer. The first six months of the year were characterized by warmer than average conditions across [inaudible 00:04:50].

With record-warm temperatures across parts of Central America, South America, the Atlantic Ocean, the Indian Ocean, and across parts of the Pacific Ocean. Cooler than average conditions were present across parts of the western contiguous US, Antarctica, and small areas in southern Asia, and the southeastern and eastern Pacific Ocean. Regionally, North America, South America, Europe, Africa and Asia had a top-10 warm year to date, while Oceania, despite having an above-average temperature for the January through June period, it didn't rank among the 20 warmest Junes.

Looking ahead, according to our statistical analysis, the year 2023 is virtually certain to rank among the 10 warmest years on record, and it has a little over 95% chance of ranking among the top-five warmest years on record. Moving now to slide number four to look at the contiguous US. During June 2023, the US had above-average temperatures from the Northwest to the Northern Plains, as well as in the Southern Plains in Florida. While below-average temperatures were observed from the Southwest to the Central Plains, and across much of the Mid-Atlantic and the Southeast.

Averaged as a whole, the US had a June temperature of 69 degrees Fahrenheit, which is .5 degrees Fahrenheit above average, and this ranked in the middle third of the 129-year record. Statewide, excuse me, North Dakota, Minnesota, Louisiana had a top-10 warm June, while West Virginia and Virginia had a top-10 cold June. In terms of precipitation, it varied across the US. Above-average precipitation was observed across much of the West and in parts of the Southeast and New England, while below-average conditions were present across the Midwest and in parts of the Northwest and Southern Plains.

Statewide, the states of Wisconsin, Michigan, Illinois, and Missouri had a top-10 dry June on record, while Wyoming, Colorado and Maine had a top-10 wet June. In terms of the billion dollar disasters, there have been 12 confirmed weather climate disaster events with losses exceeding $1 billion this year. These disasters consisted of 10 severe storm events, one winter storm and one flooding event. For the year-to-date period, the first six months of 2023, ranked second highest for disasters' count behind 2017.

Moving now to slide number five, the January through June average temperature for the contiguous US, was the 21st warmest such period on record at 1.7 degrees Fahrenheit above average. As you can see from the map on the left, above-average temperatures were present across much of the eastern half of the contiguous US, while much of the western half had near to below-average temperatures during the six-month period. The state of Florida had its warmest

January through June period on record, while there were an additional 28 states that had a top-10 warm year-to-date period.

However, no state had a top-10 cold January through June period. Precipitation for the contiguous US or the first six months of the year was 15.7 inches, which is .39 inch above average, and ranked in the middle third of the 129-year record. Precipitation was above average from California to the western Great Plains, and in parts of the Southern Mississippi Valley, Southeast and the Northeast. Meanwhile, below-average conditions were present across parts of the Northwest, Northern and Central Plains, Central Mississippi Valley and Mid-Atlantic during the first six months of the year.

Maryland had its fourth-driest January through June period, however, no other state had a top-10 dry or a top-10 wet January through June. Moving now to slide number six to look at the current drought conditions across the US. As of today, there was about 26% of the contiguous US that was in some type of drought. This is about one percentage point less than a month ago. As you can see from the map, drought was present across much of the Midwest and across parts of the western High Plains and Southern region, the southwestern Florida and southern parts of the Northeast also had some type of drought.

During the last month, during this four weeks, drought conditions improved across much of the Northeast and across the eastern parts of the Midwest region, as well as parts of the High Plains. Drought deteriorated across parts of the South, specifically Texas, excuse me, the northern and southwestern parts of the High Plains and the northern and southeastern parts of the western US. Outside of the contiguous US, moderate drought was present across parts of Hawaii and Puerto Rico, while mild to moderate drought was present across the US and Virgin Islands. That is all that I have for today. I'll now turn it over to Dr. Nielsen-Gammon.

John Nielsen-Gammon:

Thank you very much. I'm John Nielsen-Gammon. In addition to being director of the Southern Regional Climate Center, I serve as the Texas state climatologist and I'm a faculty member at Texas A&M University in College Station. I'll be focusing on the heat in the area of responsibility for the Southern Regional Climate Center, which stretches from Texas to Tennessee, including four states in between. Slide seven shows the number of record maximum-high temperatures that were set during the month of June.

I've added in for the sake of statistics, perspective for the first half of July as well. The peak of the heat wave in the South was June 20th through 22nd. Each of those days set at least three dozen daily temperature records across the South. Most of this was in Texas, Louisiana later on was affected by the heat and set a few high temperature records as well. But 399 total for the period from the beginning of June to the middle of July. Slide number eight shows the number of minimum temperature records that were set.

We do have occasional relatively cool weather as well. That was not predominantly in Texas. That was mainly in Tennessee during the first part of June. Then in northern parts of the region of Oklahoma and Arkansas, did set a few minimum temperature records in early July. Slide number nine shows the comparison though between the maximum temperature records and the minimum temperature records. You can see maximum temperature records predominated throughout the period, especially when the heat was going on.

I should mention these are preliminary records. It's possible there's one or two erroneous readings in here, but certainly the overall trend is clear. In addition to daily records, there were also a handful of monthly records and even eight all-time temperature records were set during the June heat wave. Those eight stations were in Texas, basically from west central Texas down to south Texas. Texas did not set its all-time, statewide temperature record.

It came within one degree of doing so, as a station in the Big Bend area reached 119 degrees Fahrenheit, one degree short of the record of 120 degrees, which was set in the 1930s and tied again in the 1990s. Slide number 10 shows how

hot it's gotten in June on the left-hand panel, and so the first half of July on the right-hand panel. This is a map of each location's highest temperature for the period. 100 degrees and above is in the light orange on both panels.

You can see most of Texas and about half of Oklahoma reached triple digits, as well as portions of Louisiana, Arkansas, and Mississippi. In July, the intensity of the heat has been less. There's much less area, which reached 110 degrees or above, but 100 degree weather has spread farther east, affecting more of the area around Dallas and Houston and approaching Louisiana as well. Minimum temperatures are a problem as well, especially when you're in the heat wave because your body needs to cool off at night.

If there's no air conditioning available, the ambient temperature is what matters. Slide 11 shows basically the hottest nights in June and the first half of July. Red is where the temperature never dropped below 80 degrees Fahrenheit on at least one day. Dark red is where it never dropped below 84 degrees Fahrenheit, which shows up at a few places along the coast, including the New Orleans area. In contrast to the maximum temperatures, we see more intense heat at night in July than we saw in June.

There's much more widespread area in north Texas, which hasn't dropped below 80 degrees Fahrenheit on at least one day. The causes for the June heat wave are fairly complex, but basically because there's a large number of causes, anytime you have something that's record-setting or near record-setting, you typically have a variety of contributing factors to it. In this case, one factor was just the overall increase of temperatures that we're seeing globally, that you heard about June being a record-hot temperature globally.

In Texas and much of the South, temperatures have increased by about one or two degrees Fahrenheit compared to the early part of the 20th century. In addition to that, it's been an unusually hot year, and in the Gulf of Mexico where the air feeds into most of the southern United States, the water temperatures have been unusually hot. According to NOAA data, it has been the second-hottest June on record for the Gulf of Mexico. That sets things up for being fairly hot.

Then a couple of other factors come in in the short-term to kick things up a notch. Slide number 12 on the left, we have the upper-level jet stream pattern. Those contours swinging south and north show the position of the jet stream. There is an upper-level anticyclone colored in red over in northern Mexico, which colloquially is known as a heat dome when it occurs in the summertime. That causes warm temperatures for several reasons.

First, when you have one of those, you typically have sinking air and air warms as it sinks. Secondly, in that particular location, it brings air over the hot, high-altitude terrain of northern Mexico and the southwest United States and then takes it over Texas. So that we have basically superheated air in Texas, that allows for that air to mix down to the ground and produce high local temperatures. On the right, the air temperature anomalies compared to normal for altitude about one mile above the ground.

Temperatures were 10 degrees Celsius above normal for the three-day period during the peak of the heat wave above the ground, and that of course, allowed the ground to warm up as well. The contrast to that in slide 13 for July, we do have a bit of a heat dome in place. It's not as localized and it's not causing the extreme-high temperatures aloft that we saw in June. Basically, we've transitioned from a weather-driven heat wave in Texas, to more of a climate-driven heat wave.

The high temperatures and lack of rain during the past month and a half, have dried out the soil. Now the sun's heat basically heats the ground and heats the air without any energy being diverted to evaporation. We're looking at persistently warm temperatures, at least possible, given the conditions in the ocean and on the land surface presently. Last set of slides I'm going to highlight, show the departures from normal of the surface temperatures within the region.

Slide 14 covers the month of June and it doesn't look all that impressive. There's a couple of cities in southern Texas that were five or six degrees Fahrenheit above normal, but on the whole, it wasn't that hot because it started out as a relatively mild June. The heat only turned on substantially during the second half. Slide 15 shows the temperature

anomalies during the last two weeks of June. There we see five to nine degrees above normal widespread across most of Texas and parts of Louisiana.

With northern areas, Oklahoma through Tennessee, still having normal to below-normal conditions. So far in July, slide 16 shows that we're still running three to five degrees above normal across most of Texas and Louisiana and coastal Mississippi, but it's still nonetheless, been relatively mild to the north across Oklahoma to Tennessee. They're still running below normal. Just a brief, short-term outlook on what's going on. We're going to get a cool front coming through on Friday.

Saturday will probably be the relatively mildest day in a while for this region, but then the heat will crank up again and you'll find people in the Midwest complaining, as some of that hot air heads in their direction. We don't like to hog all the hot weather down here in the South, so that's what's been going on with the heat. I'll turn it over to Matt Rosecrans to talk about what's going on in the future.

Matt Rosencrans:

Hello everyone, it's Matt Rosencrans from the Climate Prediction Center. On slide 17, there's a couple images here to talk about, and it's referencing the sea surface temperature anomalies for the last month. There's a lot of abnormally warm waters in the central and eastern Pacific, and that's related to the ongoing El Nino. We are an El Nino advisory right now. We've been since May and that continued through the advisory in July. The sea surface temperatures that are above normal in the equatorial Pacific, are causing some of the winds there to respond.

The response in the winds and decoupling between the ocean and the atmosphere, it's a bit weaker than maybe might be expected for an El Nino advisory at this point, we've been at for two months. But we are starting to see some changes in the wind patterns both locally in Pacific, and even some globally that can be attributed to that changing state. From that we were in La Nina for a couple of years in a row, now into the El Nino state currently. The sea surface temperatures in the Atlantic, particularly the eastern Atlantic off the coast of Africa, are well above normal for the last 30 days.

That's about 18 June to 15 July is the data period that I have. The month of June was quite warm in parts of the Gulf of Mexico. It's interesting too, it's a flip from May when you had some cooler waters off in the eastern Gulf and even off the east coast of Florida. Now, I only see some below-normal temperatures in the Atlantic, up off the coast of Canada. Almost the entire rest of the Atlantic Ocean is above normal. There are temperature anomalies at least two degrees centigrade above normal on the positive side there, off the west coast of Africa.

It's quite the interesting dynamic to have both of the Pacific and the Atlantic Ocean basins so warm, so now mostly warm at the same time. Looking forward to the future, we are expecting this El Nino to continue. There's at least a 90% chance of El Nino continuing through the Northern Hemisphere winter season of December, January and February into 2024. That will likely have impacts downstream on the US climate. Moving to slide 18, this is our outlooks for August. August has some impact from the ongoing El Nino.

Typically, that's with the drier conditions out in the western US. El Nino's are typically associated with reduced precipitation totals in the monsoon region. That can also act to have some of those feedback mechanisms that Professor NG just mentioned. Where once you get dry then the heating of your sun, which is still strong in August, can then lead to higher temperatures. We do have a forecast for above-normal temperatures favored through much of the Southwest, Four Corners region. That does extend to the Pacific Northwest where there is some drought there currently.

Then that also extends across the Southern tier of the US, and wrapping up into the Northeast where the trends during the month of August for the past 15 years, do show above-normal temperatures. We actually do have an area of below-normal temperatures favored in the Northern Plains. Because of the circulations that are typically induced by El Nino conditions, they are associated with troughing and low-pressure systems over the Great Lakes region.

You can get some bouts of cool weather to pull down on the western side of those troughs, and that could impact some of the Northern Plains and up the Mississippi Valley. Along the southern side of that, you are likely to have some storm track and storm activity. We've seen some of that already with repeated heavy rain events moving across parts of Kansas and eastern Oklahoma, and then trending into the eastern US into the Southeast. We've seen some of that already in July.

Then some of that is likely to continue from the area from Nebraska, down to northern Mississippi and eastward to the East Coast, ranging anywhere from Massachusetts down to about the coast of Georgia. That box is all favored to have above-normal precipitation during the month of August. Moving to slide 19, the temperature outlook for August, September and October, favors above-normal temperatures from the Pacific Northwest to the Four Corners region, across the Southern tier of the US and up into the Northeast.

The Southwest and the Four Corners region, has the highest odds for above-normal temperatures at greater than 60%. Again, that's where we think there will be warm temperatures during August and then September as well, really associated with potentially reduced precipitation during the monsoon. That should really favor above-normal temperatures in that region. Trends are quite strong in that region as well, so that's another prediction that we look at.

There is an area of below-normal temperatures on the seasonal outlook here, out of northern Missouri up to southeastern South Dakota. It's a smaller area than is indicated on the forecast for August, and that's just because that cool trend there, that cool area from on the back side of the trough for the Great Lakes in the same region there, it does tend to fade as you get towards October. You start to set up more of a transition pattern, so we should see some of that fade out.

That's why probabilities are lower on this seasonal outlook. Northeast, there are still strong trends in August and September for above-normal temperatures, so that really played a factor in this outlook as well. For the precipitation outlook, we are thinking that the Pacific Northwest will have below-normal precipitation during August, September, October. We're looking at the Southwest having a reduced amplitude of their monsoon.

That should lead to August, September and October being below normal for precipitation, in parts of eastern Arizona and western New Mexico, western parts of Colorado and Utah, so in the Four Corners region. Then above-normal precipitation is favored from Nebraska down to eastern Texas, across Louisiana, and off to the Mid-Atlantic Coast including the Carolinas. There is potential for the early part of the period to have some of that troughing and storm activity moving from west to east across that region associated with El Nino.

We do often also see when the monsoon is dry, the Plains are wet. That is a common dipole that has been identified in much of the academic literature. For the seasonal temperature outlook for Alaska, they are expecting above-normal temperatures for August, September, October. We have noticed some ice edge retreat along western Alaska. We have also noticed some sea surface temperatures getting above normal in the Bering Strait area, where those temperatures were below normal for the past couple of months.

We are starting to see some of those temperatures get to above normal now. That should reinforce some of the trends that are observed over the land and not be a mitigating factor there. As some of those sea surface temperatures may be above normal and then may be some later ice edge impacts, you can end up with above-normal precipitation along the southwest and western portions of Alaska. Next slide and it's slide 20. The drought outlook does favor some drought development in the Pacific Northwest.

Associated with the potential for the below-normal precipitation during August, September and October. That area did not benefit as much from the winter rains from 2022 to 2023 winter. From those winter rains and winter snowpack during that time period, so there's much less residual storage capacity there. In the Southwest, Four Corners region, there is some drought development likely there due to the increased potential for a reduced amplitude monsoon that is indicated in the August, September, October outlooks.

There are some indications for drought improvement and potential drought removal in the Plains, from northern Oklahoma up to southern Minnesota and southern Wisconsin. You could end up with some drought removal there, as you end up with some cooler conditions potentially in the outlook and some wetter conditions from much of those during the August, September, October period. Across northern North Dakota and northern Minnesota and northern Wisconsin, there is the potential for some of the drought there to largely persist through the August, September, October period.

But there could be places of localized drought improvement due to smaller scale storms, thunderstorms, or even a mesoscale complex that goes through there and can drop a lot of rain, but over a very small area. We are also expecting drought persistence and development across much of Texas and potentially southwest Louisiana. That could be some reinforcing and positive feedback cycles from that heat and dryness that the professor mentioned a couple of minutes ago. That's all I have and I'll turn it back to John.

John Bateman:

Thanks so much, Matt. We will now take specific questions from the call participants. Please be sure to identify who you would like to answer the question if possible.

Lisa, could you please remind the call participants how they can ask a question, and then please queue up the first question?

Lisa (Operator):

Thank you. We will now begin the question and answer session. If you would like to ask a question, please press star one. To withdraw your request, press star two. Please unmute your phone and record your name clearly when prompted.

Your name is required to introduce your question. Again, to ask a question, please press star one. One moment please for the first question. Our first question comes from Seth Borenstein of the AP. You may ask your question.

Seth Borenstein:

Yes, thank you. I actually have one for both Matt and one for John. For Matt, I know what you told us was national. In terms of just what we're looking at for the rest of the summer, in terms of globally, it has been an incredibly wild summer, not just heat but extremes. Given what we're seeing right now, what does the second half of the summer look like? Are we looking at more of the same, worse, slight easing, a lot of easing and why?

A quick corollary, are you basically for the Southwest saying the monsoon, which hasn't shown up, is just going to be missing in action all year, just won't show up? For John, when Ahira showed Texas, did not have a top-five hottest June only because of the first half of the June as you mentioned. Can you describe, put in context, especially the last month from mid-June to mid-July has been like in historical context?

Is this the most brutal summer you've seen in the South or is it not really not as bad? Just a little more language and less statistics if you don't mind, even though I love statistics.

Matt Rosencrans:

All right. This is Matt Rosencrans from the Climate Prediction Center. For the rest of August, and the rest of the second half of the summer, including the rest of July, we are expecting the later parts of July to be quite warm across parts of the southern parts of the US, the Southern Plains. Some of that heat is likely to push northward into the upper Mississippi Valley and to the Northern Plains, and even out into the Central Rockies. It is likely to be quite a warm period in the second half of July.

A bit of more of the same on that, but even further north than we really have seen from the end of June into early July. For August, we are expecting a bit of that to retreat in the Northern Plains, but the Southern tier of the US and even to the Pacific Northwest, could end up with another period of quite warm weather and quite extreme weather during the month of August for temperature wise. For precipitation, the outlooks do not indicate that the monsoon will fail to show up.

But you'll have less days and less intensity of the monsoon overall, so therefore, you'll end up with a below-normal total seasonal and monthly total of precipitation in the Southwest. We are seeing some indications and some setups in some of the pictures, in the images that Professor Nielsen-Gammon showed with some high pressures moving further to the West and to the Four Corners region. That does set you up for some better monsoonal activity than we have seen during the early parts of July.

We should start to see some more monsoon activity, but overall, it's still likely to be more spotty potentially, and not as active as in the past climatological years that we use in our analysis.

Seth Borenstein:

What about globally, how are we looking? How hot globally?

Matt Rosencrans:

I don't do an outlook for the globe.

Seth Borenstein:

Thank you, and John?

John Nielsen-Gammon:

Yeah, thank you. Yeah, John Nielsen-Gammon. For the heat, so far in terms of historical, part of the problem is Texas is a big state. For basically the southwestern half of the state from mid-June on, this has been the hottest summer on record or at least top-five depending upon location. El Paso is now at 34 days of consecutive days over 100 degrees and counting. One of the really difficult aspects of this heat wave, was when it kicked in there had been plenty of rain in April and May.

That combined with the high Gulf of Mexico temperatures, meant that the humidity was unusually high. We saw heat indexes, which although we don't have data for that going back all the way beginning of the century, we're probably close to all-time record-setting, if not all-time record-setting in a few places. As time goes on, that humidity has decreased a little bit, but it's still on track to being one of the hottest, if not the hottest, summer in many places in south and southwest Texas.

Seth Borenstein:

Thank you.

Lisa (Operator):

Our next question comes from James Deneen of New Scientist.

James Daneen:

Hello. Can you hear me okay?

John Nielsen-Gammon:

Yes, we can.

James Daneen:

Okay. My question is for Matt Rosencrans. I saw in the most recent NOAA ENSO discussion from July 13th, it had that there was a one in five chance of a "historic El Nino developing this year."

When is that forecast likely to become clearer? Can you say more about what downstream effects there might be from a very strong El Nino on US climate, on top of this background of strong global warming?

Matt Rosencrans:

Sure. Yeah. Some of the models and things we look at, have indicated that we could be in record territory for where we would get to what would be our measure of El Nino. The only value, which is based on temperatures in the Pacific. There's currently a 52% chance right now that it would get to greater than 1.5 degrees, which would put it in the upper echelons of some of a strong event category.

There's a 52% chance of that happening during October, November, December of 2023. Should that happen and maintain through the winter, it would likely be a quite warm winter over much of the lower 48. The more variable in the results that happen over Alaska, but it could be quite a warm winter over much of the lower 48. The last time we had an El Nino, a strong El Nino for the winter, it was above-normal temperatures were observed across the entire lower 48 or contiguous US.

James Daneen:

Can you say when we might have a clearer sense of whether that upper echelon strong or a historically strong El Nino will develop? Is that something we'll have a clearer sense of by August or by September?

Matt Rosencrans:

By September, because the highest probabilities we're looking at now are during October, November, December, so you'd probably get that in the beginning parts of September.

James Daneen:

Thank you.

Lisa (Operator):

Our next question comes from Rebecca Hersher of NPR.

Rebecca Hersher:

Hello. My question is for John. I wonder if he can elaborate a little bit more on the phenomenon he described, where hot temperatures dry out the soil and then the sun is able to heat the soil even more?

I think that's an important phenomenon, but one that's not super familiar to a lot of people. If you could just elaborate a little bit more on how that happens and what the effects are for people who live in places it's happening?

John Nielsen-Gammon:

Sure, I'd be happy to do that. This is John. Basically, when the sun doesn't heat the air directly very much, the sunlight goes through the air, which is why we are able to see things through the air as well. Heat reaches the soil where it gets absorbed as energy. Then that energy can either be used to heat the ground itself, or to evaporate any water that's available on the ground and in plants and so forth. As a general rule, the more evaporation that takes place, the less the amount of heating that takes place.

As things dry out, as you run out of water to evaporate, all of the energy is able to go into heating the ground, which then heats up the air above the ground. Then we get the heat as a result of that. There's also a potential climate feedback loop there, because with less water available to evaporate, there's less water in the air to form clouds and precipitation in areas where daytime thunderstorms are common. That means that the water in the ground is not replenished, and so if things get on the dry side, they tend to dry out even more.

Whereas things are wet, they tend to stay wet. The Southern Plains of the United States is one of the parts of the globe where that feedback mechanism can kick in. That feedback's been triggered by the heat wave we had in June, and so now that things are dry, they're more likely to stay dry and hot.

Lisa (Operator):

Our next question comes from Mose Buchele of NPR Austin.

Mose Buchele:

Hey, this one's for John too. How you doing, John?

John Nielsen-Gammon:

Yeah, pretty good, thanks.

Mose Buchele:

You mentioned, I thought it was interesting the way you described switching from a weather to a climate-driven heat. I was hoping maybe you could just go into a little more detail about how the heat we've seen, be it this anomalous June heat or the heat we're in now, has been exacerbated by or at very least consistent with what we expect from global climate change, global warming?

John Nielsen-Gammon:

Okay. Yeah. Global climate change in general, affects our weather in two ways, one is just the direct effect of temperatures. In that respect, with temperatures having increased in Texas by about two degrees Fahrenheit since the 1970s because of climate change, we could say that temperatures during this heat wave are about two degrees warmer than they would've been. The other aspect is what we called dynamical, how it affects the weather patterns, how it affects weather systems.

Whether the heat dome forming over the Southwest was more or less likely because of climate change, that's a bit of a harder question. There's been some research pointing to increased likelihood of jet stream patterns that tend to lock in place during the summertime, but whether that specific pattern we had in June was one of those things, isn't clear at the moment. It's hard to say whether that influence was acting in this particular heat wave.

Last thing on those lines I'll comment on is that because of the higher temperatures, we get more rapid evaporation of water. That feedback mechanism I talked about kicks in sooner and temperatures get hotter faster, because we lose the cooling effect of the water more rapidly as it evaporates more rapidly because of the higher overall temperatures.

Mose Buchele:

Yeah. Maybe I could get a quick follow up just on that, the way that that operated this year, because we had such a nice spring and into early June. Maybe this isn't a fair question, but was this a surprise?

I feel like a lot of people felt like we might get a nicer start to the summer because it was wet and cool in the spring. Then suddenly bam, we're stuck with a summer that looks like last summer, which was also extremely hot.

John Nielsen-Gammon:

Well, it's part of the problem between weather and climate. Actually, I think I'd rather have Matt answer that question, because he was actually involved in figuring out long-term what might happen this summer. Matt, if you're game for it?

Mose Buchele:

Have anything to say, Matt?

Matt Rosencrans:

Yeah. John, this is Matt Rosencrans from Climate Prediction Center. The explanation in the differentiation between the weather and the climate really does come into play here, where two weeks of a month can be one temperature regime and the other two weeks be another temperature regime. If one is just more amplified, that can overwhelm the statistics for the month. Our seasonal outlook for the summertime, when I go back and look at our May, June, July outlook, the summertime had a lot of above-normal temperatures across the Southern tier of the US.

That didn't start out that way, but then it seems to be finishing that way. Doing an attribution of that, it could have been that flip in El Nino state. It could have been flips and other oscillations that drove that change during the month. We did go from a what was a largely... No, I don't see anything as far as the global scale oscillation in the Northern Hemisphere, the Arctic oscillation that would've changed dramatically. I don't see anything in just the state of the indices that I have available to look at right now really quickly while on this call.

I don't see anything that would have changed there. We'd have to look at the attribution of that. What changed in the atmosphere to change the circulation pattern over that, just to have that quick flip right in the middle of the month? We do notice that El Nino's do tend to have that troughing and pull some cooler air down into the Central Plains. How far south that makes it, it could have just been that it was able to make it quite a bit further south during May and early parts of June.

Then as the seasonal cycle comes along, it isn't able to make it as far south. That could just be the difference in part of the seasonal cycle where it's not quite locked in north-south as much.

Lisa (Operator):

The next question comes from Eric Niiler of The Wall Street Journal.

Eric Niiler:

Hi, thanks for putting this together. Can you hear me?

John Nielsen-Gammon:

Yes, I can.

Eric Niiler:

Just quickly two things. John, if you look at your readings and forecasts for the central South and you just shifted a little bit to the left, in the southwestern US, we've seen just tremendous temperatures in Phoenix, southern Nevada, parts of California and so forth.

What's happening there and when will that region get some relief? Then just on the macroscale, how does this end? This heat dome that's been sitting there, what pattern or energy, or physical thing is going to knock it so that it either moves or dissipates?

Matt Rosencrans:

John, do you want to take that or you want me to take that?

John Nielsen-Gammon:

I think I prefer to leave that one to you. I can comment on it after you're done.

Matt Rosencrans:

All right. Matt Rosencrans with Climate Predictions Center. The Southwest has experienced some very intense heat recently. Our outlook for August and for August, September, October, how they both favor a continuation of above-normal temperatures in that region. There may be a slight relief coming towards the beginning of August, and maybe just because the monsoon will kick in at some point. You will end up with some more cloud cover potential rainy days.

That is one mechanism that could shake that up and change the circulation pattern for at least the Southwest. But again, we are favoring above-normal temperatures for the next three months over the Southwest. It's actually got my highest odds of above-normal temperatures are in the southwest US and the Four Corners region. As far as what could shake that and change that pattern, you can end up with tropical storms are a big changer of the circulation pattern.

If you end up with tropical storms that form off the coast of Mexico and move up to the Northwest, they can bring a large moisture surge into the Southwest. They can also then also result in changing the wind patterns downstream of those. You can also have tropical cyclones that form in the Western Pacific and move up near Korea or near Japan. They can shake whatever is residual in the jet stream in the summertime over there and lead to changes.

Those typically happen a bit later in the season, a bit later in the calendar, more of a September, October time period for both of those scenarios. It does look like August could be a continuation of the hot, but maybe not as intense as we've seen within the early part of August, but the later part of August could definitely return to above-normal temperatures.

Eric Niiler:

Okay, thank you.

Matt Rosencrans:

John, do you have anything you want to add?

John Nielsen-Gammon:

Yeah. At least for the southern United States, particularly another way of breaking the pattern ironically, is having the high-pressure system expand eastward. Because right now, as you might be able to see on slide 13, you've got that localized high pressure. The air is circulating clockwise around that so that the air is stuck over the Southwest.

If that ridge elongates, then the air to the south of that can be coming from the Atlantic and from the Gulf of Mexico, and feeding into west Texas and New Mexico and bringing tropical moisture with it. There's lots of ways the pattern can

be tweaked, but unfortunately the southwest US is one of the parts of the globe that geographically, high-pressure systems like to camp out on top of. It does take something to move them out of the way.

Eric Niiler:

Thanks a lot.

Lisa (Operator):

Our next question comes from Delger Erdenesanaa. You may ask your question.

Delger Erdenesanaa:

Hi, this question is for Mr. Nielsen-Gammon. Yeah. I understand what you're saying about the June heat wave in Texas and northern Mexico being mainly weather driven. But I have heard from a couple of other researchers, who have done general, global attribution studies looking at how much attributing extreme temperatures.

Not for specific heat waves like this, but in general to climate change from Climate Central and also from Lawrence Berkeley National Lab. I don't know if you've seen their work, but they have said that the high temperatures we saw last month were about five times more likely because of climate change, and about five degrees Fahrenheit hotter than they would've been. I was just wondering what you think of that kind of research, if you think that's reasonable and reliable?

John Nielsen-Gammon:

Yeah, thank you. Yeah, I'm familiar with the research in general. I haven't looked at what they've done specifically in this case, but a couple of ways to reconcile these. One is generally speaking, the larger scale, the bigger the relative importance of climate versus weather. For example, the global temperature, June being hottest on record, that's something that was extremely unlikely to happen this year without climate change and is much more likely with it.

As you get down to that's because temperatures don't vary by more than a couple degrees from one June to the next on a global average. Locally, temperatures vary by five degrees or more averaged over a month, and even more from one week to the next. To that extent, climate change has a relatively small, proportional impact in terms of the magnitude of the event. On the other hand, as you get to more extreme events, the change in odds becomes particularly key.

Because you can have events that were so hot, that they may not have been possible at all without the extra couple degrees increment due to climate change. Climate change can enable extreme events even at the local level, that theoretically weren't possible, were almost impossible otherwise, so both of those things are in play. The difference in large scale and small-scale climate anomalies, and the difference between the amount of temperature change attributable and the change in the ops attributable to climate.

Lisa (Operator):

Our final question comes from Leony George of ZDF German TV.

Leony George:

Hi. My question would be for John, and I'm interested about the jet stream pattern. Just from my understanding, the jet stream is really changing.

I want to ask how unusual the pattern this year is, and what consequences would go along with the jet stream that is changing that much?

John Nielsen-Gammon:

Okay. This is John again. I haven't looked at the jet stream pattern for the month and year in general. The sorts of things we're seeing with the jet stream in terms of trends, are a slight tendency for it to be a bit farther north and a bit weaker as well. Those are relatively small changes, potentially more consequential tendency for the wavy patterns in the jet stream to get locked into place.

Unfortunately, as I mentioned, I don't know whether this particular pattern we saw in June was one of those. It seemed like it was a smaller scale than the one that's being attributed to having a direct influence from climate change. Unfortunately, I don't think I can give you a satisfactory answer.

Leony George:

Okay. Thank you.

Lisa (Operator):

This concludes the question and answer session.

John Bateman:

All right. Thanks so much. If there are no other questions, I will wrap up the call. I will end by reminding you to mark your calendar for a few upcoming events. The release of the July 2023 US Climate Report is scheduled for August 8th. The release of the July 2023 Global Climate Report is scheduled for August 14th.

NOAA will hold its next monthly US and Global Climate Media Call at 11:00 AM Eastern Time on Thursday, August 17th. Lastly, an audio file of this call will be posted on the NOAA.gov media advisory site later today. If you have any further informational needs, please feel free to email me, John Bateman. My contact information is available at the top of the media advisory. Thank you.

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