

Global Water Monitor & Forecast Watch List

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Introduction

The ISciences Water Security Indicator Model (WSIM) monitors and forecasts water anomalies on a global basis. Each month we produce data and a report that document current conditions and provide forecasts with lead times from 1-9 months. WSIM has been run continuously since April 2011 and has been validated against subsequently observed data.

ISciences also provides assessments of the impacts of water anomalies on people, agriculture, and electricity generation. Detailed data and reports are available for purchase. Additional information and pricing are available upon request.

We have recently completed the latest Water Security Indicator Model (WSIM) analysis of global water anomalies using observed temperature and precipitation through December 2019 and an ensemble of forecasts issued the last week of December 2019. This edition of *Global Water Monitor & Forecast Watch List* presents a selection of regions likely to encounter significant water anomalies in the next few months. This report uses results from WSIM Version 2. In Version 2, WSIM has been re-engineered to be more computationally efficient and uses revised methodology for calculating composite water anomalies. Our blog post "[Introducing WSIMv2](#)" explains these and other improvements. In addition, WSIM is now available as an open source product. Visit <https://wsim.isciences.com> for details.

All maps have half-degree resolution and depict our composite water anomaly index, which is based on WSIM estimates of soil moisture, evapotranspiration deficit, runoff, and total blue water anomalies. Shades of red indicate deficits and shades of blue indicate surpluses. Since different variables are used to estimate deficits and surpluses, it is possible for a single half-degree cell to register both a deficit and a surplus in a given month. These cases are depicted on the maps in shades of purple, with the more extreme value (deficit or surplus) used to determine the shade.

Deficits and surpluses are stated in terms of return period – a measure that characterizes the rarity of an anomaly. For example, a return period of 10 years indicates an anomaly that would occur, on average, once every ten years. Higher return periods indicate more extreme and, therefore, more disruptive anomalies. Anomaly levels correspond to return periods: abnormal=3-5 years, moderate=5-10 years, severe=10-20 years, extreme=20-40 years, and exceptional=greater than 40 years. Return period is computed by comparison to cell-specific distributions of data from 1950 through 2009.

Please note that the WSIM model makes use of seasonal temperature and precipitation forecasts produced by the U.S. National Oceanic and Atmospheric Administration (NOAA) Climate Forecast System Version 2 (CFSv2). These forecasts predict broad temperature and precipitation patterns, but do not effectively predict singular events such as tropical storms. Detailed outlooks and analyses of tropical storms are available from the [NOAA National Hurricane Center](#).

There are numerous regions around the world where country borders are contested. ISciences depicts country boundaries on these maps solely to provide some geographic context. The boundaries are nominal, not legal, descriptions of each entity. The use of these boundaries does not imply any

judgement on the legal status of any territory, or any endorsement or acceptance of disputed boundaries on the part of ISciences or our data providers.

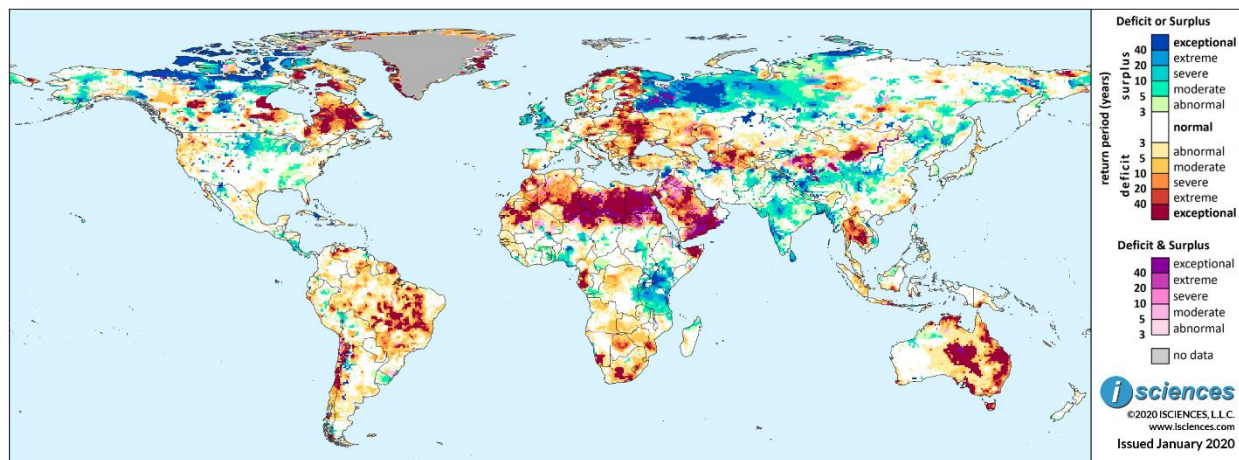
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Worldwide Water Watch List

This map presents a selection of regions likely to encounter significant water anomalies during the one-year period beginning in October 2019 and running through September 2020 using 3 months of observed temperature and precipitation data and 9 months of forecast data.

ISciences Water Anomalies Forecast: October 2019 - September 2020



Based on observed data through December 2019 and forecasts through September 2020

Watch List: Regional Synopsis

This synopsis provides highlights of regional water forecasts. More detailed analysis is available in "Watch List: Regional Details" immediately following the synopsis.

United States: The forecast through March 2020 indicates persistent, widespread water surpluses in the Plains States and Upper Midwest with exceptional anomalies in the Dakotas and central Nebraska. Intense deficits will persist in central Colorado and the Salmon River Mountains in Idaho, and deficits will emerge in eastern Texas. Moderate surpluses are forecast for several states in U.S. Southeast.

Canada: The forecast through March 2020 for Canada's most populated areas indicates nearly normal water conditions for Québec City, Montreal, Saskatoon, Calgary, Edmonton, and Vancouver; moderate deficits west of Ottawa and around Regina; and severe surpluses west of Toronto. Nationwide, anomalies will be similar to those observed in the prior three months including widespread, exceptional deficits in central and northern Quebec.

Mexico, Central America, and the Caribbean: The forecast through March 2020 indicates intense water surpluses in Sonora, Mexico, and intense deficits along Mexico's Pacific Coast in Michoacán, Guerrero, Oaxaca, and Chiapas. Deficits will persist in Veracruz State, reaching inland, and emerge in the Yucatán. Surpluses are forecast in Central America, Haiti's western coast, and the central Bahamas.

South America: The forecast through March 2020 indicates that water deficits in the region will shrink considerably. Nearly normal water conditions are forecast for much of the Amazon Basin in Brazil and

eastern and southern states, but intense deficits will increase in central Brazil. Deficits will persist in much of Chile. Areas of surplus include Venezuela's Orinoco Delta, central Colombia, and northern Peru.

Europe: The forecast through March 2020 indicates that water deficits will shrink and downgrade in western Ukraine, Belarus, and the Baltics but become exceptional in Moldova, southern Ukraine, eastern Bulgaria, and west-central Poland. Deficits will remain intense in much of Finland. Widespread intense surpluses will persist in northern European Russia. Surpluses in Ireland and the U.K. will moderate.

Africa: The forecast through March 2020 indicates that water deficits in Africa will shrink and downgrade considerably, but exceptional deficits will emerge from central Somalia into Ethiopia. Surpluses in East Africa will remain widespread, particularly in Tanzania and Kenya. Other areas with a forecast of surplus include the Nile River through Egypt and nations on the north coast of the Gulf of Guinea.

Middle East: The forecast through March 2020 indicates that water deficits in the region will retreat considerably, leaving pockets in western Turkey and its central Caspian Coast, Georgia and Azerbaijan, and southwestern Saudi Arabia. Intense surpluses will persist from central into northern Syria; around Mosul, Iraq; and along Iran's Caspian Sea Coast and border with Turkmenistan.

Central Asia and Russia: The forecast through March 2020 indicates widespread exceptional water surpluses in Russia from the Northern European Plain into the Western Siberian Plain. Exceptional deficits will persist on the Gulf of Ob and increase in the Nizhnyaya Tunguska River and the Upper Lena River regions. Surpluses are forecast for Kyrgyzstan, Tajikistan, and Kostanay in northern Kazakhstan.

South Asia: The forecast through March 2020 indicates that water surpluses of varying intensity will continue to dominate the breadth of India with intense anomalies in central Rajasthan, Madhya Pradesh, western Maharashtra, south-central Karnataka, central Chhattisgarh, and the Far East. Surpluses are also forecast for Bangladesh, Nepal, Bhutan, Sri Lanka, rivers in Pakistan, and central Afghanistan.

Southeast Asia and the Pacific: Persistent, widespread water deficits are forecast through March 2020 for Thailand and western Cambodia. Deficits will shrink in Malaysia, Sumatra, and Java. Areas of surplus include Myanmar, Vietnam, northern Laos, and Luzon, Philippines.

East Asia: The forecast through March 2020 indicates widespread water surpluses in Northeast China, the Yellow River Basin, the Yangtze's Upper Basin, and south-central China. Areas of deficits include Yunnan, Hong Kong, Henan, Mongolia, and North Korea.

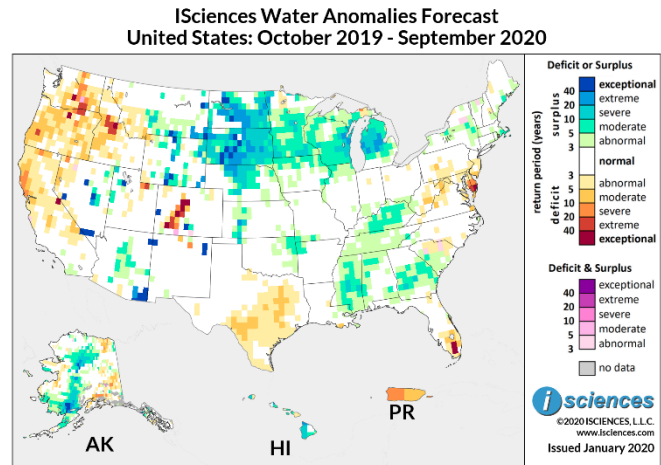
Australia & New Zealand: Water deficits will shrink and downgrade considerably in Australia through March 2020. Moderate deficits are expected in the southeast from Brisbane, growing more intense as they reach into southern Victoria and Tasmania. Surpluses are forecast in northwestern Western Australia. Deficits will downgrade in New Caledonia.

Watch List: Regional Details

United States

The 12-month forecast ending September 2020 indicates water surpluses of varying intensity in the Northern Plains States and Upper Midwest. Surpluses will reach exceptional intensity in the Dakotas and extreme intensity in the central region of Michigan’s Lower Peninsula. Pockets of surplus are also expected in southern Montana, peppered throughout Wyoming, and central and southeastern Arizona.

Areas with a forecast of moderate surplus include Kentucky, Mississippi, northern Alabama, Georgia, western Kansas, and the intersection of Missouri, Oklahoma, and Arkansas.



Based on observed data through December 2019 and forecasts through September 2020

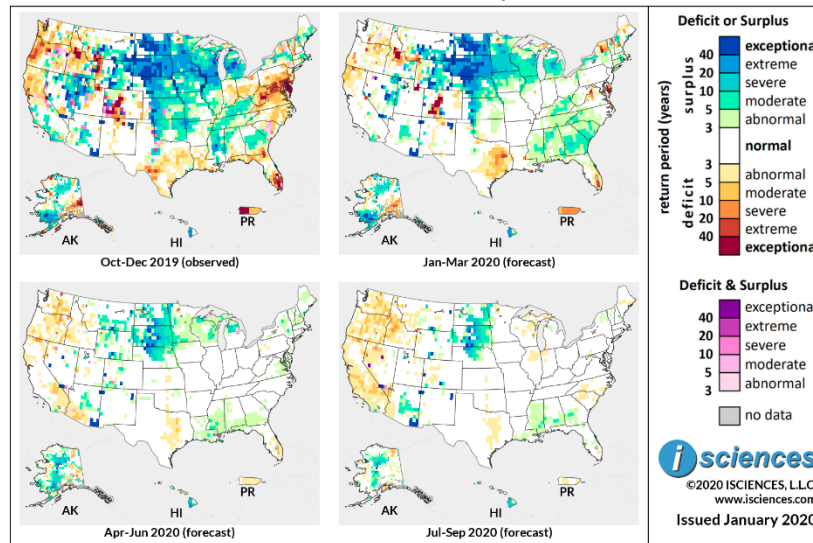
The Pacific Northwest can expect deficits of varying intensity reaching into Idaho, with intense deficits in the Salmon River Mountains in Idaho. Moderate to severe deficits are forecast along California’s coast north of San Francisco, and intense deficits are expected in central Colorado leading southwest. Texas will see some areas of moderate deficit west of San Antonio and south of Dallas.

In the eastern U.S., severe to exceptional deficits are forecast for the Delmarva Peninsula between Chesapeake Bay and the Atlantic Ocean, with small pockets of moderate deficit scattered in nearby states of Pennsylvania, the Virginias, and New Jersey. In Florida, moderate deficits will surround Lake Okeechobee with exceptional deficits farther south.

Outside the contiguous U.S., surpluses are forecast for much of Hawaii, severe deficits in western Puerto Rico and moderate deficits in the east. In Alaska, surpluses are forecast in the Koyukuk and Kobuk River regions in the north and in a wide path from the base of the Alaska Peninsula into the center of the state. Some deficits are expected from Anchorage leading east.

The 3-month maps (below) show the evolving conditions in more detail.

**ISciences Water Anomalies Forecast
United States: October 2019 - September 2020**



Based on observed data through December 2019 and forecasts through September 2020

From January through March 2020, widespread surpluses will persist in the Plains States and Upper Midwest with extreme to exceptional anomalies in the Dakotas and central Nebraska. Surpluses of varying intensity are expected in much of southern Montana and Wyoming. Surpluses will shrink in Nevada and central Arizona, persist in southeastern Arizona with intensity, and nearly disappear from Southern California. Intense deficits will persist in central Colorado and the Salmon River Mountains in Idaho. Deficits in the Pacific Northwest and northern California will shrink. Anomalies in the western half of Texas will normalize but deficits will emerge in the east from Dallas to Houston and will include severe to extreme pockets.

East of the Mississippi, moderate surpluses are forecast for Kentucky, pockets of Mississippi and Alabama, Georgia, South Carolina, and western North Carolina. Deficits in Florida south of Lake Okeechobee will be extreme. Deficits are expected in the Delmarva Peninsula between Chesapeake Bay and the Atlantic Ocean and in northwestern Virginia. In the Northeast, New York State's northern corner will see deficits, but moderate surpluses are expected along the Lake Ontario shore. A patchwork of deficit and surplus anomalies is forecast for Vermont, New Hampshire, and Maine.

From April through June, anomalies east of the Mississippi will nearly disappear, though surpluses are forecast for the northern portion of Michigan's Lower Peninsula and small pockets in Upstate New York and southwestern Mississippi. Though surpluses will downgrade and shrink in the Dakotas and Nebraska, anomalies will remain widespread in South Dakota with some exceptional pockets persisting. Surpluses will generally moderate and shrink in southern Montana and Wyoming, and Colorado's areas of deficit will normalize. A few pockets of surplus are forecast in Colorado, surpluses in central Arizona will shrink slightly, and surpluses in southeastern Arizona will remain exceptional. Deficits will become merely mild in eastern Texas; moderate deficits will emerge in southwestern Arizona; and some pockets of primarily moderate deficit are forecast in the Pacific Northwest and a few isolated areas of California.

The forecast for the final months – July through September 2020 – indicates surpluses in the Dakotas, Nebraska, and Arizona; moderate deficits scattered throughout the Pacific Northwest and Southern California; and generally normal conditions elsewhere in the nation.

(It should be noted that forecast skill declines with longer lead times.)

Canada

The 12-month outlook for Canada through September 2020 indicates a forecast of deficits for nearly all of Quebec north of the Gouin Reservoir in the Mauricie region of the province, including vast areas of exceptional deficit.

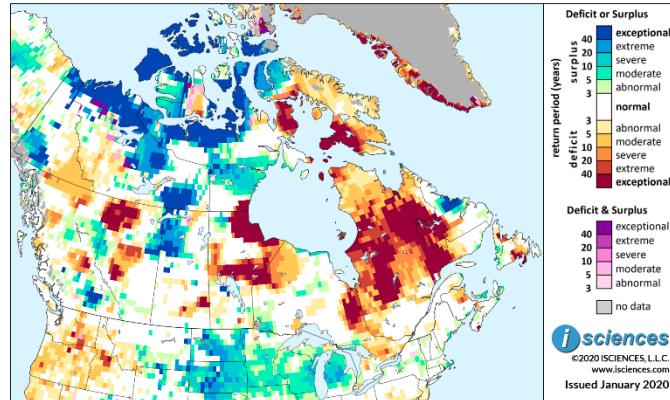
Elsewhere in the nation, exceptional deficits are also forecast for western Labrador, a column along Ontario's eastern border, the southwest corner of Hudson Bay, a belt across central Manitoba north of Lake

Winnipeg reaching into Ontario, the Upper Assiniboine River region in southeastern Saskatchewan, central Alberta west of Edmonton and also the province's northwest corner, and in British Columbia at the bend of the Fraser River east of Prince George.

A large block of extreme to exceptional surplus is forecast surrounding Fort McMurray, Alberta leading north well past Lake Athabasca and east past Churchill Lake, Saskatchewan. Surpluses of similar intensity are expected in the southern Columbia Mountains of British Columbia.

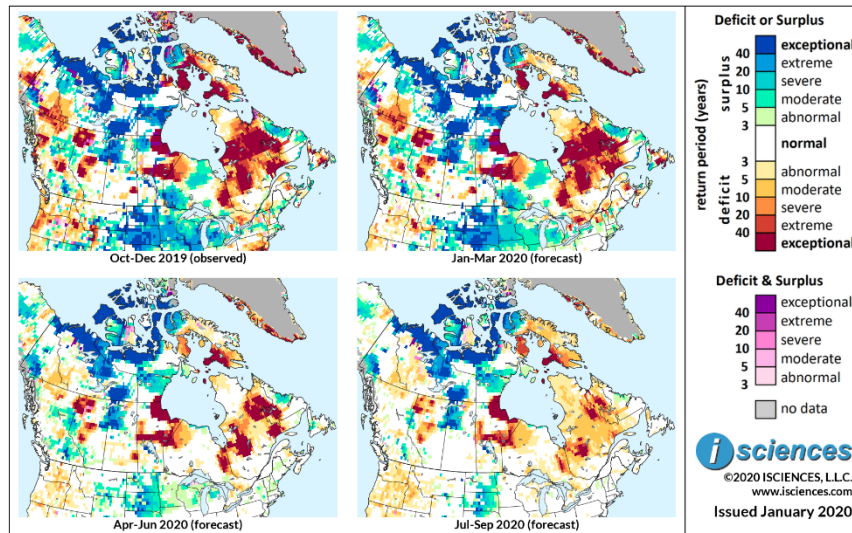
The 3-month maps (below) show the evolving conditions in more detail.

**ISciences Water Anomalies Forecast
Canada: October 2019 - September 2020**



Based on observed data through December 2019 and forecasts through September 2020

**ISciences Water Anomalies Forecast
Canada: October 2019 - September 2020**



Based on observed data through December 2019 and forecasts through September 2020

The forecast through March 2020 for Canada's most populated areas indicates nearly normal water conditions for Québec City, Montreal, Saskatoon, Calgary, Edmonton, and Vancouver. Moderate deficits are expected west of Ottawa and around Regina, and severe surpluses west of Toronto.

The overall distribution pattern of anomalies throughout the nation from January through March is expected to be similar to conditions observed in the prior three months. Specifically, exceptional deficits will persist in many vast areas of central and northern Quebec (QC) reaching into western Labrador. Deficits are forecast for much of Southern Ontario (ON) and will intensify from prior months, though surpluses are expected west of Toronto. Exceptional deficits will persist in a wide pocket along ON's eastern border surrounding Timmons, and severe to exceptional deficits in the province's northwest quadrant. Surpluses will persist in a large block of north-central ON from Hudson Bay to the Albany River and in southern Kenora District.

In the Prairie Provinces, exceptional deficits are forecast in a large block north of Lake Winnipeg, Manitoba (MB), and in the northeast along Hudson Bay. Intense surpluses will persist in MB's northwestern corner and severe to extreme surpluses are forecast around Brandon along the Assiniboine River in the south. In Saskatchewan (SK), moderate deficits are expected around Regina, exceptional deficits in the Upper Assiniboine River, and intense surpluses in a vast block of northwestern SK reaching across the border past Fort McMurray, Alberta (AB).

Exceptional deficits will persist in northwestern AB and severe to exceptional deficits in the Middle Reaches of the Athabasca River Watershed in the center of the province. In British Columbia (BC), intense surpluses are forecast in the southern Columbia Mountains and moderate to extreme surpluses in the northeast surrounding Williston Lake. Deficits in central BC at the intersection of the Nechako and Fraser Rivers will remain intense though the extent of exceptional anomalies will shrink somewhat, and exceptional deficits will persist in the north around Prince Rupert. Severe to exceptional deficits will persist along BC's border with Yukon.

From April through June 2020, deficits will shrink in QC, but vast blocks of exceptional deficit will persist west of Lake Mistassini, surrounding the Caniapiscau Reservoir in the northeast leading well into Labrador past the Smallwood Reservoir, and near Sept-Îles in the east at the mouth of the St. Lawrence River. Intense deficits will persist along ON's northeastern border and in the northwest quadrant of the province, shrinking and downgrading somewhat, but surpluses in ON will nearly disappear. Aforementioned deficits and surpluses in SK and AB will generally persist, and surpluses will increase around Grand Prairie in northwestern AB and across the border into BC. In BC, deficits will shrink, and surpluses will shrink around Williston Lake in the north but increase in the south.

The forecast for the final three months – July through Sept 2020 – indicates that exceptional deficits will shrink in QC, but widespread moderate anomalies will emerge. Deficits will downgrade in ON and AB but persist with intensity in MB. Surpluses will shrink in BC but persist in northern SK.

(It should be noted that forecast skill declines with longer lead times.)

Mexico, Central America, and the Caribbean

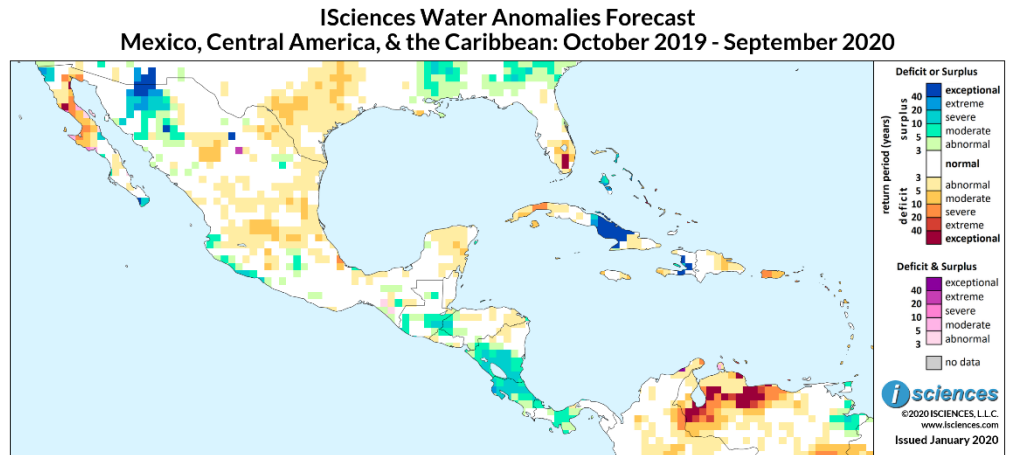
The 12-month forecast ending September 2020 indicates deficits in northern Baja, Mexico ranging from moderate to exceptional. Pockets of surplus are forecast for the Peninsula's southern tip and northwestern corner.

Surpluses are also forecast across the Gulf of California in the

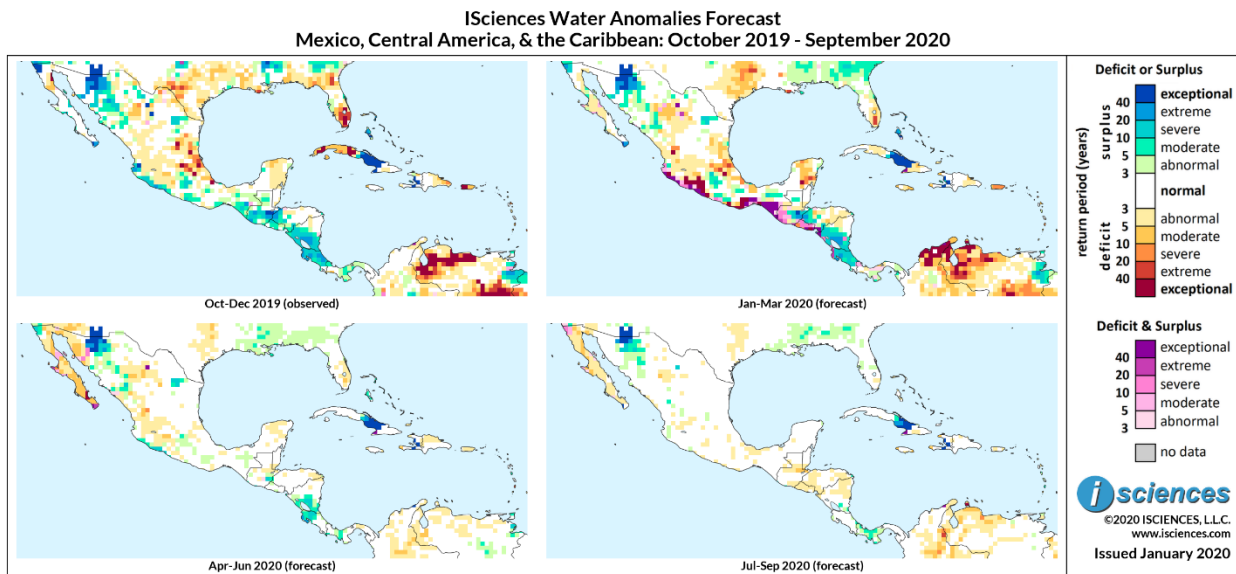
northwestern state of Sonora and will be intense in the northern Yaqui River Basin. A scattering of moderate surpluses is forecast on Mexico's Pacific Coast from Puerto Vallarta through coastal Michoacán. Moderate surplus deficits are expected in pockets of central Mexico and at the shared border of Chihuahua and Durango in the north.

In Central America, moderate to severe surpluses are forecast for Nicaragua, Costa Rica, Panama, and pockets of Guatemala. Havana, Cuba can expect severe deficits. Surpluses are forecast along Haiti's western coast and in the Bahamas.

The 3-month maps (below) show the evolving conditions in more detail.



Based on observed data through December 2019 and forecasts through September 2020



Based on observed data through December 2019 and forecasts through September 2020

The forecast through March 2020 indicates that intense surpluses will persist in Sonora in northwestern Mexico and severe surpluses around Monterrey in Nuevo León. Surpluses in coastal Mexico along the Pacific will transition to exceptional deficit in Michoacán and Guerrero, as well as further south around the Gulf of Tehuantepec in Oaxaca and Chiapas with conditions of both deficit and surplus as transitions occur. Pockets of surplus are expected near the Federal District and in the south. Deficits of varying intensity will persist in the state of Veracruz, reaching inland, and will emerge in the eastern Yucatán Peninsula.

In Central America, surpluses are forecast from central Guatemala into Honduras, southern Nicaragua, and Costa Rica. In the Caribbean, surpluses are expected in the central Bahamas and along Haiti's western coast spreading from Port-au-Prince.

From April through June 2020, normal water conditions are expected in many parts of the region. However, deficits are forecast for Mexico's Baja Peninsula and across the Gulf into coastal Sonora. Surpluses will persist in northern Sonora, and with much lesser extent and intensity around Monterrey in Nuevo León. Coastal regions in the Pacific states of Colima, Michoacán, Guerrero will transition to surplus. In Central America, moderate to severe surpluses are forecast for southern Nicaragua, northern Costa Rica, and a few other pockets in the region. Intense surpluses will persist around Port-au-Prince, Haiti, and moderate surpluses in the Bahamas.

The forecast for the final three months – July through September 2020 – indicates near-normal conditions in much of Mexico with moderate deficits in Baja and surpluses in Sonora. Surpluses are also forecast for Panama and Haiti's western coast.

(It should be noted that forecast skill declines with longer lead times.)

South America

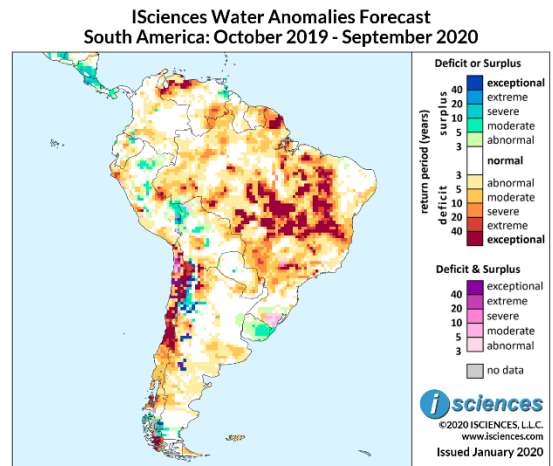
The 12-month forecast through September 2020 indicates many large pockets of exceptional water deficit throughout central Brazil in Mato Grosso, Pará, Goiás, northern Minas Gerais, western Bahia, Tocantins, and farther north in Piauí, Maranhão, and Amapá. Deficits of lesser intensity are expected in many other regions of the country.

Intense deficit anomalies are also forecast for French Guiana and in northern Venezuela from the Colombian border to Caracas. In Chile, deficits will be exceptional and widespread around Valparaiso and Santiago in the center of the country, and of varying intensity to the north through the Atacama Desert and to the south through the Gulf of Corcovado.

Other areas of deficit include southeastern Venezuela and eastern Suriname. Some moderate deficits are expected in the southern Pampas of Argentina.

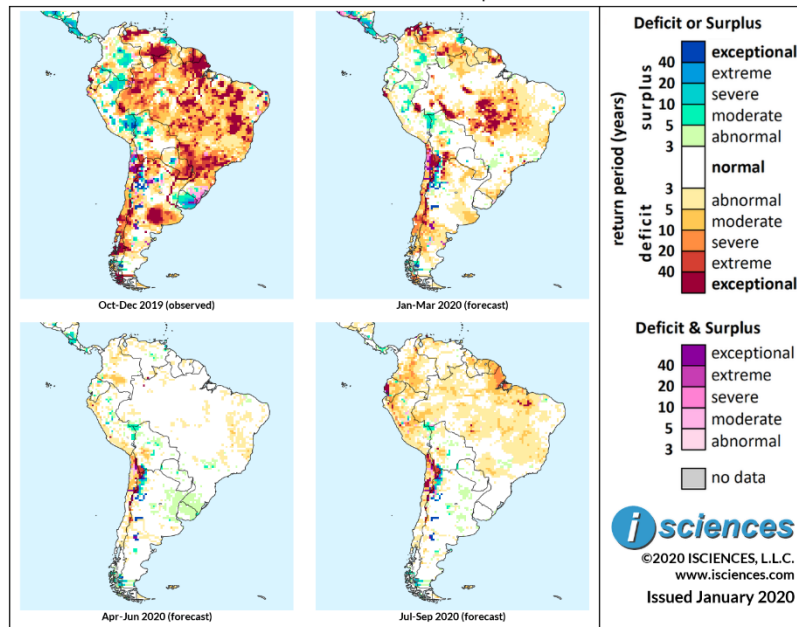
Surpluses, primarily moderate, are forecast for the Orinoco Delta in northeastern Venezuela, some pockets in north-central Peru, the northern border of Peru and Bolivia, and eastern Uruguay. Surpluses of varying intensity are forecast in northwestern Argentina, central Mendoza Province, eastern Neuquén Province, and surrounding O'Higgins/San Martín Lake in Patagonia.

The 3-month maps (below) for the same 12-month period show the evolving conditions in greater detail.



Based on observed data through December 2019 and forecasts through September 2020

ISciences Water Anomalies Forecast
South America: October 2019 - September 2020



Based on observed data through December 2019 and forecasts through September 2020

The forecast through March 2020 indicates that the extent of deficits in the region will shrink considerably overall. While nearly normal water conditions are forecast for much of the Amazon Basin in Brazil and in the eastern and southern states, the extent of intense deficits in central Brazil will increase, with severe to exceptional anomalies in Mato Grosso, Pará, and Tocantins, and in the western state of Rondônia. Across the northern arc of the continent, exceptional deficits will emerge in far northern Colombia; deficits in northwestern Venezuela and in the southeastern region of the Orinoco River Basin will downgrade slightly but remain intense; and deficits will moderate in Guiana and Suriname and shrink in French Guiana.

Deficits of varying intensity will persist in much of Chile, and intense deficits in the north will reach across the Bolivian border. In Argentina, exceptional deficits will disappear in the western Pampas and moderate in their eastern extent. Deficits on the Bermejo River will moderate and conditions on the Paraná River will become nearly normal.

Areas of surplus include the Orinoco Delta in eastern Venezuela, central Colombia, pockets of northern Peru, along the northern border of Peru and Bolivia and pockets in central Bolivia, and northwestern Argentina.

From April through June 2020, nearly normal water conditions are expected for much of the continent. Deficits of varying intensity will persist in northern Chile and extreme deficits across the border into southern Bolivia. Moderate deficits will emerge in southern Colombia. Areas of surplus include the shared border of Peru, Bolivia, and Brazil; northwestern Argentina and central Mendoza Province; and surrounding O'Higgins/San Martín Lake in Patagonia.

In the final quarter – July through September 2020 – mild to severe deficits are expected to emerge in many regions in the northern bulk of the continent. Intense deficits will persist in northern Chile and emerge in coastal Ecuador. A few areas of surplus will persist in Argentina and the intersection of Brazil, Peru, and Bolivia.

(It should be noted that forecast skill declines with longer lead times.)

Europe

The 12-month forecast through September 2020 indicates widespread water deficits of varying intensity from Finland through the Balkans and widespread surpluses in northern European Russia and the United Kingdom.

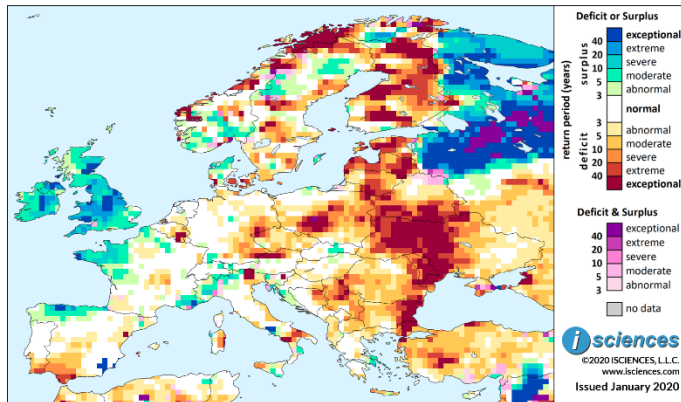
Exceptional deficits will cover much of Ukraine's western half and many areas of Finland. Other regions with a forecast of intense deficit include the Baltics, and

pockets in Sweden, the Norwegian Sea coast, southern Belgium, eastern Germany, central Poland, northern Austria, Moldova, and eastern Bulgaria. Moderate to severe deficits are expected surrounding Seville in southern Spain, reaching through southernmost Portugal.

Surpluses are expected in Ireland and the U.K.; Brittany, France, and from southeastern France into northern Italy; along Spain's north coast; Jutland (Denmark) and southern Norway; and European Russia. Surpluses will be widespread and exceptional in northern European Russia and somewhat less intense in Ireland and the U.K.

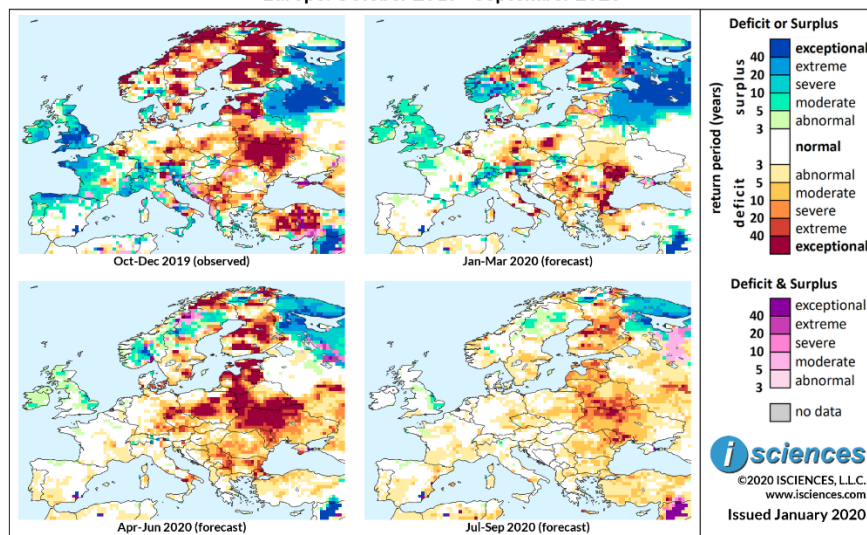
The 3-month composites (below) for the same 12-month time period show the evolving conditions.

ISciences Water Anomalies Forecast
Europe: October 2019 - September 2020



Based on observed data through December 2019 and forecasts through September 2020

ISciences Water Anomalies Forecast
Europe: October 2019 - September 2020



Based on observed data through December 2019 and forecasts through September 2020

The forecast through March 2020 indicates that deficits will shrink and downgrade overall in western Ukraine, Belarus, and the Baltics but deficits in Moldova and nearby regions in southern Ukraine will intensify, becoming exceptional, as will deficits in eastern Bulgaria and a pocket in west-central Poland. Intense deficits are also forecast for pockets in eastern Germany, northern Austria, southern Belgium, and Italy. Moderate to severe deficits will persist in the Balkans. Surpluses are forecast in northwestern France and from southeastern France through Switzerland and southern Austria, and in central Slovakia.

In Northern Europe, widespread exceptional deficits will persist in much of Finland and pockets of Sweden, particularly in the north, but some areas of surplus will emerge in central Sweden, southern Finland, and much of southern and coastal Norway. Extreme to exceptional surpluses will remain widespread in northern European Russia. Surpluses will moderate in Ireland and the U.K. and moderate surpluses will persist in much of peninsular Denmark with deficits forecast for the nation's major islands to the east.

From April through June 2020, exceptional deficits will increase in Eastern and Central Europe and the Baltics, with widespread anomalies in western Ukraine and central Poland. Moderate to extreme deficits are forecast throughout much of the Balkan region and some pockets in southern Italy. Intense deficits will shrink in northern Finland but persist in the south. Some pockets of intense deficit are forecast in Sweden, particularly in the far north but surpluses are also expected in parts of the nation's northern half. Surpluses will persist in Norway's central south, retreating from the fiords. Surpluses in northern European Russia will persist around the White Sea, increasing in Murmansk, but the extent of exceptional surpluses will shrink considerably. Conditions south of St. Petersburg will normalize. In Ireland and the U.K., surpluses will shrink and downgrade considerably, leaving a few pockets of primarily moderate surplus in southern Ireland and eastern England.

The forecast for the remaining months – July through September 2020 – indicates deficits from Finland through the Baltics and Eastern Europe into the eastern Balkans. Surpluses are forecast for Murmansk, Russia. Areas of intense deficit include northwestern Ukraine into Belarus, and along regions of the Moskva and Oka Rivers east of Moscow.

(It should be noted that forecast skill declines with longer lead times.)

Africa

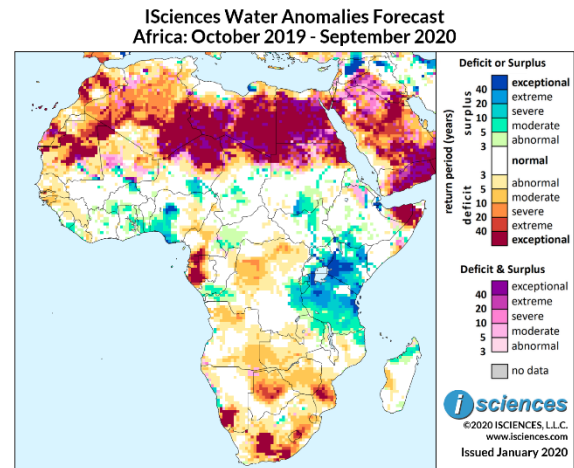
The 12-month forecast through September 2020 indicates intense water deficits across much of northern Africa and will include widespread exceptional anomalies in Egypt and Libya, bleeding well into neighboring nations. Exceptional deficits are also forecast at the continent's eastern tip in northern Somalia and into Somaliland and on the west coast from southern Cameroon through Equatorial Guinea and western Gabon.

In southern Africa, deficits of varying intensity are forecast with exceptional anomalies in southwestern Namibia, Northern and Eastern Cape in South Africa, Lesotho, and southern Mozambique. Deficits in central Botswana will be extreme. Moderate to severe deficits are expected in Democratic Republic of the Congo's northern half.

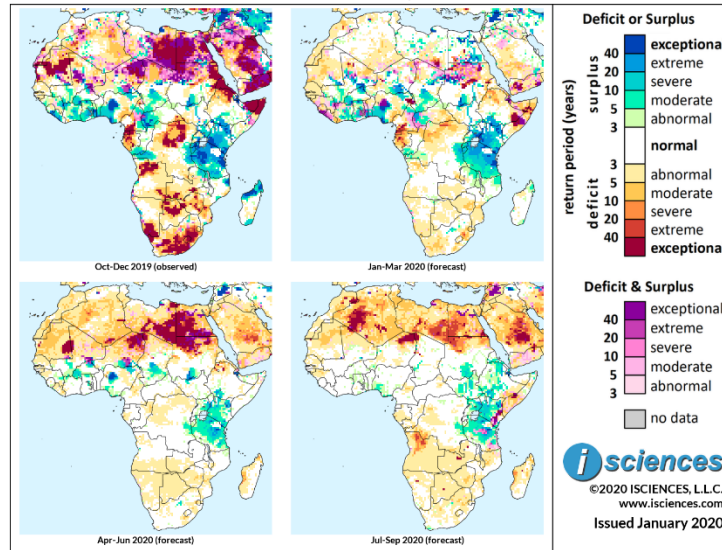
Surpluses ranging from moderate to exceptional are forecast in East Africa including Tanzania, Kenya, and Uganda, reaching into bordering countries including through Burundi into Democratic Republic of the Congo. Anomalies are expected to be exceptional in western Kenya stretching across Lake Victoria and the lake's western shore, the Victoria Nile through Uganda, and in Dar es Salaam and Zanzibar in eastern Tanzania. Severe surpluses are forecast for southern Ethiopia and the White Nile through South Sudan leading across the northern border to a pocket of surplus in Sudan.

Other areas of surplus include coastal Nigeria and the Niger Delta reaching north, pockets scattered through nations on the Gulf of Guinea, and pockets across the Sahel.

The 3-month maps (below) show the evolving conditions in greater detail.



ISciences Water Anomalies Forecast
Africa: October 2019 - September 2020



Based on observed data through December 2019 and forecasts through September 2020

The forecast through March 2020 indicates that deficits in Africa will shrink and downgrade considerably. Across northern Africa some mild deficits are expected in the west, intense deficits in Libya's southeastern corner, and surpluses in Egypt including along the Nile. Surpluses are also forecast scattered across the Sahel and in nations on the north coast of the Gulf of Guinea, though conditions of both deficit and surplus are also indicated around the Gulf as transitions occur. In the Horn of Africa, exceptional deficits will shrink in northern Somalia and Somaliland but will emerge in central Somalia across the border into Ethiopia.

Surpluses in East Africa will maintain a widespread distribution pattern similar to that observed in the prior three months but will downgrade slightly and will retreat from Madagascar. Extreme deficits are forecast along the Uele (Welle) River in northern Democratic Republic of the Congo. Deficits will remain intense in southwestern Cameroon, Equatorial Guinea, and Gabon. Southern African nations can expect normal conditions or generally mild deficits, though moderate to extreme deficits are forecast in South Africa northeast of Lesotho and surpluses around Pretoria and north of the Vaal River in North West Province.

From April through June 2020, exceptional deficits will emerge in Libya, Egypt, northern Sudan, northern Niger, and at the central border of Mauritania and Mali. Moderate deficits are forecast across much of the remainder of northern Africa. Conditions in the Horn will normalize as will prior deficit conditions in Cameroon and its neighbors to the south. Surpluses in East Africa will shrink slightly and moderate. Surpluses around the Gulf of Guinea will diminish considerably but surpluses will reemerge in northwestern Nigeria in the Mariga River Watershed. Pockets of surplus will persist from southern Mali east to South Sudan. Mild deficits or normal conditions are forecast for much of the remainder of the continent.

During the final quarter – July through September 2020 – deficits of varying intensity are forecast across northern Africa, though exceptional deficits will downgrade slightly in Libya and Egypt. Generally moderate surpluses will persist in East Africa and will emerge farther north in Ethiopia, Eritrea, and South Sudan, and will increase somewhat in south-central Sudan. Severe deficits are forecast for northern Angola.

(It should be noted that forecast skill declines with longer lead times.)

Middle East

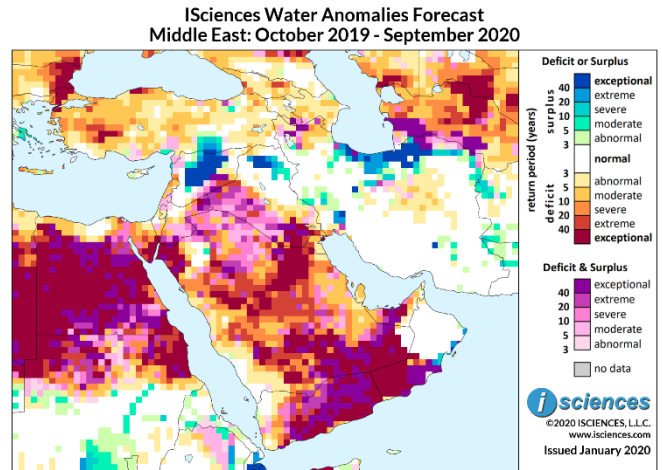
The forecast for the 12-month period ending September 2020 indicates widespread, intense water deficits covering much of the Arabian Peninsula including exceptional anomalies in Saudi Arabia, Yemen, and Oman.

Intense deficits are also forecast for southern Iraq, intense surpluses in northern Iraq, and conditions of both deficit and surplus (pink/purple) west of the Euphrates River as transitions occur.

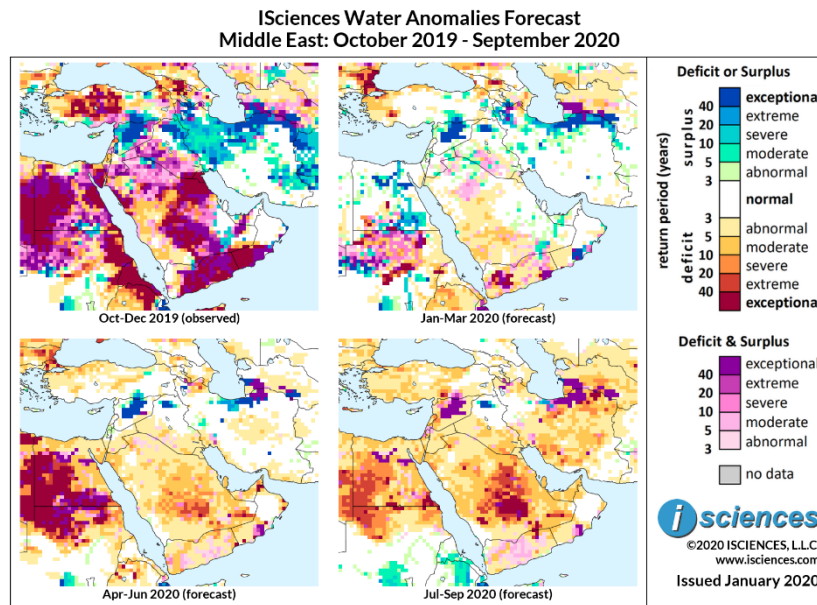
Exceptional surpluses are forecast from central into northern Syria. Western Turkey can expect deficits ranging from moderate to exceptional. Deficits of generally lesser intensity are forecast for Georgia and from Azerbaijan across the border into Iran.

Moderate to severe surpluses are forecast along Iran's Caspian Sea Coast and extending east along the Turkmenistan border. Some pockets of surplus are also forecast in the southwest province of Khuzestan near the Persian Gulf and neighboring provinces to the north.

The 3-month maps (below) show the evolving conditions in greater detail.



Based on observed data through December 2019 and forecasts through September 2020



Based on observed data through December 2019 and forecasts through September 2020

The forecast through March 2020 indicates that deficits in the region will retreat considerably, leaving some pockets in western Turkey and its central Caspian Coast, Georgia and Azerbaijan, and southwestern Saudi Arabia. Conditions of both deficit and surplus are forecast for Yemen. Intense

surpluses will persist from central into northern Syria and a pocket in northern Iraq around Mosul. Surpluses in Iran will shrink considerably but will persist with intensity along the Caspian Sea Coast and border with Turkmenistan, and will also persist in pockets of the west, particularly the northwest corner around Lake Urmia. A pocket of surplus will emerge in central Khuzestan Province north of the Persian Gulf. Some areas of moderate surplus are expected in southeastern Saudi Arabia and into United Arab Republic, and a pocket of exceptional surplus will emerge along the coast in central Oman.

From April through June 2020, intense surpluses will persist from central into northern Syria and around Mosul in Iraq. Areas of surplus in Iran will shrink but will persist along the Caspian Sea Coast. Deficits will increase and intensify in central and southeastern Saudi Arabia, becoming extreme to severe in some regions. Generally moderate deficits will emerge in Qatar and United Arab Emirates. Moderate deficits are also forecast for pockets of Yemen, Turkey, and Georgia. Deficits somewhat more intense are expected near Iran's border with Azerbaijan.

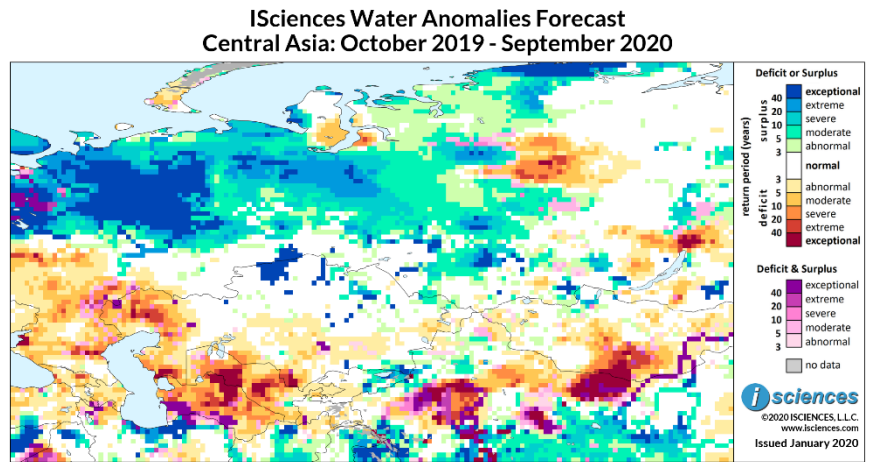
In the final quarter – July through September 2020 – deficits will increase and intensify in the region with widespread deficits in Saudi Arabia and the bulk of central Iran. Exceptional surpluses will persist surrounding Mosul, Iraq.

(It should be noted that forecast skill declines with longer lead times.)

Central Asia and Russia

The 12-month forecast through September 2020 indicates a vast expanse of water surplus in Russia from St. Petersburg through the Western Siberian Plain with exceptional anomalies in the Vycheгда Lowland west of the Urals.

Extreme surpluses are expected on the other side of the Urals in the Middle Ob River Watershed, and moderate anomalies will reach through the Western Siberian Plain.

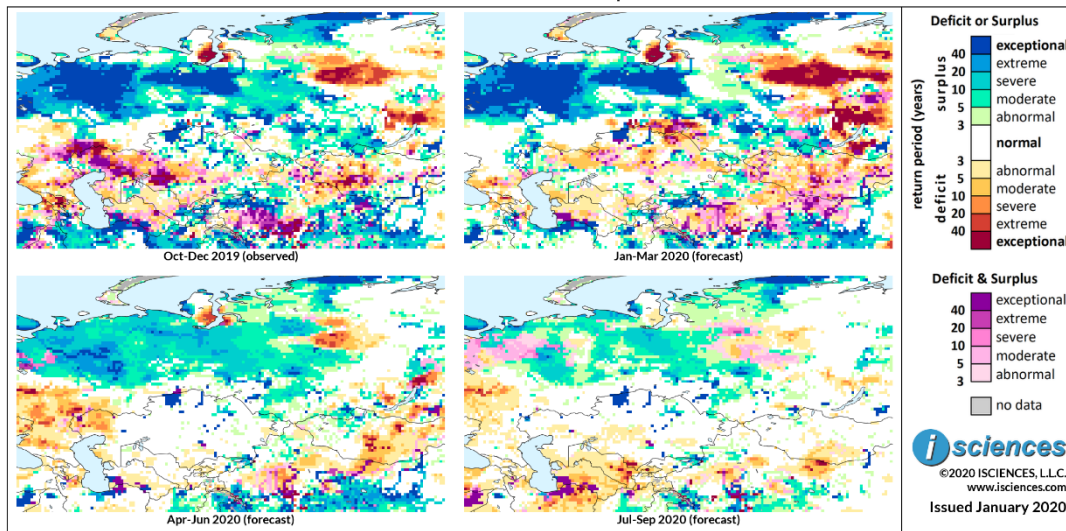


Deficits of varying intensity are forecast in the Lower Volga River Basin and the Don River Basin, along the central coasts of the Gulf of Ob, in the Nizhnyaya Tunguska River region of the Yenisei River Watershed, and north and west of Lake Baikal.

Surpluses are forecast in northern Kazakhstan in Kostanay Region and pockets between the Esil (Ishim) and Ertis (Irtysh) Rivers, and in eastern Kyrgyzstan. Deficits ranging from moderate to extreme are expected in western Kazakhstan, and moderate to exceptional in Turkmenistan and Uzbekistan. As transitions occur Turkmenistan's southern border will see conditions of both deficit and surplus (pink/purple).

The 3-month composites (below) for the same 12-month period show the evolving conditions in more detail.

ISciences Water Anomalies Forecast
Central Asia: October 2019 - September 2020



Based on observed data through December 2019 and forecasts through September 2020

The forecast through March 2020 indicates widespread exceptional surpluses in Russia in the Northern European Plain and across the Ural Mountains into the Western Siberian Plain. Exceptional deficits will persist on the central shores of the Gulf of Ob and will increase in Central Siberian Plateau in the Nizhnyaya Tunguska River region of the Yenisei Watershed. Deficits are also forecast in the Lena River Watershed and anomalies will be exceptional in the Upper Lena River region west and north of Lake Baikal. Intense deficits will emerge in the Irtysh River Watershed around Omsk, reaching into northern Kazakhstan.

Exceptional surpluses will persist in Kostanay in northern Kazakhstan, pockets of moderate deficit are expected in a belt across much of the nation's middle, and surpluses are forecast in the western and eastern tips. In Kyrgyzstan, intense surpluses will persist, and surpluses are also forecast for central and northern Tajikistan. Conditions of both deficit and surplus (pink/purple) are expected along Turkmenistan's southern border as transitions occur along with exceptional surpluses.

From April through June 2020, intense, widespread surpluses will increase in Russia from the Northern European Plain through the Western Siberian Plateau but will downgrade, though extreme to exceptional anomalies will persist in the Vychegda Lowland. Deficits will downgrade on the Gulf of Ob, shrink considerably in the Central Siberian Plateau but persist in the Nizhnyaya Tunguska River region, and will shrink around Lake Baikal, persisting north of the lake. Deficits in the Irtysh River Watershed around Omsk will disappear and deficits of varying intensity will emerge from Moscow to the Caspian Sea and into western Kazakhstan. Conditions will become nearly normal in much of the remainder of Kazakhstan and in the other nations of Central Asia, with some surpluses in northern Kazakhstan, eastern Kyrgyzstan, and southern Turkmenistan.

The forecast for the final months – July through September 2020 – indicates that surpluses in the Northern European Plain and Western Siberian Plain will shrink. Deficits are forecast for Uzbekistan and Turkmenistan.

(It should be noted that forecast skill declines with longer lead times.)

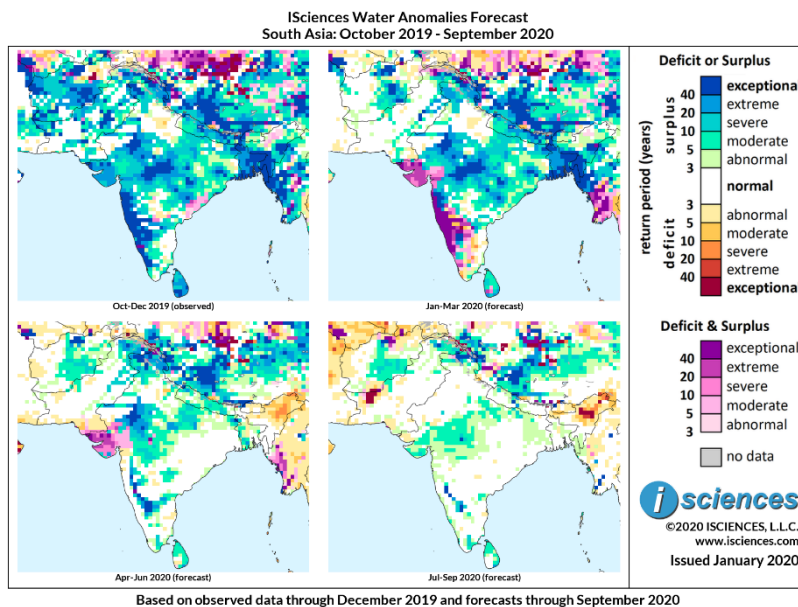
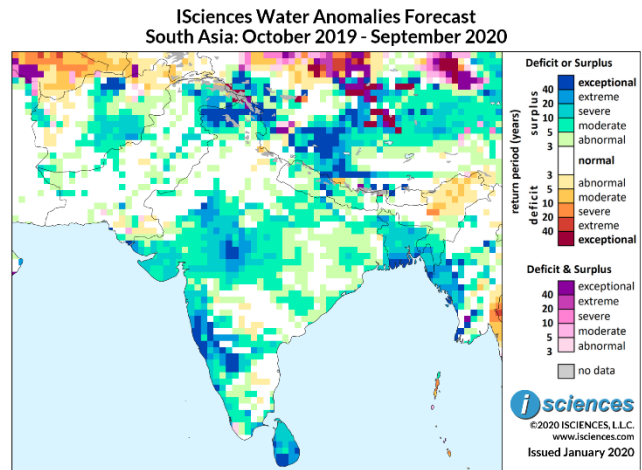
South Asia

The 12-month forecast through September 2020 indicates water surplus as the dominant anomaly in the region covering much of India, Bangladesh, Nepal, and Sri Lanka; several rivers in Pakistan; and a large block of central Afghanistan from Mazar-e Sharif to Kabul to Kandahar.

Areas of exceptional surplus in India include the west coast from south of Mumbai through Goa, veering east well into Karnataka; western Madhya Pradesh; and Jammu and Kashmir in the far north. Exceptional surpluses are also forecast for southern Sri Lanka, coastal Bangladesh, the Gandak River through central Nepal, and surrounding Mazar-e Sharif in northern Afghanistan.

Primarily moderate deficits are expected in Far Northeast India with a pocket of severe deficit in central Assam.

The 3-month composites (below) show the evolving conditions in greater detail.



The forecast through March 2020 indicates that surpluses of varying intensity will continue to dominate the breadth of India while conditions of both deficit and surplus (pink/purple) are forecast on the west coast as transitions occur. Extreme to exceptional anomalies are expected in central Rajasthan, Madhya Pradesh, western Maharashtra, south-central Karnataka, central Chhattisgarh, and in the Far Eastern

regions of Mizoram, Tripura, and Nagaland. Extreme to exceptional surpluses are also forecast for Bangladesh, and surpluses of varying intensity throughout Nepal and into Bhutan. Surpluses will moderate in Sri Lanka, shrink in Pakistan but persist along rivers, and shrink in Afghanistan but persist in a wide column in the central of the nation from Mazar-e Sharif past Kandahar. Anomalies will be exceptional in Afghanistan around Mazar-e Sharif and in Ghazni and Paktika Provinces.

From April through June 2020, surpluses will shrink and downgrade in the region but will remain widespread. Nearly normal water conditions will return to India's eastern regions along the Bay of Bengal, but widespread surpluses of varying intensity are forecast for the Far North, Rajasthan, Madhya Pradesh, Uttar Pradesh, and a long loop from northern Maharashtra through Karnataka sweeping east through Andhra Pradesh. Conditions of both deficit and surplus are forecast for Gujarat in the west, and deficits will emerge in India's Far Northeast. Surpluses will shrink in Sri Lanka, Nepal, and Bangladesh. In Afghanistan, surpluses will moderate overall but exceptional anomalies will persist around Mazar-e Sharif.

The forecast for the final months – July through September 2020 – indicates moderate surpluses in central Afghanistan and in India from Gujarat along a wide path leading to Nepal. Pockets of surplus are also forecast in southern India and Sri Lanka. Deficits will intensify in India's Far Northeast and will emerge across the southern border of Afghanistan and Pakistan.

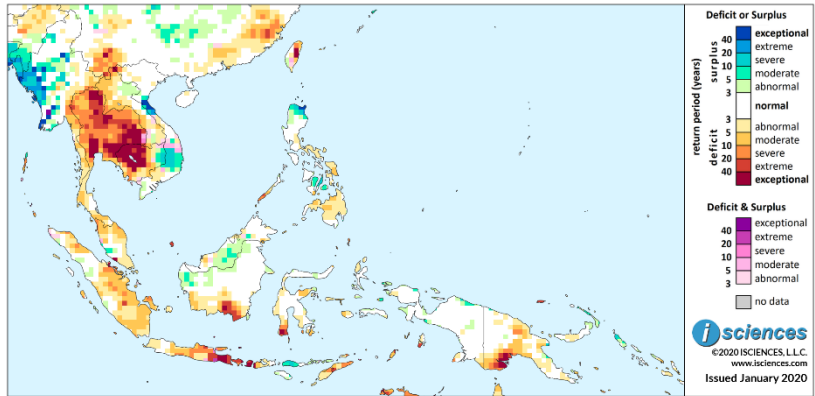
(It should be noted that forecast skill declines with longer lead times.)

Southeast Asia and the Pacific

The 12-month forecast through September 2020 indicates water deficits of varying intensity throughout Thailand and exceptional water deficits in western Cambodia including Tonlé Sap.

Moderate deficits are forecast for parts of peninsular Malaysia and Sumatra, but deficits will be intense in eastern Java, southern Borneo, and around the western shore of the Gulf of Papua in Papua New Guinea.

ISciences Water Anomalies Forecast
Southeast Asia: October 2019 - September 2020

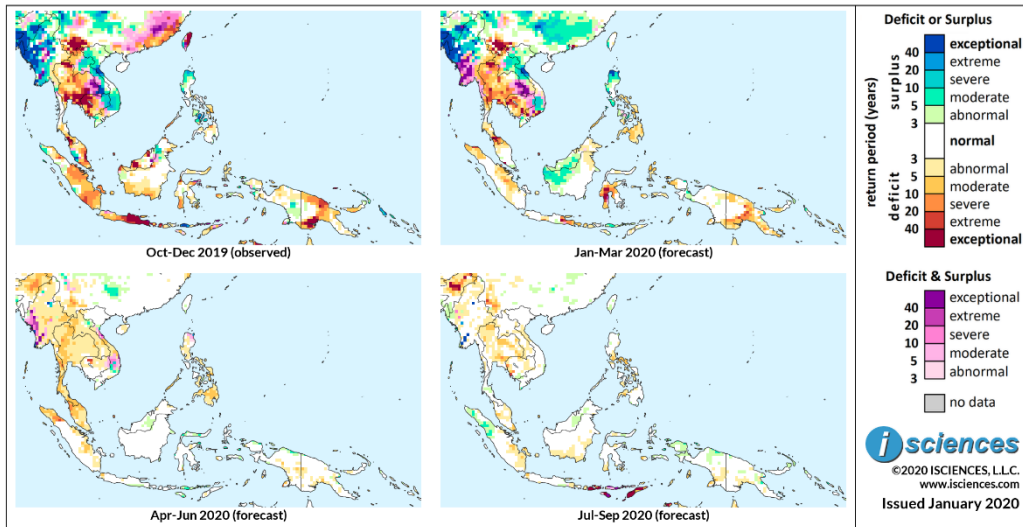


Based on observed data through December 2019 and forecasts through September 2020

Surpluses are forecast for: Myanmar, particularly in the west; Vietnam’s North Central Coast and the Central Highlands reaching into easternmost Cambodia; northern Luzon and central Cebu, Philippines; Malaysian Borneo; and Flores Island. Surpluses will be intense in western Myanmar, north-central Vietnam, and northeastern Luzon at the mouth of the Cagayan River.

The 3-month maps (below) show the evolving conditions in more detail.

ISciences Water Anomalies Forecast
Southeast Asia: October 2019 - September 2020



Based on observed data through December 2019 and forecasts through September 2020

The forecast through March 2020 indicates persistent deficits in Thailand and western Cambodia though the extent of exceptional deficits will shrink to small pockets. Surpluses will persist in western and northern Myanmar with conditions of both deficit and surplus (purple) in the Lower Irrawaddy River

region and Delta as transitions occur. Surpluses will be intense in western Myanmar. Moderate to severe surpluses will persist in northern Laos and Vietnam's Central Highlands, and exceptional anomalies in the North Central Coast of Vietnam.

In the Philippines, surpluses will emerge on Mindoro and intensify in northern Luzon. Some areas of moderate deficit are expected to emerge in the central Philippines and Mindanao. Deficits will shrink in Malaysia, Sumatra, and Java; emerge in central Sulawesi with intensity; and downgrade in Papua New Guinea. Moderate surpluses are expected to emerge in northwestern Borneo.

From April through June 2020, some moderate deficits are expected in a path from the shared border of Myanmar and Laos tracing south through western Thailand and into peninsular regions of Myanmar, Thailand, and Malaysia. Some moderate deficits are also forecast for pockets of central Vietnam and for the central and southern Philippines. A pocket of extreme deficit is forecast north of Tonlé Sap in Cambodia and also in northern Sumatra. Moderate surpluses are expected in scattered small pockets of Indonesia.

The forecast for the final months – July through September 2020 – indicates nearly normal conditions in most of the region, but intense deficits in the Lesser Sunda Islands, moderate deficits in pockets of Thailand, and moderate surpluses in pockets of northern Sumatra.

(It should be noted that forecast skill declines with longer lead times.)

East Asia

The 12-month forecast for East Asia through September 2020 indicates water surpluses of varying intensity in Northeast China, in the Yellow River Basin (Huang He), and in western Tibet (Xizang).

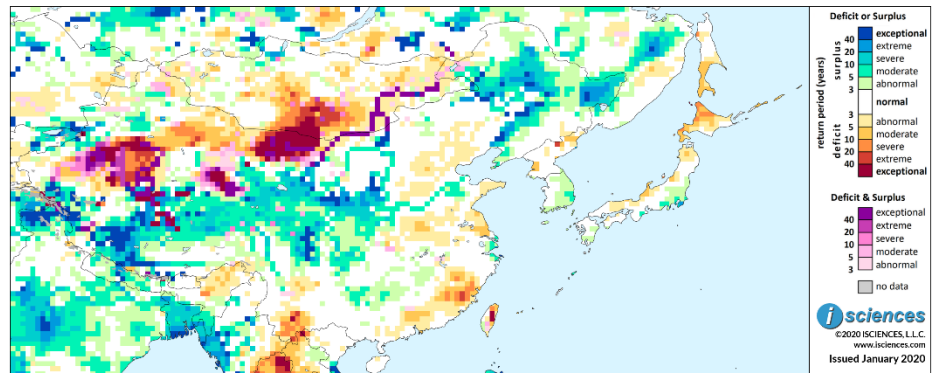
Exceptional deficits are expected in western Inner Mongolia with deficits of varying intensity reaching into southern and central Mongolia. Deficits will also be intense in Xinjiang in western China, particularly in the Taklimakan Desert.

Deficits ranging from moderate to extreme are forecast in southeastern China in Fujian and Guangdong, with a pocket of exceptional deficit forecast in northern Taiwan. Yunnan, too, can expect deficits.

On the Korean Peninsula, a few pockets of deficit are forecast in the north and some moderate surpluses in the southeast. Japan can expect moderate surpluses in eastern Honshu around Tokyo, and moderate deficits trailing up the island's west coast, becoming more widespread and intense on Hokkaido.

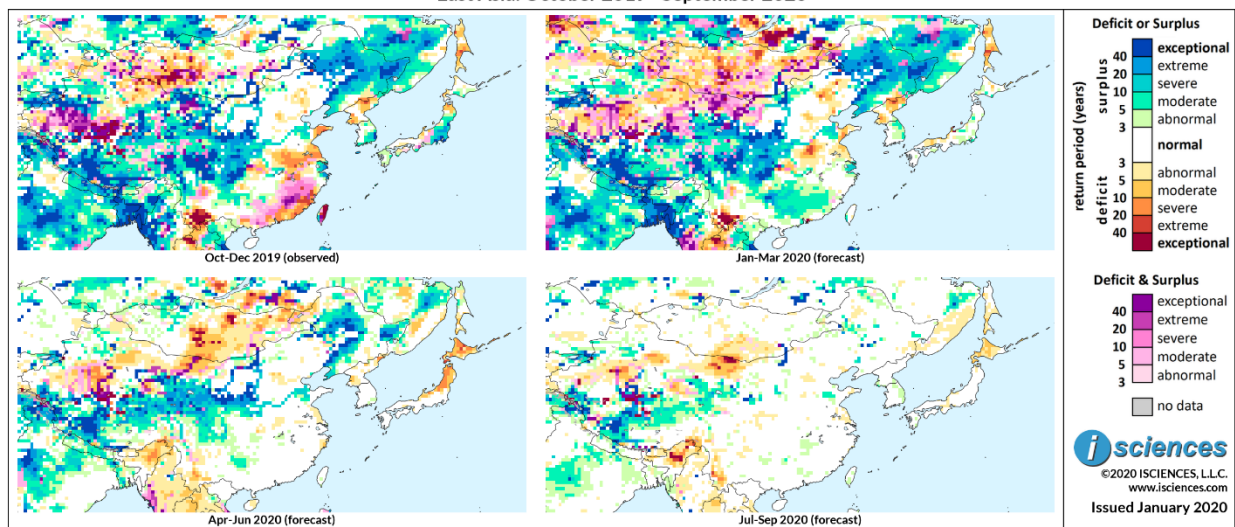
The 3-month time series maps below show the evolving conditions in more detail.

ISciences Water Anomalies Forecast
East Asia: October 2019 - September 2020



Based on observed data through December 2019 and forecasts through September 2020

ISciences Water Anomalies Forecast
East Asia: October 2019 - September 2020



Based on observed data through December 2019 and forecasts through September 2020

The forecast through March 2020 indicates widespread surpluses in the Yellow River Basin, primarily moderate in the Lower and Middle regions but reaching exceptional intensity in the Yellow's Upper Basin as well as the Yangtze's Upper Basin. Widespread surpluses are also forecast in the south for Guizhou, Hunan, eastern Guangxi, northern Guangdong, southern Jiangxi, and western Fujian. And, surpluses are forecast for Shanghai. Exceptional deficits are expected in southern Yunnan and a pocket around Hong Kong, and severe deficits in eastern Henan in the North China Plain. Deficits are also expected at the base of the Shandong Peninsula and in the Shandian River region in northern Inner Mongolia.

Deficits of varying intensity are forecast throughout much of Mongolia and in North Korea around Pyongyang and in the northeast. South Korea can expect moderate surpluses in the northeast and southeast. Small pockets of moderate anomalies, deficits and surpluses, are forecast scattered throughout Japan.

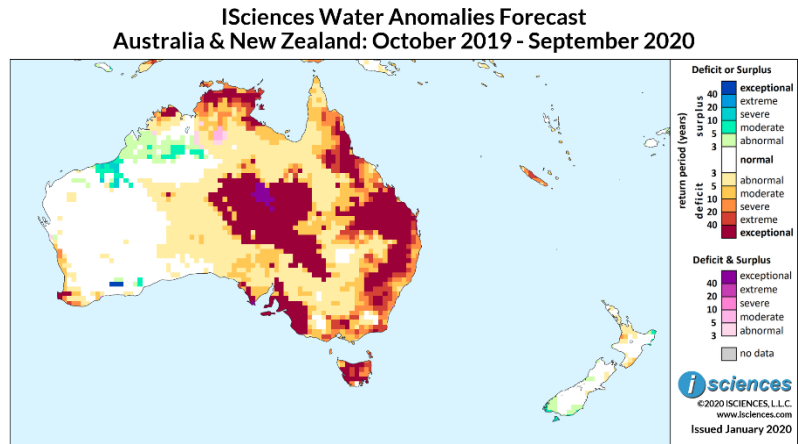
From April through June 2020, surpluses of varying intensity will persist, shrinking somewhat, in Northeast China, the Yellow River Basin, and western Tibet. Moderate surpluses are forecast in southeastern Guizhou. Nearly normal water conditions are forecast for southern and southeastern China and the North China Plain. Deficits are expected in central and pockets of eastern Mongolia and will include intense anomalies around Ulaanbaatar; surpluses will emerge in the northwest. The Korean Peninsula will transition to near-normal conditions. Severe deficits are forecast in northern Honshu and in Hokkaido, Japan.

The forecast for the final three months – July through September 2020 – indicates nearly normal water conditions in much of the region with surpluses in western Tibet and much of Qinghai, and deficits in Mongolia, western Inner Mongolia, Yunnan, and Hokkaido.

(It should be noted that forecast skill declines with longer lead times.)

Australia & New Zealand

The 12-month forecast through September 2020 indicates intense water deficits in eastern Australia from Cairns in northern Queensland through the eastern Murray-Darling Watershed. Deficits will be exceptional in many areas including a large block from Rockhampton to Brisbane in Queensland reaching inland to the center of the state.



Based on observed data through December 2019 and forecasts through September 2020

Deficits of varying intensity are expected in Victoria with exceptional deficits from its western border into South Australia past Adelaide. The forecast for Tasmania indicates severe to exceptional deficits.

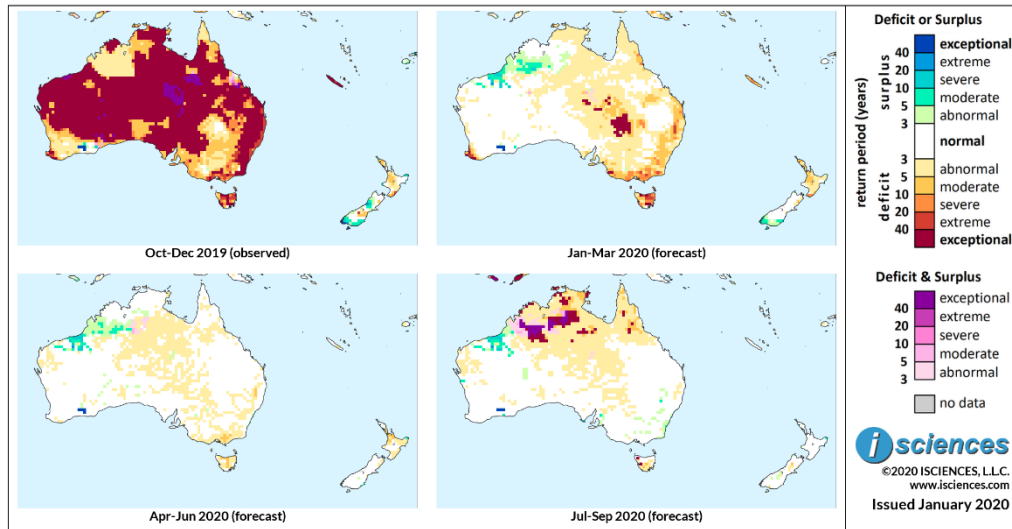
Exceptional deficits will also encompass a vast area in center of the nation in the Lake Eyre drainage basin at the intersection of Northern Territory, Queensland, and South Australia, and the Strzelecki Desert in the northwest corner of New South Wales.

Top End, Northern Territory can expect severe to exceptional deficits as can the northern Kimberley in Western Australia. Some surpluses are forecast along the northwest coast of Western Australia, and exceptional deficits in the southwest tip around Busselton. A pocket of intense surplus is forecast inland of the southern coast of Western Australia north of Esperance.

Nearly normal conditions are expected in New Zealand with a few small pockets of generally moderate deficit in the north and moderate surplus in the southern extremes. Severe to extreme deficits are forecast for New Caledonia.

The 3-month maps (below) show the evolving conditions in greater detail.

**ISciences Water Anomalies Forecast
Australia & New Zealand: October 2019 - September 2020**



Based on observed data through December 2019 and forecasts through September 2020

The forecast through March 2020 indicates that deficits will shrink and downgrade considerably in Australia, with exceptional deficits persisting at the intersection of South Australia (SA), Queensland (QLD), and New South Wales (NSW). Moderate to severe deficits are forecast in eastern Australia from Brisbane to Canberra with some isolated pockets of extreme deficit. Conditions in southern Victoria (VIC) will be similar. Deficits will be somewhat more intense in Tasmania (TAS) with exceptional anomalies around Hobart and the Derwent River region. In Western Australia (WA), intense deficits are forecast for the southwestern tip near Busselton and the Blackwood River. Surpluses of varying intensity are expected along the northwest coast of WA radiating from the Eighty Mile Beach area and moderate surpluses in the northern portion of the Great Sandy Desert.

In New Zealand, moderate deficits are forecast in the north though deficits may be severe east of Wellington. Some surpluses are expected in the southern extremes including the region around Dunedin. Deficits in New Caledonia will downgrade, becoming primarily moderate to severe.

From April through June conditions will become nearly normal in much of Australia, New Zealand, and New Caledonia with some moderate deficits east of Melbourne and down the center of TAS, and surpluses persisting in northwestern WA. A pocket of exceptional surplus is expected to persist in southern WA north of Esperance.

The forecast for the final months – July through September 2020 – indicates persistent surpluses in northwestern WA radiating from Eighty Mile Beach, though exceptional deficits are expected to emerge in the eastern Great Sandy Desert as transitions occur and in Northern Territory.

(It should be noted that forecast skill declines with longer lead times.)