

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 January 2020 and an ensemble of forecasts issued the last week of January 2020. 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.

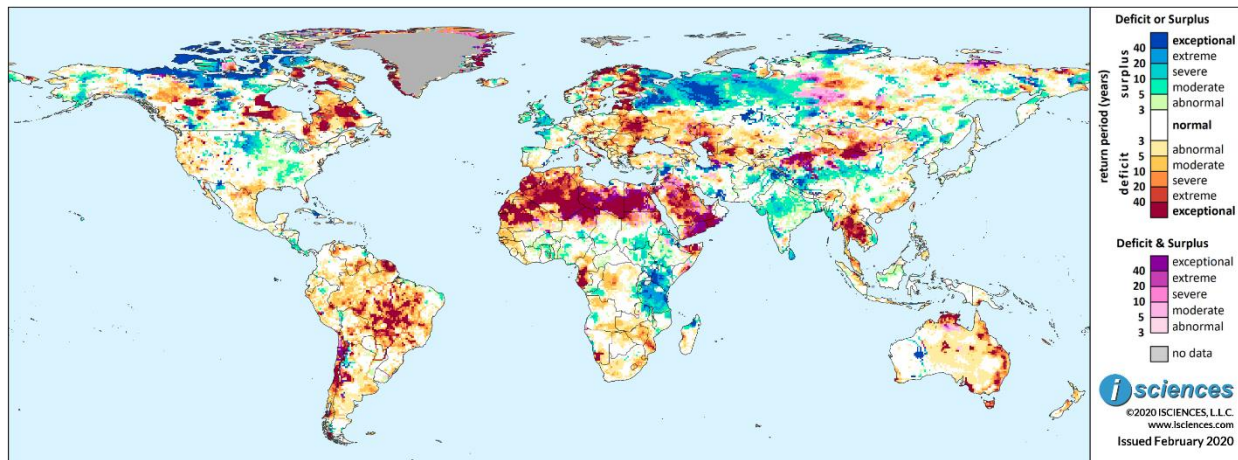
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Worldwide Water Watch List

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

ISciences Water Anomalies Forecast: November 2019 - October 2020



Based on observed data through January 2020 and forecasts through October 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 April indicates widespread water surpluses in the Northern Plains States and Upper Midwest, exceptional in the Dakotas and Nebraska. Moderate surpluses are expected in Tennessee, the Carolinas, Mississippi, Alabama, and Georgia. Areas of deficit include central Colorado, eastern Texas, and northern California.

Canada: The forecast through April indicates nearly normal water conditions for Québec City with deficits to the south, deficits near Ottawa and Regina, and surpluses near Toronto and Calgary. Exceptional deficits are forecast for much of northern Quebec. Surpluses are forecast for southern British Columbia.

Mexico, Central America, and the Caribbean: The forecast through April indicates intense water surpluses in northeastern Sonora, Mexico. Exceptional deficits will emerge in Guerrero and Michoacán. Surpluses will shrink but persist in Central America and deficits in the Caribbean will nearly disappear.

South America: The forecast through April indicates that water deficits will shrink considerably. However, intense deficits are forecast in Amapá, Pará, Amazonas, Rondônia, and Acre, Brazil, and French Guiana, Suriname, and Chile. Surpluses are forecast for the Orinoco Delta in eastern Venezuela.

Europe: The forecast through April indicates that water surpluses will shrink in Western Europe and around the Adriatic Sea but increase in northern European Russia. Deficits will persist in Finland, the Baltics, eastern Germany, central Poland, Ukraine, Bulgaria, and the central Balkans.

Africa: The forecast through April indicates water deficits of varying intensity across many regions in northern Africa. Exceptional deficits will retreat from the Horn. Widespread surpluses will persist in East Africa, downgrading slightly. Southern African nations can expect normal conditions or mild deficits.

Middle East: The forecast through April indicates that widespread water surpluses in the region will shrink. However, surpluses are forecast in Syria, around Mosul, along Iran's Caspian Sea Coast, and in southern Iran. Intense deficits are forecast from eastern Yemen into western Oman.

Central Asia and Russia: The forecast through April indicates widespread intense water surpluses in Russia from the Northern European Plain into the Western Siberian Plain. Exceptional deficits are forecast for the Central Siberian Plateau, north and southeast of Lake Baikal, and in western Kazakhstan.

South Asia: The forecast through April indicates that water surpluses will dominate much of India's breadth and will be exceptional in central Madhya Pradesh. Deficits will emerge in the Far Northeast. Intense surpluses will persist in Bangladesh and Nepal and shrink somewhat in Pakistan and Afghanistan.

Southeast Asia and the Pacific: The forecast through April indicates persistent water deficits in Thailand and western Cambodia though the extent of exceptional deficits will shrink to small pockets. Intense surpluses will persist in western Myanmar, Vietnam's North Central Coast, and northern Mindanao.

East Asia: The forecast through April indicates widespread water surpluses in the Yellow River Basin, the Yangtze Basin, Northeast China, and Tibet. Intense deficits are expected in Yunnan and Mongolia and severe deficits in Hainan. In North Korea, deficits are forecast in the northeast.

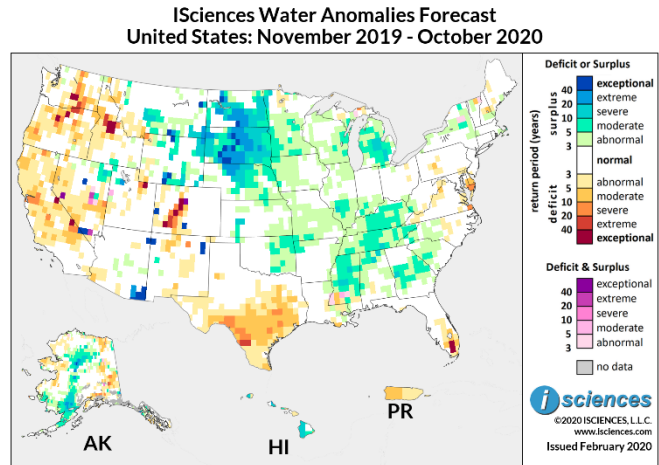
Australia & New Zealand: The forecast through April indicates that water deficits will shrink and downgrade considerably. Deficits will be exceptional at the confluence of the Murray and Darling Rivers, moderate to severe from Canberra to Melbourne, and intense in Tasmania. Deficits are also forecast in northern New Zealand and in New Caledonia.

Watch List: Regional Details

United States

The 12-month forecast ending October indicates moderate to extreme water surpluses in the Dakotas, particularly widespread in South Dakota, with some areas reaching exceptional intensity. Surpluses will extend well into Nebraska and are also forecast in pockets of southern Montana, Wyoming, and Minnesota.

Around the Great Lakes region Michigan can expect widespread, primarily moderate surplus anomalies in the Lower Peninsula reaching severe intensity in the center and southeast of the state. Moderate surpluses are forecast in pockets of eastern Wisconsin.



Based on observed data through January 2020 and forecasts through October 2020

Moderate surpluses are also expected in the southern Ohio River Basin in southern Illinois, Kentucky, and Tennessee, and in a few southern states including Mississippi and Georgia. Elsewhere, moderate surplus anomalies are forecast for eastern Oklahoma, a path in southwestern Kansas, and Nevada's northeast corner. Intense surpluses are forecast in Arizona's southeast corner and a few other isolated pockets in the Southwest.

The Pacific Northwest can expect deficits of varying intensity reaching into Idaho, with intense deficits in the Columbia River region of south-central Washington and in the Salmon River Mountains of Idaho. Primarily mild deficits are forecast for much of California with severe anomalies in the San Francisco Bay Area and around Fresno, and moderate pockets scattered throughout the state and in pockets of Nevada. Colorado can expect severe to exceptional deficits in the center of the state leading southwest.

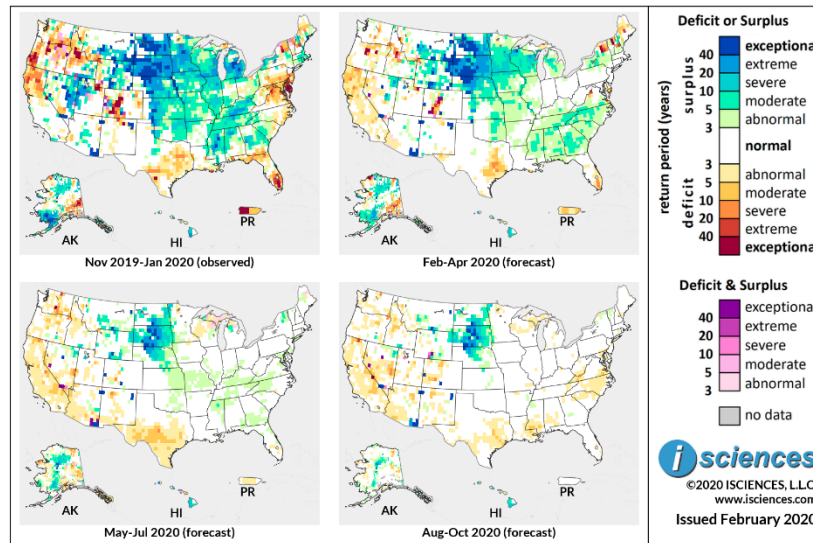
Primarily moderate deficits will cover much of the southern half of Texas though anomalies will be severe to extreme along the southwestern border.

In the eastern U.S., moderate to severe deficits are forecast for the Delmarva Peninsula east of Chesapeake Bay; severe deficits around Norfolk, Virginia; and exceptional deficits south of Lake Okeechobee in Florida.

Outside the contiguous U.S., surpluses are forecast for much of Hawaii and moderate deficits in western Puerto Rico. 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, and also east of Fairbanks.

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

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



Based on observed data through January 2020 and forecasts through October 2020

From February through April, surpluses will persist in the Northern Plains States and Upper Midwest with extreme to exceptional anomalies from the Dakotas reaching into Nebraska, and moderate to severe surpluses in Minnesota, Iowa, Wisconsin, and covering lesser extent in Michigan. Some pockets of moderate surplus are expected in Kansas, Oklahoma, and Missouri including along the Missouri River and Upper Mississippi. Surpluses of varying intensity are forecast in southern Montana and in Wyoming. In the Rockies and Southwest, isolated pockets of surplus are forecast in eastern Idaho, Nevada, Arizona, and New Mexico and will include some exceptional anomalies in the Southwest. In the South and Southeast, moderate surpluses are expected in eastern Tennessee and pockets of the Carolinas, Mississippi, Alabama, and Georgia. In Upstate New York, moderate surpluses are forecast near the Finger Lakes Region.

Intense deficits will shrink but persist in central Colorado and in the Salmon River Mountains of Idaho. Deficits will shrink in the Pacific Northwest and moderate in northern California, though mild deficits will emerge in much of the remainder of California. Deficits will also shrink in Texas but moderate to severe anomalies are forecast in a triangle from Dallas to San Antonio to Houston. Deficits in Florida south of Lake Okeechobee will be severe, downgrading from exceptional. Deficits in northern Virginia and Chesapeake Bay will nearly disappear, while some pockets of deficit will persist in New York State's northern corner, and in Vermont, New Hampshire, and Maine.

From May through July, anomalies east of the Mississippi will nearly disappear, though moderate surpluses are forecast in the northwestern portion of Michigan's Lower Peninsula and will emerge in Upstate New York's northern corner, transitioning from deficit. 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 shrink in Montana and Wyoming, nearly disappear in Idaho and Nevada, and persist in isolated pockets of Colorado, Arizona, and New Mexico. Colorado's areas of

deficit will normalize. Deficits will become merely mild overall in California, the Pacific Northwest, and Idaho. Moderate deficits will emerge in the Hill Country of Texas in the Edwards Plateau but will nearly disappear in the east.

The forecast for the final months – August through October – indicates surpluses in the Dakotas and Nebraska, and some pockets of generally moderate deficit in the West and along the Lower Brazos River in Texas.

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

Canada

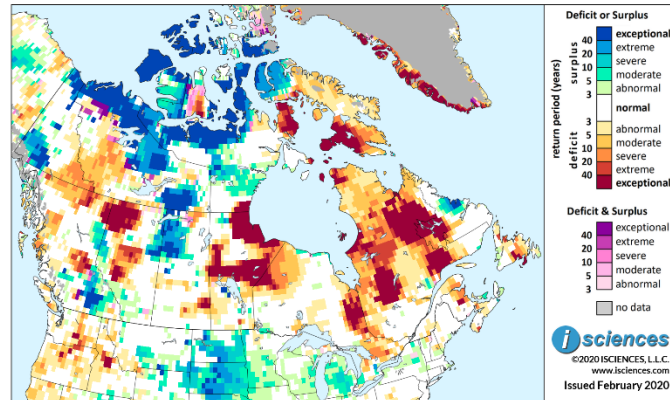
The 12-month outlook for Canada through October indicates a forecast of deficits for nearly all of Quebec north of the Gouin Reservoir in the Mauricie region of the province including vast areas of exceptional deficit.

Elsewhere in the nation, exceptional deficits are 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 Churchill Lake in northern Saskatchewan leading north well past Lake Athabasca and west to Fort McMurray, Alberta. Surpluses of similar intensity are expected in the southern Columbia Mountains of British Columbia.

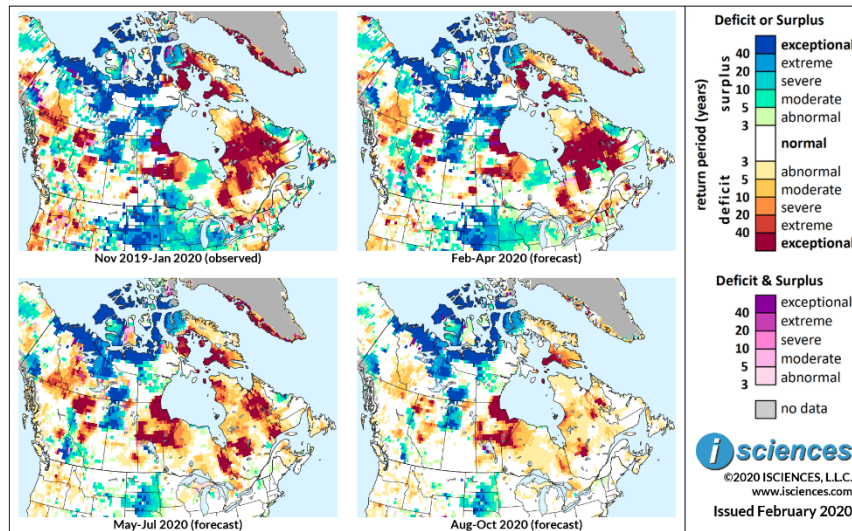
The 3-month maps (below) show the evolving conditions in more detail.

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



Based on observed data through January 2020 and forecasts through October 2020

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



Based on observed data through January 2020 and forecasts through October 2020

The forecast through April for Canada's most populated areas indicates nearly normal water conditions for Québec City with deficits to the south, and normal conditions in Montreal, Saskatoon, Edmonton, and Vancouver. Moderate deficits are forecast near Ottawa, and moderate to extreme surpluses near Toronto. Deficits are expected around Regina and moderate surpluses near Calgary.

Exceptional deficits will persist in a vast area of northern Quebec (QC) reaching into western Labrador. Intense deficits are forecast in a wide path along Ontario's (ON) eastern border, 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.

In the Prairie Provinces, exceptional deficits are forecast in a wide band north of Lake Winnipeg, Manitoba (MB) and in the northeast along Hudson Bay. Intense surpluses will persist in MB's northwestern corner. In Saskatchewan (SK), moderate to extreme deficits are expected around Regina and exceptional deficits in the Upper Assiniboine River region. Intense surpluses will persist 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. Moderate surpluses will emerge on the South Saskatchewan River. Surpluses are also forecast in the Upper Peace River Region reaching across the border into British Columbia (BC) past Fort St. John and Williston Lake.

Elsewhere in BC, intense surpluses are expected in the southern Columbia Mountains; surpluses of lesser intensity in the southern Coast Mountains will increase. Deficits in central BC at the intersection of the Nechako and Fraser Rivers will remain intense though the extent of exceptional anomalies will shrink. A small pocket of exceptional deficit will persist around Prince Rupert on the coast and severe deficits will persist along BC's border with Yukon.

From May through July, deficits will shrink in QC, but 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; surpluses in ON will nearly disappear. Similarly, deficits in MB north of Lake Winnipeg and around Hudson Bay will persist, but surpluses in the northwest quadrant will nearly disappear. Deficits around Regina, SK will downgrade, becoming merely mild. Widespread surpluses around Williston Lake in BC will retreat and surpluses in the southern Coast Mountains will shrink.

The forecast for the final three months – August through October – indicates that deficits will shrink, particularly in QC, as will surpluses in AB and BC.

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

Mexico, Central America, and the Caribbean

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

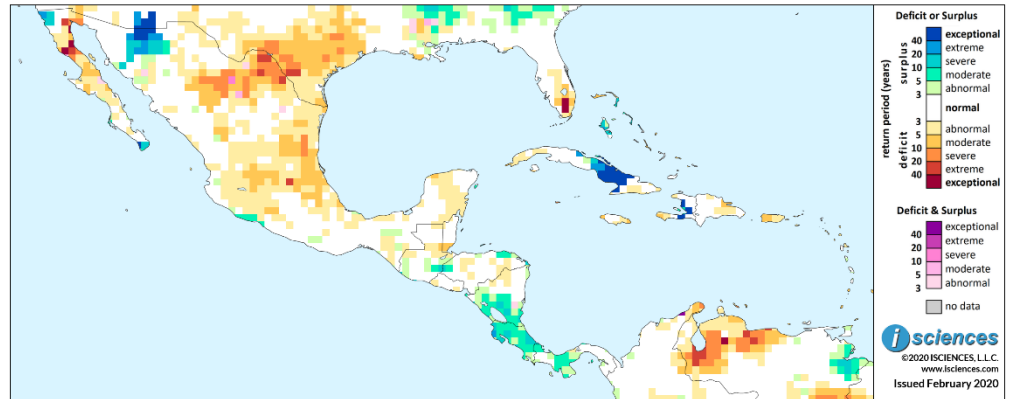
Surpluses are also forecast across the Gulf of California in

northeastern Sonora and will reach exceptional intensity. Moderate to extreme deficits are expected from eastern Chihuahua through northern Coahuila, and primarily moderate deficits along Mexico's central Gulf Coast reaching into the central states. Some moderate surpluses are forecast for coastal Michoacán on the Pacific.

In Central America, moderate to severe surpluses are forecast for southern Nicaragua, Costa Rica, Panama, and a few pockets elsewhere. Surpluses are also expected in central Cuba, along Haiti's western coast, and in the central Bahamas.

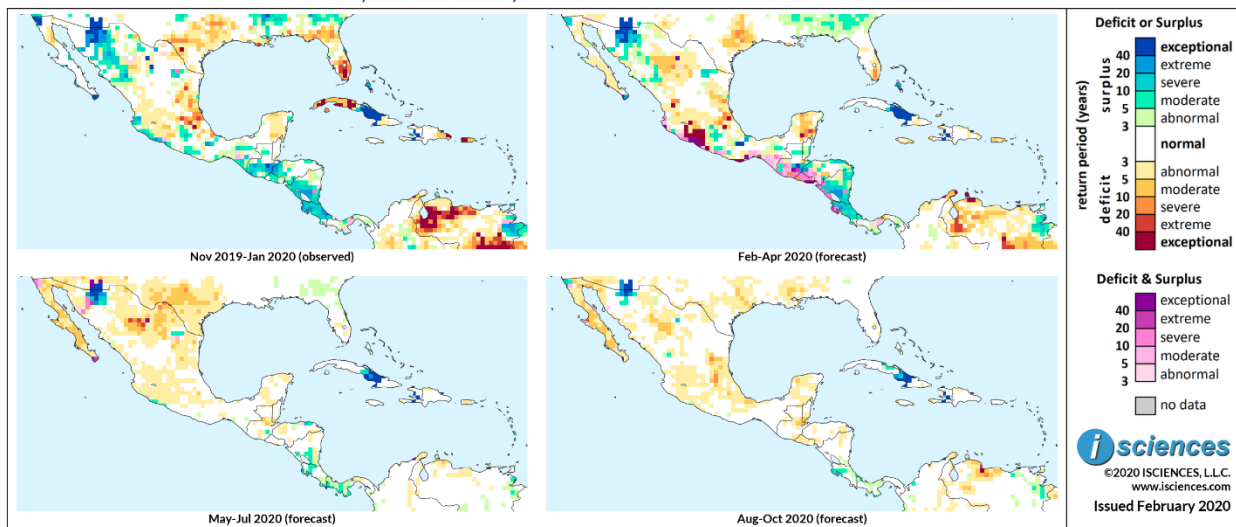
The 3-month maps (below) show the evolving conditions in more detail.

ISciences Water Anomalies Forecast
Mexico, Central America, & the Caribbean: November 2019 - October 2020



Based on observed data through January 2020 and forecasts through October 2020

ISciences Water Anomalies Forecast
Mexico, Central America, & the Caribbean: November 2019 - October 2020



Based on observed data through January 2020 and forecasts through October 2020

The forecast through April indicates that extreme to exceptional surpluses will persist in northeastern Sonora, Mexico with moderate surpluses along the lower stretches of the Yaqui River as it reaches the Gulf of California. Severe surpluses are expected around Monterrey in Nuevo León, and moderate surpluses in northwestern Durango. Other regions of surplus include Baja's northwestern corner and southern tip, and Morelos in south-central Mexico. Exceptional deficits will emerge across the border of Guerrero and Michoacán on the Pacific, moderate deficits in the Yucatán Peninsula with some intense deficits in Quintana Roo, and moderate deficits in southeastern Chihuahua. Deficits of varying intensity will persist, though shrink, along the central Gulf Coast.

Surpluses are forecast in many regions of Central America some areas of transition along the Pacific. Deficits will nearly disappear in the Caribbean and surpluses are forecast in central Cuba, near Port-au-Prince, Haiti, and for the central Bahamas.

From May through July, nearly normal water conditions are expected in many parts of the region. However, intense surpluses will persist in northeastern Sonora with conditions of both deficit and surplus (pink/purple) as transitions occur. Deficits in southeastern Chihuahua will intensify, and moderate deficits will emerge in neighboring Coahuila and on the Baja Peninsula. Some pockets of moderate surplus are expected in Nicaragua, Costa Rica, and Panama. Surpluses are also forecast for central Cuba and near Port-au-Prince, Haiti.

The forecast for the final three months – August through October – indicates deficits in Baja, Chihuahua, Tamaulipas, and Hidalgo, and surpluses in Sonora. Surpluses are also forecast for northern Costa Rica, central Cuba, and Port-au-Prince Bay in Haiti.

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

South America

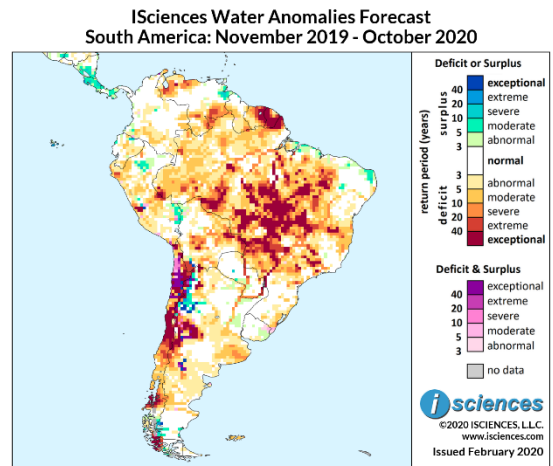
The 12-month forecast through October indicates many large pockets of exceptional water deficit throughout central Brazil in Mato Grosso, Pará, Goiás, northern Minas Gerais, western Bahia, Tocantins, and in Piauí and Amapá. Deficits of lesser intensity are expected in many other regions of the country.

Intense deficit anomalies are also forecast for French Guiana, Suriname, central Chile surrounding Santiago and Valparaiso, and pockets of northern Chile. Deficits will be exceptional along the Paraná River as it flows through southern Brazil and eastern Paraguay. Deficits along the Paraguay River will be extreme through Paraguay and severe in Argentina.

Other areas of deficit include northern Venezuela from the Colombian border to Caracas; southeastern Venezuela; pockets of Peru including exceptional anomalies east of Lima; central Bolivia; and, Mendoza, San Luis, and San Juan Provinces in northwestern Argentina, and the southern Pampas.

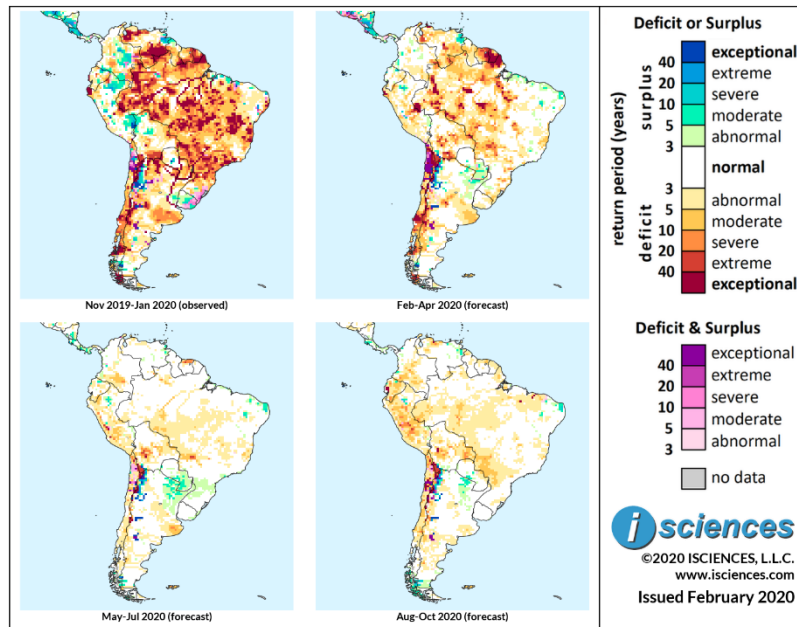
Surpluses, primarily moderate, are forecast for the Orinoco Delta in northeastern Venezuela, pockets along Brazil's northeastern coast, north-central Peru, and the northern border of Peru and Bolivia. Surpluses of varying intensity are forecast in Argentina's northwestern provinces of La Rioja and Catamarca, 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 January 2020 and forecasts through October 2020

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



Based on observed data through January 2020 and forecasts through October 2020

The forecast through April indicates that the extent of deficits in the region will shrink considerably overall. Nearly normal conditions are forecast for eastern Brazil with a few small pockets of surplus in the northeast. Deficits are forecast in central, northern, and western patches of the country with intense anomalies in pockets of Amapá, Pará, Amazonas, Rondônia, Acre, and Mato Grosso do Sul. Exceptional deficits will increase in French Guiana, and severe to exceptional deficits are forecast for neighboring Suriname.

Elsewhere on the continent, deficits of varying intensity are forecast for much of Chile and will include exceptional anomalies near Concepción and Los Angeles in the center of the country and much of the Atacama Desert in the north, though conditions of both deficit and surplus (pink/purple) are also forecast in the Atacama as transitions occur. Other areas of deficit include western and southern Venezuela; a pocket around the city of Piura in northern Peru, and the Ucayali region along the central border with Brazil; central and southern Bolivia; along the central bulk of Argentina's border with Chile; and, San Luis Province and eastern Buenos Aires Province in Argentina.

Surpluses are forecast for the Orinoco Delta in eastern Venezuela; pockets in northeastern Brazil; small pockets in western Columbia and along its central border with Ecuador; north-central Peru; pockets of eastern Paraguay and northeastern Argentina; and northwestern Argentina.

From May through July, conditions on much of the continent will normalize. However, exceptional deficits are forecast for Bolivia's southern tip and severe to extreme deficits in the center of the country. Deficits are also forecast for northern Suriname, south-central Colombia, Peru, northern Mato Grosso do Sul in Brazil, pockets of northern Chile and into Argentina, and eastern Buenos Aires Province in

Argentina. Surpluses are expected in pockets of northeastern Brazil, north-central Peru, southern Paraguay into northeastern Argentina, and in northwestern Argentina.

In the final quarter – August through October – deficits will increase somewhat, particularly in Peru, Ecuador, and Columbia.

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

Europe

The 12-month forecast through October 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; many areas of Finland, Estonia and Latvia; and Norway's northern coast.

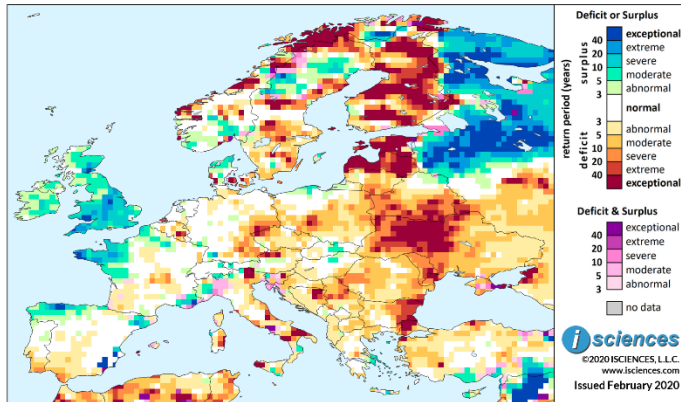
Deficits of varying intensity are forecast for southern and

northernmost Sweden, eastern Belgium, eastern Germany, northern Austria, Czech Republic, the breadth of Poland, southern Belarus, Ukraine, Moldova, and many regions in the Balkan Peninsula. Deficits are also expected in southern European Russia, pockets of Italy, central France, and along the southern Atlantic coast of the Iberian Peninsula.

Areas of surplus include northern European Russia; Ireland, the U.K., and Brittany, France; Spain's north coast, its southeast coast, and the Barcelona area; northern Jutland (Denmark); large pockets of northern Sweden; and around Oslo, Norway. Surpluses will be widespread and exceptional in northern European Russia and somewhat less intense in England, Wales, and Brittany.

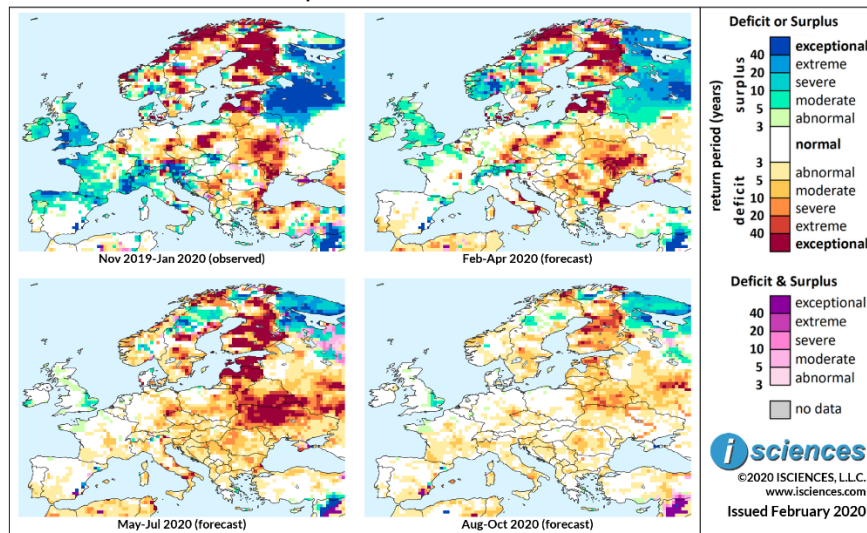
The 3-month composites (below) for the same 12-month time period show the evolving conditions.

ISciences Water Anomalies Forecast
Europe: November 2019 - October 2020



Based on observed data through January 2020 and forecasts through October 2020

ISciences Water Anomalies Forecast
Europe: November 2019 - October 2020



Based on observed data through January 2020 and forecasts through October 2020

The forecast through April indicates that surpluses will shrink in Western Europe and around the Adriatic Sea but increase in northern European Russia though the extent of exceptional deficits will diminish. Surpluses are forecast for Ireland and the U.K.; Brittany, France and northern France; northeastern Spain and pockets along its Mediterranean Coast; Switzerland and western Austria; central Slovakia; northern Poland; southern Norway; and large pockets of northern Sweden. Surpluses will be exceptional in northern European Russia, Norway northwest of Oslo, and Murcia, Spain.

Intense deficits are forecast for many regions of Finland, the Baltics, Norway's northern coast, and pockets of Sweden. Deficits of varying intensity are expected in Belgium, central France, eastern Germany, northern Austria, Czech Republic, central Poland, the islands of Denmark, southern Belarus, central and western Ukraine, Moldova, Romania, northern and eastern Bulgaria and the central Balkans. Deficits will be intense in many pockets but will be particularly widespread in central Ukraine, Moldova, and Bulgaria. Italy, too, can expect pockets of exceptional deficit.

From May through July, exceptional deficits will increase in Finland and the Baltics; will emerge in southern Belarus and southern European Russia; and will shrink in central Ukraine but increase across a wide block in the northwest. Primarily moderate deficits are forecast in pockets throughout Central and Eastern Europe and the Balkans, with more intense anomalies across the border of Germany and Czech Republic and in southern Italy. Relatively normal water conditions are forecast for Western Europe with some lingering moderate surpluses in England, Ireland, and small pockets of Mediterranean Spain. Surpluses in northern European Russia will shrink but will remain widespread in Karelia and the Kola Peninsula.

The forecast for the remaining months – August through October – indicates that deficits will shrink and downgrade, persisting from Finland through the Baltics and Eastern Europe into southern European Russia, with severe deficits on the Dnieper River through Ukraine. Surpluses are forecast for Karelia and the Kola Peninsula in Russia.

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

Africa

The 12-month forecast through October indicates intense water deficits across northern Africa including widespread exceptional anomalies. Exceptional deficits are also forecast at the continent's eastern tip in northern Somalia and into Somaliland, and north of Mogadishu; on the west coast from southern Cameroon through Equatorial Guinea and western Gabon; and a pocket in southwestern Namibia.

Primarily moderate deficits are expected on Africa's west coast from Senegal through Liberia, though deficits will be more intense in Guinea Bissau.

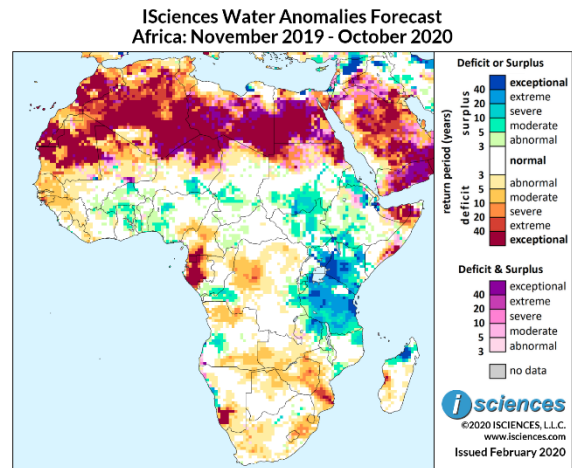
Moderate to severe deficits are forecast from central Cameroon into eastern Nigeria, and in western Democratic Republic of the Congo.

In southern Africa, deficits will be severe to exceptional in southern Mozambique and on Madagascar's central west coast at the mouth of the Tsiribihina River; moderate to severe in Zimbabwe and from Lesotho to Swaziland; and primarily moderate in northern and southeastern Angola, southern Zambia, northern Botswana, Swaziland, and some pockets in western South Africa.

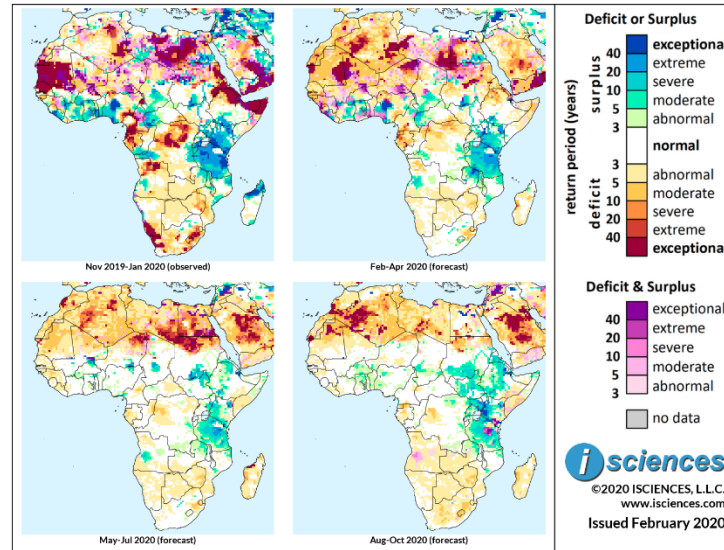
Intense surpluses are forecast in East Africa in Kenya, Uganda, Tanzania, and northern Zambia, with anomalies of generally lesser intensity spilling into Rwanda, Burundi, Democratic Republic of the Congo, and pockets of northern Mozambique. Surplus anomalies are expected to be exceptional in western Kenya, the Victoria Nile through Uganda, and in Dar es Salaam and Zanzibar in eastern Tanzania. In Madagascar intense surpluses are expected in the northwest. Surpluses are also forecast for southern Ethiopia, South Sudan, southern Sudan and the White Nile and Atbara Rivers, Eritrea and bordering regions of Ethiopia, and westernmost Somaliland.

Other areas of surplus, primarily moderate, include pockets scattered through nations along the northern Gulf of Guinea, southeastern Niger and west-central Chad, westernmost Democratic Republic of the Congo, west-central Angola, and along the central coast of Namibia.

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



ISciences Water Anomalies Forecast
Africa: November 2019 - October 2020



Based on observed data through January 2020 and forecasts through October 2020

The forecast through April indicates moderate deficits in many regions across northern Africa, particularly widespread in the west, with some large pockets of exceptional deficit in Algeria, Mauritania, Niger, Libya, and Egypt. Surpluses are expected in southeastern Egypt, pockets around the Nile Delta, and near Benghazi, Libya. Exceptional deficits will retreat from the Horn of Africa.

Nations along the northern Gulf of Guinea can expect surpluses of varying intensity along with conditions of both deficit and surplus (pink/purple) as transitions occur. Surpluses are also forecast for northern Cameroon, southern Chad, western Central African Republic, Democratic Republic of the Congo (DRC) near Kinshasa, and west-central Angola. Moderate to extreme deficits are forecast from south-central Cameroon through Equatorial Guinea into Gabon and for northern DRC.

Widespread surpluses will persist in East Africa and, while downgrading from exceptional, will be severe to extreme in many areas. Regions with a forecast of surplus include Tanzania, Kenya, Uganda, northern Zambia, and pockets of northern Mozambique, as well as the White Nile through South Sudan, and southern Sudan and southern Ethiopia.

Southern African nations can expect normal conditions or generally mild deficits, though moderate deficits are forecast in South Africa northeast of Lesotho and in Swaziland. Surpluses are forecast in Lesotho, east of Pretoria, and north of the Vaal River in North West Province. In Madagascar, surpluses will nearly disappear, and deficits will emerge on the central west coast.

From May through July, deficits will downgrade in western nations of the north but increase and intensify in eastern nations. Intense deficits will increase from southeastern Libya across northern Sudan and in Egypt, where areas of surplus will begin to transition. Normal water conditions will prevail in nations around the Gulf of Guinea, across the southern Sahara and the Sahel, punctuated by pockets of surplus in northern Burkina Faso into Mali, Nigeria into Niger, south-central Chad, and southern Sudan into South Sudan and western Ethiopia. Surpluses in East Africa will shrink and downgrade somewhat

but will remain widespread in Tanzania. A pocket of moderate surplus will persist in west-central Angola. Exceptional deficits will emerge along the northwest coast of Madagascar.

During the final quarter – August through October – deficits will shrink in Egypt, and moderate to exceptional deficits are forecast across the remainder of northern Africa. Surpluses will increase from southern Sudan through Tanzania.

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

Middle East

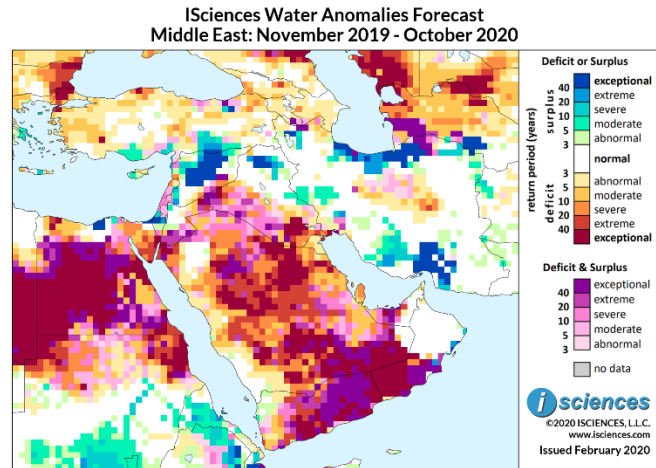
The forecast for the 12-month period ending October indicates widespread, intense water deficits covering much of the Arabian Peninsula including exceptional anomalies in Saudi Arabia, Yemen, and Oman.

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.

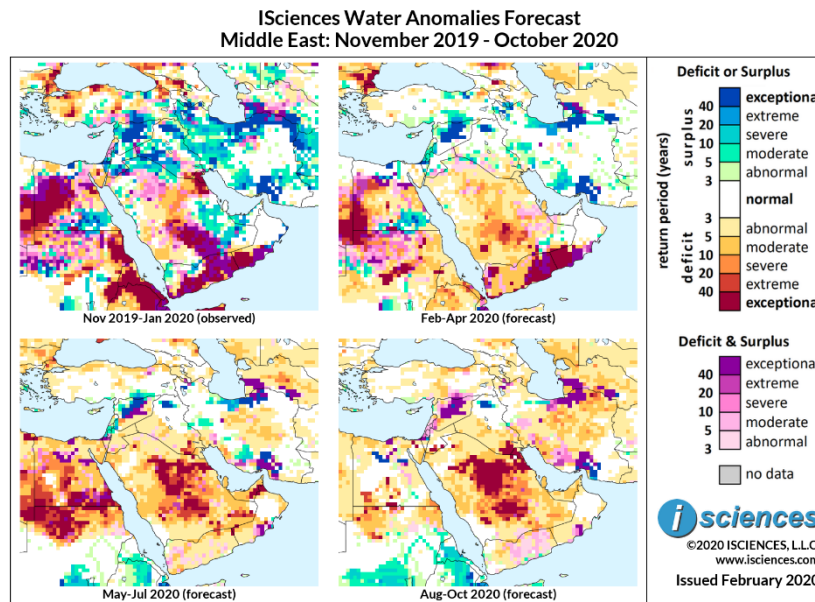
Exceptional surpluses are forecast from central Syria to the north, moderating across the border into Turkey. Deficits, primarily moderate, are forecast in many pockets of Turkey, and deficits are also forecast in Georgia.

Severe to exceptional surpluses are expected along Iran’s Caspian Sea Coast, downgrading or transitioning along the Turkmenistan border. Some large blocks of surplus are forecast in southern Iranian provinces along the Persian Gulf and will be exceptional around the Strait of Hormuz. Farther north, moderate surpluses are expected across the central Iraq-Iran border.

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



Based on observed data through January 2020 and forecasts through October 2020



Based on observed data through January 2020 and forecasts through October 2020

The forecast through April indicates that widespread surpluses in the region will shrink, though many areas of surplus are forecast. Exceptional surpluses are expected in central and northern Syria,

moderating across the border into Turkey. Some areas of surplus are also forecast along Turkey's eastern Black Sea Coast. Exceptional surpluses will persist around Mosul, Iraq, and surpluses will persist in northern Iran near Lake Urmia. Moderate to exceptional surpluses will persist along Iran's Caspian Sea Coast but will shrink somewhat along the border with Turkmenistan. A large block of exceptional surplus will persist in southern Iran around the Strait of Hormuz connecting to persistent moderate to extreme surpluses in Fars Province along the Persian Gulf. Surpluses are also forecast in Iranian provinces near Iraq just north of the Persian Gulf. Generally moderate surpluses are expected in Israel and West Bank.

Deficits are forecast on the Arabian Peninsula in Saudi Arabia, Yemen, Oman, and Qatar. Deficits will be exceptional from eastern Yemen into western Oman, and primarily severe to extreme in southern Riyadh Region, Saudi Arabia.

From May through July, surpluses will continue to shrink persisting primarily from northern Syria into Turkey, around Mosul, along Iran's Caspian Sea Coast, and in southern Iran, though several of these regions will experience conditions of both deficit and surplus as transitions occur. Deficits will downgrade significantly in Yemen and Oman, becoming mild, but deficits will increase and intensify in Saudi Arabia and intense deficits will emerge in southern Iraq and eastern United Arab Emirates. Moderate deficits are expected to emerge in central Iran.

In the final quarter – August through October – exceptional deficits are forecast for central Saudi Arabia and southern Iraq, and moderate to severe deficits in Iran. Exceptional surpluses will persist surrounding Mosul, Iraq.

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

Central Asia and Russia

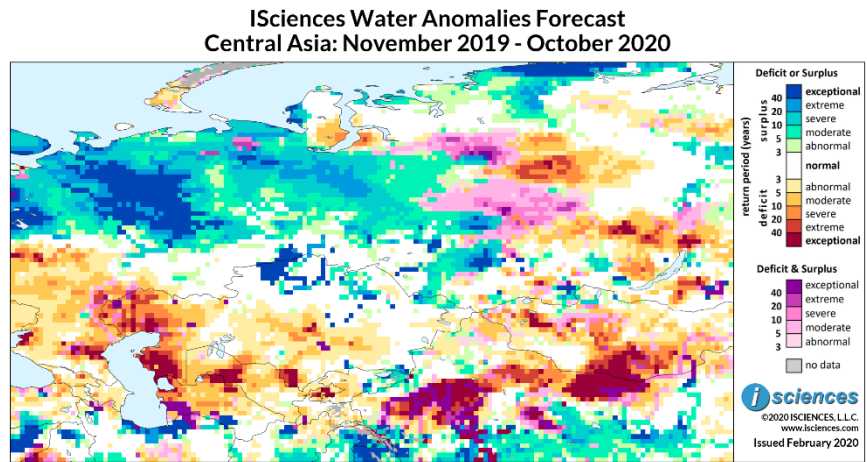
The 12-month forecast through October indicates a vast expanse of water surplus in Russia from St. Petersburg into the Western Siberian Plain with exceptional anomalies in the Vychegda Lowland west of the Urals.

Surpluses will be moderate to extreme in the Middle Ob River Watershed east of the Urals.

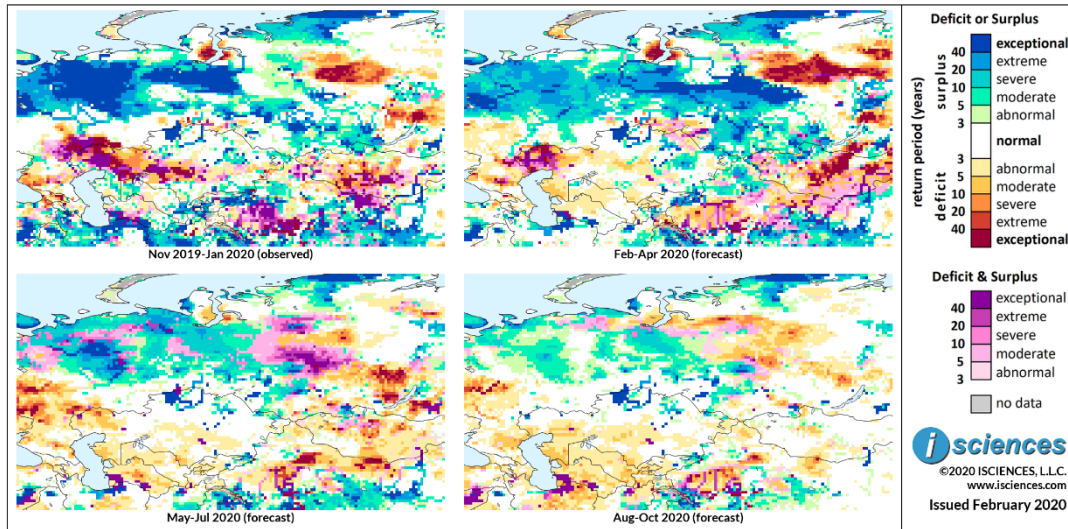
Deficits of varying intensity are forecast in Russia from Moscow to the Caspian Sea, along the central coasts of the Gulf of Ob, in the Nizhnyaya Tunguska River region of the Yenisei River Watershed, and north, west, and southeast of Lake Baikal.

Surpluses are expected in northern Kazakhstan and eastern Kyrgyzstan, and will be exceptional in Kostanay Region in Kazakhstan. Deficits are forecast for western and southern Kazakhstan, Uzbekistan, much of Turkmenistan, and a few pockets in western Kyrgyzstan and in Tajikistan. Anomalies will be intense in western Kazakhstan, northern Turkmenistan into central Uzbekistan, and the Fergana Valley of eastern Uzbekistan. Turkmenistan's southern border will see conditions of both deficit and surplus (pink/purple) as transitions occur.

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



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



Based on observed data through January 2020 and forecasts through October 2020

The forecast through April indicates widespread intense surpluses in Russia in the Northern European Plain and across the Ural Mountains into the Western Siberian Plain. The extent of exceptional surplus will diminish in the Vychehda Lowland but increase in the Ob River Watershed. Exceptional deficits will persist on the central shores of the Gulf of Ob and will increase in the Central Siberian Plateau in the Nizhnyaya Tunguska River region of the Yenisei Watershed. Deficits are also forecast in the Lena River Watershed. Exceptional deficits are forecast north and southeast of Lake Baikal. Deficits of varying intensity will persist in Stavropol Krai between the Black and Caspian Seas and generally mild deficits will emerge from Moscow to Volgograd.

Exceptional surpluses will persist in Kostanay in northern Kazakhstan, and intense deficits in the west along with conditions of both deficit and surplus as transitions occur. Intense surpluses will shrink but persist along Turkmenistan's southern border. Extreme to exceptional surpluses are forecast for eastern Kyrgyzstan. In Tajikistan, surpluses are expected in the center of the country and deficits in the east.

From May through July, surpluses in Russia from the Northern European Plain through the Western Siberian Plateau will shrink and downgrade but remain widespread with exceptional anomalies resurging in the Vychehda Lowland. Conditions of both deficit and surplus are also forecast for some regions of the Northern European Plain and in the eastern half of the Western Siberian Plateau as transitions occur. Intense deficits will emerge northwest of Lake Baikal while those to the north retreat. Deficits will increase and intensify from Moscow to Volgograd but will diminish in Stavropol. Surpluses will shrink but persist in northern Kazakhstan and deficits in the west will shrink and downgrade. In Turkmenistan, deficits will emerge in the center of the country, and the southern border region will continue to transition. Surpluses in eastern Kyrgyzstan will shrink and downgrade and anomalies in Tajikistan will retreat.

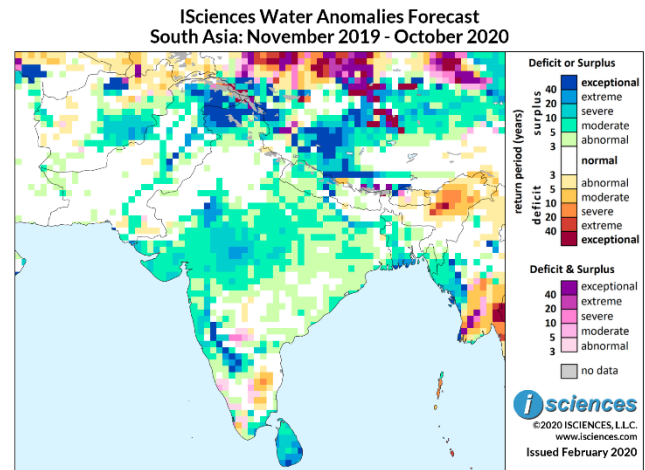
The forecast for the final months – August through October – indicates that surpluses in the Northern European Plain and Western Siberian Plain will continue to shrink and downgrade. Intense deficits are forecast for the Oka River, a tributary of the Volga, from Moscow to Nizhny Novgorod, and severe deficits on the Don River.

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

South Asia

The 12-month forecast through October indicates widespread water surpluses in India and Sri Lanka, and substantial areas of surplus in Bangladesh, Nepal, Pakistan, and Afghanistan.

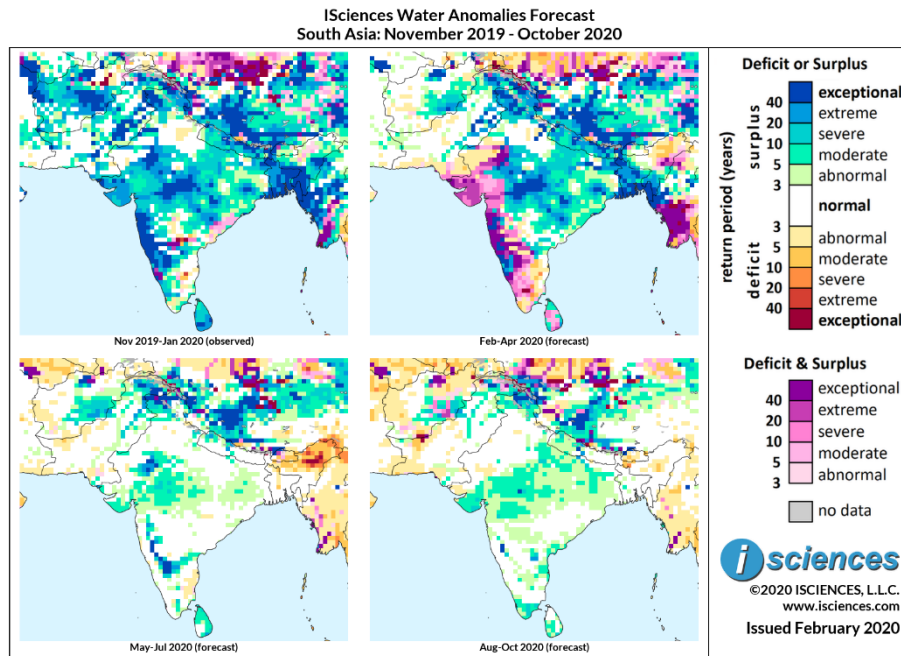
Surpluses will dominate much of central India from Gujarat through Madhya Pradesh and into parts of the Gangetic Plain. Surpluses will also trace a wide path along the western coast from Mumbai, veering inland through Karnataka where anomalies will reach exceptional intensity. Anomalies will also be intense in India's Far North.



All of Sri Lanka will experience surplus conditions and anomalies in the southeast will be extreme to exceptional. Moderate surpluses are expected in much of Bangladesh with more intense conditions in the Ganges Delta. Surpluses are also forecast for western Nepal; along major rivers in Pakistan and in the north; surrounding Mazar-e Sharif in Afghanistan, and from Kabul to Kandahar. Anomalies will be exceptional around Mazar-e Sharif.

Deficits are expected in Far Northeast India, primarily severe with some extreme to exceptional anomalies in central Assam. A pocket of moderate to severe deficits is forecast in northern Tamil Nadu and some relatively mild deficits are expected in northern Afghanistan.

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



The forecast through April indicates that surpluses of varying intensity will continue to dominate the breadth of India, though conditions of both deficit and surplus (pink/purple) are forecast in the west along a vast path from Gujarat through northern Kerala as transitions occur. Areas of transition are also forecast for central Rajasthan. Surpluses will be exceptional in central Madhya Pradesh and pockets along west coast. Severe to exceptional surpluses will persist in the Far North. Deficits will emerge in the Far Northeast and in Tamil Nadu in the south.

Widespread surpluses will persist in Nepal and Bangladesh reaching extreme to exceptional intensity. Though surpluses will shrink overall in Pakistan and Afghanistan, substantial areas of surplus will persist. Intense surpluses are forecast along rivers in Pakistan and in the north. In Afghanistan, surpluses will remain exceptional around Mazar-e Sharif and, though downgrading from Kabul to Kandahar, severe to extreme anomalies are expected. Conditions in Sri Lanka will moderate or begin to transition.

From May through July, surpluses will shrink and downgrade in the region with relatively normal water conditions returning to Bangladesh, most of Nepal, and the Gangetic Plain and eastern regions of India along the Bay of Bengal. Surpluses will persist in India's Far North, from southern Gujarat through central and eastern Rajasthan and western Madhya Pradesh, and will re-emerge from transition in a long, hooked path from the Upper Reaches of the Godavari River in Maharashtra through central Karnataka, veering northeast through Andhra Pradesh. Deficits in the Far Northeast will intensify. Surpluses will persist around Mazar-e Sharif and from Kabul to Kandahar in Afghanistan, and in northern Pakistan and along northern portions of its major rivers. Moderate surpluses are forecast for Sri Lanka and along the Gandaki River in central Nepal.

The forecast for the final months – August through October – indicates moderate surpluses in India from Gujarat along a wide path leading through the Gangetic Plain and into western Nepal, pockets in southern India and Sri Lanka, northern Pakistan, and in Afghanistan from Kabul to Kandahar along with areas of transition.

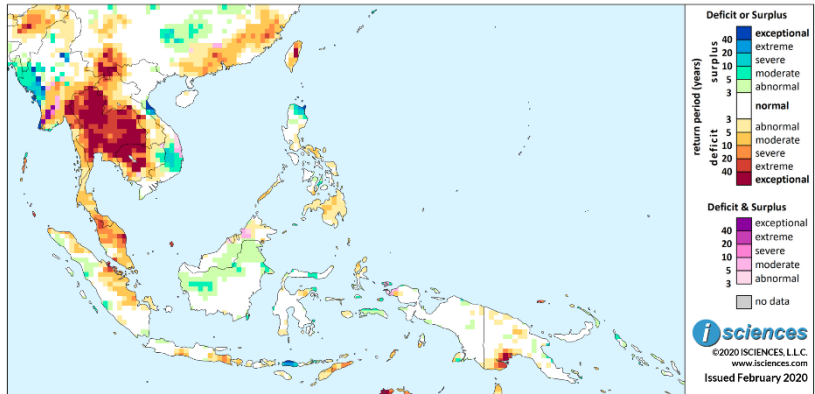
(It should be noted that forecast skill declines with longer lead times.)

Southeast Asia and the Pacific

The 12-month forecast through October indicates extreme to exceptional water deficits throughout mainland Thailand and western Cambodia including Tonlé Sap.

Deficits of lesser intensity are expected in peninsular Thailand, parts of Laos, and southern Myanmar. Western Myanmar will see surpluses as will Vietnam's North Central Coast and Central Highlands reaching into easternmost Cambodia.

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



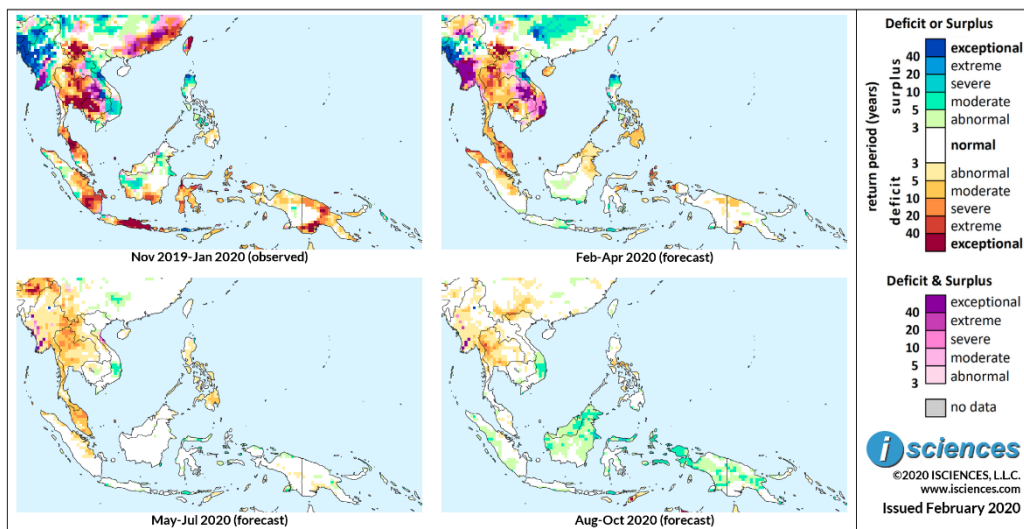
Based on observed data through January 2020 and forecasts through October 2020

Moderate to severe deficits are forecast for peninsular Malaysia and primarily moderate deficits for eastern Sumatra with a few small, isolated pockets of moderate surplus on the island's west coast. Deficits will reach severe intensity in pockets of Java and East Timor, but intense surpluses are expected on Flores Island. Some pockets of moderate surplus are forecast in Indonesian Borneo and intense deficits are forecast around the western shore of the Gulf of Papua in Papua New Guinea.

In the Philippines, moderate to exceptional surpluses are expected in northeastern Luzon, and moderate deficits in the southeastern arm of the island and pockets of Mindanao.

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

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



Based on observed data through January 2020 and forecasts through October 2020

The forecast through April indicates persistent deficits in Thailand and western Cambodia though the extent of exceptional deficits will shrink to small pockets. Intense surpluses will persist in western Myanmar and surpluses of varying intensity in pockets across central Myanmar, while conditions of both deficit and surplus (pink/purple) are forecast in the south as transitions occur. Other areas of transition include southern Laos, eastern Cambodia, and southeastern Vietnam where deficits will emerge. Intense surpluses will persist in Vietnam's North Central Coast.

Deficits will increase in peninsular Malaysia but diminish considerably in Indonesia and Papua New Guinea. Deficits are forecast, however, for northern and eastern Sumatra, northeastern Borneo, North Maluku, and pockets of New Guinea. Surpluses will downgrade on Flores Island, but some moderate surpluses will emerge in Java and along Borneo's southern coast. In the Philippines, surpluses will persist in northern Luzon and increase on Mindoro. Deficits are forecast for Luzon's southeastern arm and in Mindanao.

From May through July, anomalies in the region will downgrade and shrink overall. Severe deficits will emerge in northernmost Myanmar, and moderate to severe deficits are expected in a path from the shared border of Myanmar and Laos tracing south through western Thailand and in peninsular regions of Myanmar and Malaysia. Conditions in Cambodia will become nearly normal and moderate surpluses will emerge from Vietnam's Central Highlands to the coast. In the Philippines, moderate deficits are expected in Mindanao. Some small pockets of surplus are forecast scattered throughout Indonesia and New Guinea.

The forecast for the final months – August through October – indicates deficits in western and southern Thailand, some island in the central Philippines, and the island of Timor. Moderate deficits are forecast in central Vietnam, Borneo, Flores Island, northern Sulawesi, and New Guinea.

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

East Asia

The 12-month forecast for East Asia through October 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 in Mongolia.

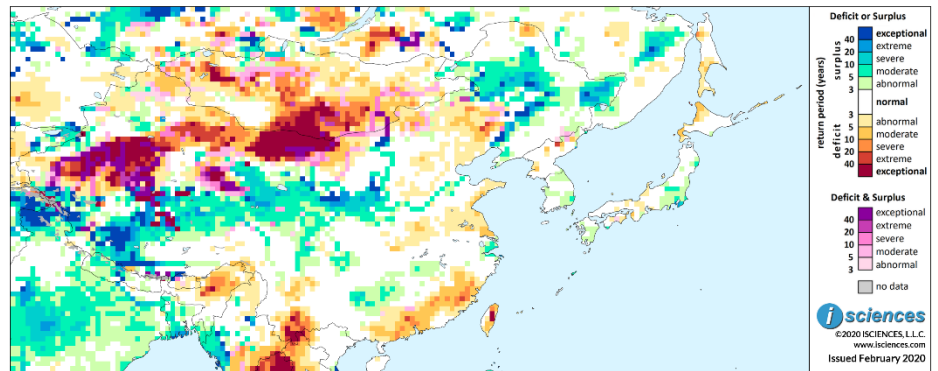
Deficits will also be intense in Xinjiang in western China, particularly in the Taklimakan Desert.

Deficits ranging from moderate to extreme are forecast for 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 surpluses in eastern Honshu including Tokyo, and moderate deficits in western Hokkaido.

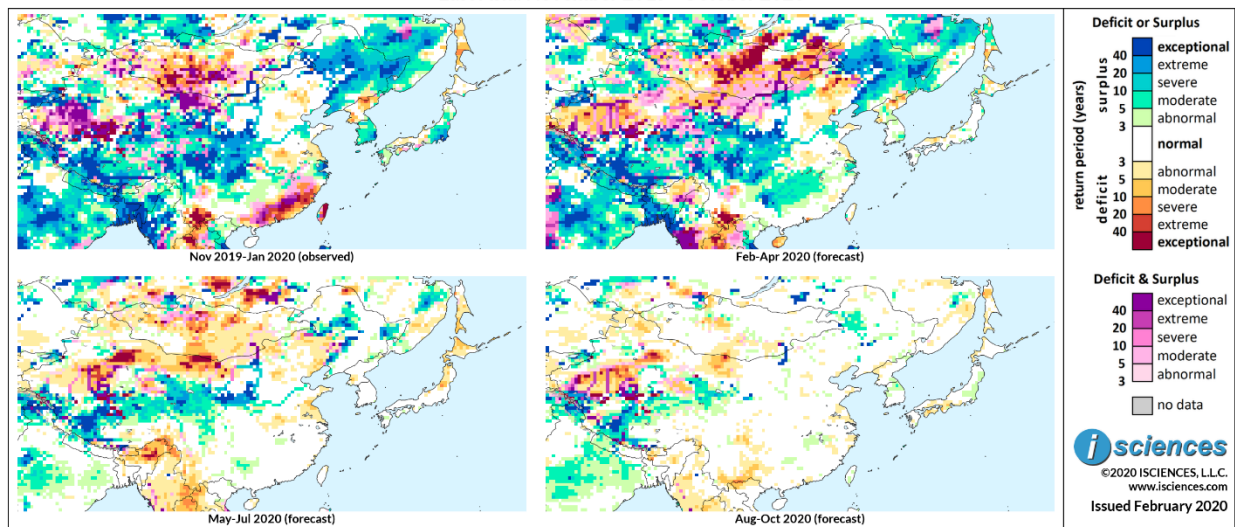
The 3-month time series maps below show the evolving conditions in more detail.

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



Based on observed data through January 2020 and forecasts through October 2020

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



Based on observed data through January 2020 and forecasts through October 2020

The forecast through April indicates widespread surpluses in the Yellow River Basin, moderate to severe in the Lower and Middle regions but reaching exceptional intensity in the Yellow's Upper Basin.

Surpluses are forecast in Tibet which will be exceptional in central Tibet and along the Yarlung (Brahmaputra) River, and intense surpluses are forecast for Northeast China. Surpluses will be widespread in the Yangtze River Basin as well, moderate to severe near Shanghai and in Jiangxi and Hunan, but more intense in the Upper Yangtze Basin.

Deficits are forecast for Yunnan and Hainan in the south, northern Inner Mongolia, and the Taklimakan Desert in Xinjiang in the west. Deficits will be exceptional in Yunnan. Exceptional deficits are also forecast for a vast block of north-central Mongolia including Ulaanbaatar. Conditions of both deficit and surplus (pink/purple) are expected in western Inner Mongolia, southern Mongolia, and Xinjiang as transitions occur. On the Korean Peninsula, deficits are forecast in northeastern North Korea, and some pockets of moderate surplus in the center of the country and in southeastern South Korea. Primarily normal water conditions are expected in Japan.

From May through July, surpluses will nearly disappear in the Yangtze Basin, will shrink considerably in Northeast China, and will shrink in the Yellow River Basin and Tibet but remain widespread. Deficits will shrink and downgrade overall though exceptional anomalies are expected to re-emerge from areas of transition in western Inner Mongolia and in Xinjiang. Deficits in Yunnan will shrink and moderate. While deficits are expected to diminish considerably in Mongolia, extreme anomalies are forecast for Ulaanbaatar. Nearly normal water conditions will return to the Korean Peninsula though some moderate deficits will persist south of Pyongyang. Some patches of primarily moderate deficit will emerge in northern Honshu, Japan, and increase in Hokkaido.

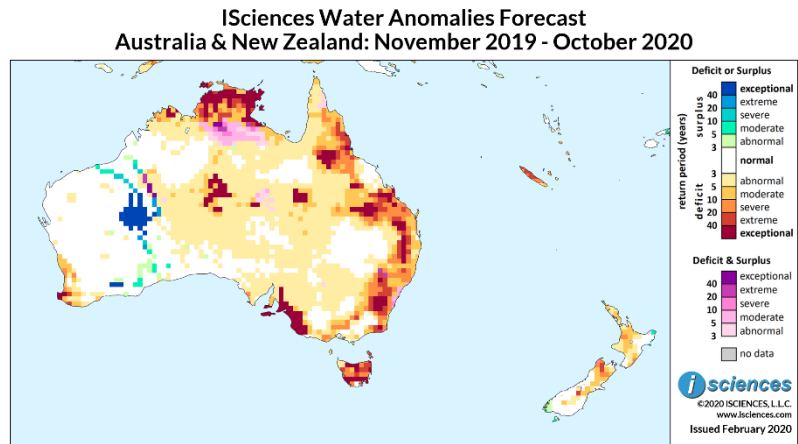
The forecast for the final three months – August through October – indicates nearly normal water conditions in much of the region with surpluses in the Upper Yellow River Watershed and central Tibet, and deficits in western Inner Mongolia, Xinjiang, and Yunnan.

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

Australia & New Zealand

The 12-month forecast through October indicates a wide path of water deficits along Australia's east coast from Cairns in northern Queensland through the eastern Murray-Darling Watershed and Tasmania. Deficits will range in intensity and anomalies will be exceptional in many pockets.

In South Australia, exceptional deficits are forecast from Adelaide to the border with Victoria, including Kangaroo Island.



Based on observed data through January 2020 and forecasts through October 2020

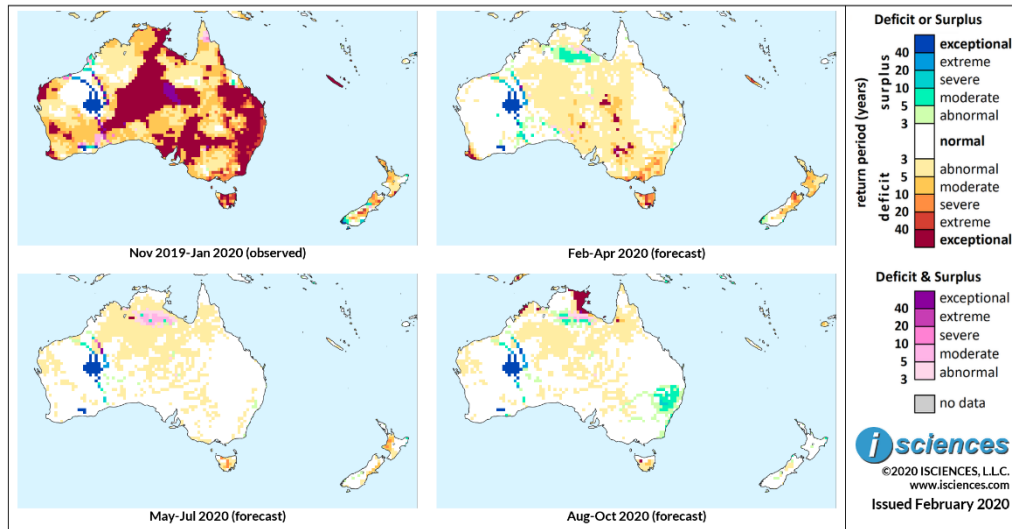
Severe to exceptional deficits are expected in Top End, Northern Territory and to the west along the coast of northern Kimberley, Western Australia. The McDonnell Ranges in the center of the country west of Alice Springs can expect exceptional deficits. Moderate to severe deficits are forecast in Western Australia around Perth, leading south to exceptional deficits in the Busselton and Blackwood River region in the nation's southwestern tip.

A large pocket of exceptional surplus is forecast crossing the western Gibson Desert in Western Australia connecting to surpluses of lesser intensity along the De Grey and Fortescue Rivers to the north and a few pockets trailing south. A small pocket of intense surplus is forecast inland of the southern coast of Western Australia north of Esperance.

In New Zealand, moderate to extreme deficits are forecast from the center of South Island to the northern tip of North Island. Surpluses are expected in the southwestern and northeastern tips of the country. 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: November 2019 - October 2020**



Based on observed data through January 2020 and forecasts through October 2020

The forecast through April indicates that deficits will shrink and downgrade considerably in Australia leaving just a few relatively small pockets of exceptional deficit in stark contrast to widespread intense deficits observed in the prior three months. Areas of intense deficit include the Blackwood River region in the southwestern tip of Western Australia (WA) and the confluence of the Murray and Darling Rivers in New South Wales (NSW). Primarily moderate to severe deficits are expected from Canberra to Melbourne in the southeast but deficits will be more intense in Tasmania (TAS) with exceptional anomalies in Hobart and along the Derwent River.

A large pocket of exceptional surplus is forecast crossing the western Gibson Desert in WA connecting to surpluses of lesser intensity along the De Grey and Fortescue Rivers to the north and a few pockets trailing south. A small pocket of intense surplus is forecast inland of WA's southern coast north of Esperance. A broad belt of moderate surplus will emerge south of Top End, Northern Territory (NT).

In New Zealand, moderate surpluses will persist in Fiordland in South Island. Deficits of varying intensity are forecast for much of remainder of the island as well as much of North Island. Deficits will downgrade from exceptional in New Caledonia but will remain intense.

From May through July water conditions will become nearly normal in much of Australia. Exceptional surpluses will persist in the western Gibson Desert in WA and surpluses of lesser intensity along the De Grey and Fortescue Rivers, with conditions of both deficit and surplus (pink/purple) in the middle reaches of the Fortescue. A pocket of exceptional surplus will also persist in southern WA north of Esperance. Surpluses south of Top End, NT will nearly disappear. Severe deficits are forecast down the center of TAS, and moderate to severe deficits in the western region of North Island, New Zealand.

The forecast for the final months – August through October – indicates the emergence of exceptional deficits in Arnhem Land, NT and along the coast of northern Kimberley. Moderate surpluses will emerge in NSW in the northeastern reaches of the Murray-Darling Basin, and will re-emerge south of Top End,

NT. Intense surpluses will persist in WA in the western Gibson Desert, along the De Grey and Fortescue Rivers, and north of Esperance.

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