

# 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 to 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 2022 and an ensemble of forecasts issued the last week of January 2022. 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. 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. 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 event. For example, a return period of 10 years indicates an event that would occur, on average, once every ten years. Higher return periods indicate more extreme and, therefore, more disruptive anomalies. Return period is computed by comparison to cell-specific distributions of data from 1950 through 2009. 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.

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.

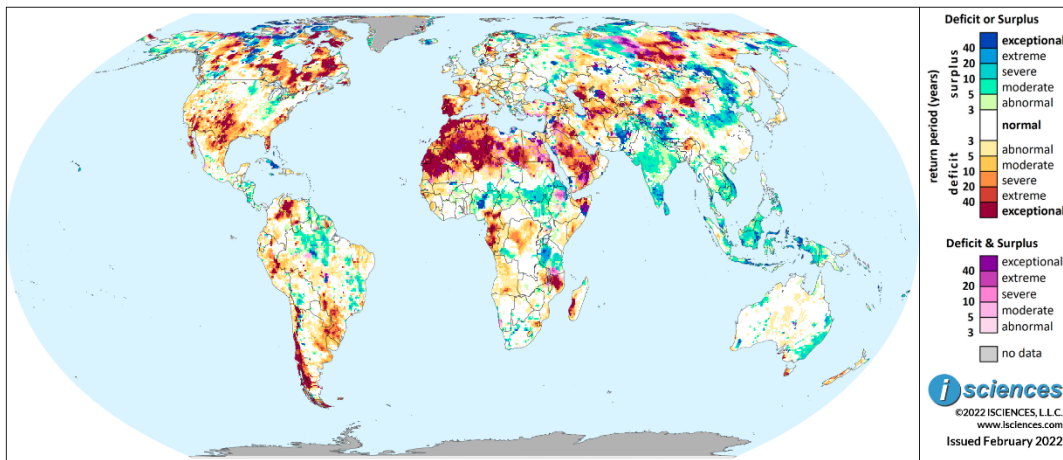
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## Worldwide Water Watch List

This map presents a selection of regions likely to encounter significant water anomalies during the one-year period beginning in November 2021 and running through October 2022 using 3 months of observed temperature and precipitation data and 9 months of forecast data.

ISciences Water Anomalies Forecast: November 2021 - October 2022



Based on observed data through January 2022 and forecasts through October 2022

### 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, primarily moderate, water surpluses in much of the Ohio River Basin, intense deficits in Peninsular Florida, and widespread deficits in Texas. Mild to moderate deficits will emerge in California as surpluses retreat.

**Canada:** The forecast through April indicates water conditions much like those of the prior three months: vast areas of deficit, less in the southern Prairie Provinces. Intense deficits are forecast in Montreal, west of Ottawa, near Winnipeg, west of Regina, and north of Calgary.

**Mexico, Central America, and the Caribbean:** The forecast through April indicates exceptional water deficits in Jalisco and widespread deficits in north-central Mexico. Surpluses are forecast in Honduras, Nicaragua, Jamaica, Cuba, and the central Bahamas.

**South America:** The forecast through April indicates widespread water surpluses in the northern Amazon Basin and the Guianas, but exceptional deficits in southern French Guiana. Deficits are expected eastern Argentina and also in Chile where anomalies will be exceptional in the south.

**Europe:** The forecast through April indicates widespread, intense water deficits in Portugal, Spain, France, Estonia, and Hungary. Widespread surpluses of varying intensity are expected in European Russia and the Nordic nations.

**Africa:** The forecast through April indicates that water deficits in the Horn of Africa will nearly disappear. Though downgrading, deficits will persist from Cameroon through Gabon. Areas of surplus include southeastern Sudan, Tanzania, central Nigeria, and Western Cape, South Africa.

**Middle East:** The forecast through April indicates moderate water deficits in Riyadh, Saudi Arabia and in pockets of central Iran and central Iraq. Surpluses are forecast in several regions of Turkey including the Kizilirmak River Basin, and in Cyprus, Israel, West Bank, and Gaza.

**Central Asia and Russia:** The forecast through April indicates widespread water surpluses in European Russia and widespread, exceptional deficits in the Central Siberian Plateau. Deficits are also forecast from the southern Urals past Tyumen. Surpluses will persist in eastern Kyrgyzstan.

**South Asia:** The forecast through April indicates water surpluses of varying intensity in many regions. Surpluses will be extreme to exceptional in Karnataka and Kerala, India; throughout Nepal; and from central Pakistan into Afghanistan. Deficits are forecast in India's Far Northeast.

**Southeast Asia and the Pacific:** The forecast through April indicates that water surpluses will remain widespread and intense in much of Southeast Asia but will shrink and downgrade in Indonesia and Pacific regions. Anomalies will be intense in the Lower Mekong River Basin.

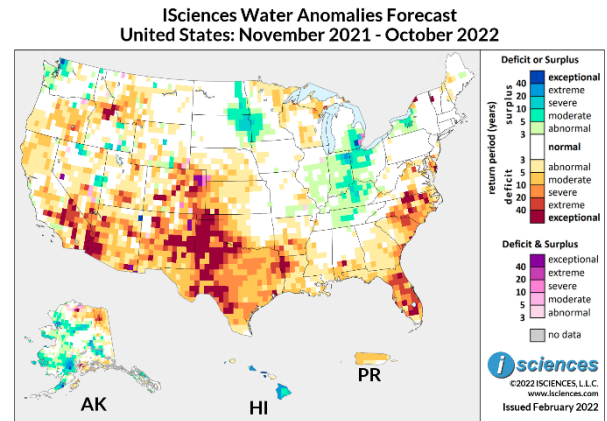
**East Asia:** The forecast through April indicates persistent, widespread, intense water surpluses in Northeast China and the Yellow River Basin. Deficits in Southeast China will nearly disappear. Deficits will emerge in South Korea and southern Japan; surpluses in North Korea will downgrade.

**Australia & New Zealand:** The forecast through April indicates that, while downgrading, water surpluses will remain widespread in eastern Australia from Rockhampton through the Murray-Darling Basin. Areas of deficit include Tasmania and New Zealand.

## Watch List: Regional Details

### United States

The 12-month forecast ending October indicates widespread water deficits from the southern Rockies through Texas. Deficits will be exceptional from the Oklahoma Panhandle through the Llano Estacado, and in a broad belt along the Rio Grande near Amistad Reservoir. Deficits will reach east into Arkansas and Louisiana and will be especially intense from Shreveport, Louisiana past the Toledo Bend Reservoir on the Sabine River. Some moderate deficits are forecast in the Central Plains States.



Based on observed data through January 2022 and forecasts through October 2022

Deficits will also be widespread in the Southwest and will include exceptional deficits in east-central New Mexico and in Arizona at the confluence of the Gila and Colorado Rivers. California can expect deficits, intense in Death Valley and moderate in the San Joaquin Valley and the far north. In the Pacific Northwest, moderate deficits are forecast in Oregon and surpluses in western Washington. In Idaho, intense deficits are expected in the Salmon River Mountains, while western Montana can expect moderate deficits. Mixed conditions are forecast in Wyoming, Nevada, and Utah, though deficits will be more common.

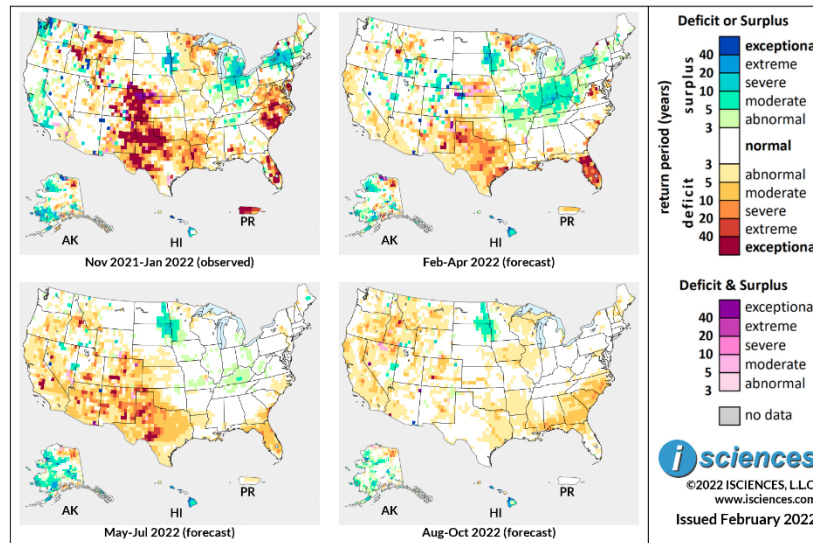
The Dakotas can expect widespread, moderate to severe surpluses in the east leading across the border into Minnesota. The Upper Great Lakes Region will experience moderate deficits in northeastern Minnesota, Wisconsin, and Michigan's Upper Peninsula. Widespread surpluses are forecast in the southern half of Michigan's Lower Peninsula and south through Indiana, northwestern Ohio, Kentucky, and central Tennessee. New York's Finger Lakes region will also see surpluses.

On the East Coast, deficits of varying intensity are forecast from the Delmarva Peninsula through Florida and will be especially widespread and intense in the Carolinas and Peninsular Florida. Southern Alabama can expect deficits as well.

Outside the contiguous U.S., deficits are forecast in northeastern Alaska; areas of surplus include Noatak and Gates of the Arctic National Preserves, Nome, the region west of Bethel, and the eastern reaches of the Alaska Range. Moderate to extreme surpluses are expected in Hawaii and moderate deficits in Puerto Rico.

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

**ISciences Water Anomalies Forecast  
United States: November 2021 - October 2022**



Based on observed data through January 2022 and forecasts through October 2022

The forecast through April indicates widespread, primarily moderate, surpluses in much of the Ohio River Basin and pockets in Missouri, southeastern Michigan, and western Upstate New York. In the East, deficits are expected in Delaware, northern Virginia, pockets along the southeast coast, and throughout Florida. Deficits will be severe to exceptional in Florida and Virginia. Deficits will skirt the Gulf Coast, becoming widespread in Texas with moderate to exceptional deficits. Deficits will reach into Oklahoma, and deficits are forecast in the Central Plains States. Mixed conditions are expected in the Rocky Mountain States with pockets of deficit in western Montana and central Idaho, and pockets of surplus in southeastern Idaho, southern Wyoming, and western Colorado. A few pockets of surplus are also forecast in Nevada. Deficits are expected in the Southwest, primarily New Mexico, and also in pockets of northern and southeastern California. In the Dakotas, surpluses will persist in the east and into Minnesota, but deficits are forecast in northern Minnesota crossing into Wisconsin. The Upper Peninsula of Michigan can expect some deficits.

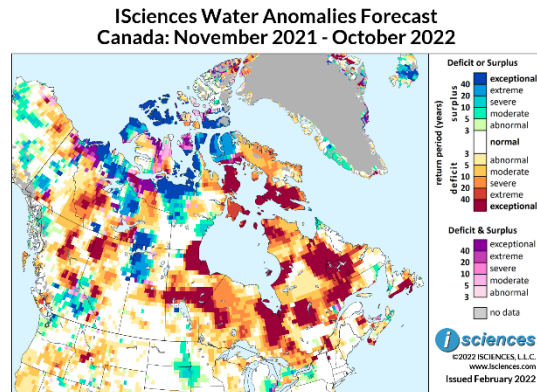
From May through July, many regions east of the Mississippi River will return to normal. Moderate deficits are forecast in Florida and southeastern Georgia. In the Upper Midwest, surpluses will persist spanning the border of the Dakotas into Minnesota but will downgrade. Widespread deficits of varying intensity are predicted in the southern Rockies, Texas, and the Southwest. Deficits, moderate overall, are expected in California and pockets of Nevada, Utah, Oregon, central Idaho, and southwestern Montana. A few isolated pockets of surplus will persist in Idaho and Nevada.

The forecast for the final months – August through October – indicates that deficits will shrink considerably in Texas and the Southwest, increase in the Northwest, and emerge along the Arkansas River. In the East, deficits will shrink in Florida, but moderate deficits will emerge from the Carolinas into the Deep South. Surpluses in the Dakotas will moderate.

Please note that WSIM forecast skill declines with longer lead times.

## Canada

The 12-month outlook for Canada through October indicates widespread water deficits in the eastern half of the nation. Deficits will be exceptional in southern Newfoundland, the Miramichi River watershed in east-central New Brunswick, the Smallwood Reservoir region in Labrador, the Manicouagan Reservoir region in Quebec and from Gouin Reservoir past Lake Mistassini, and the lower Saint-Maurice River region as it empties into the St. Lawrence between Montreal and Quebec City.



Deficits of lesser intensity are expected in much of Southern Ontario though a belt of surplus is forecast west of Toronto. Exceptional deficits are expected in a broad column along Ontario's eastern border reaching James Bay. Deficits will be widespread in Northern Ontario and will include exceptional anomalies in Kenora District.

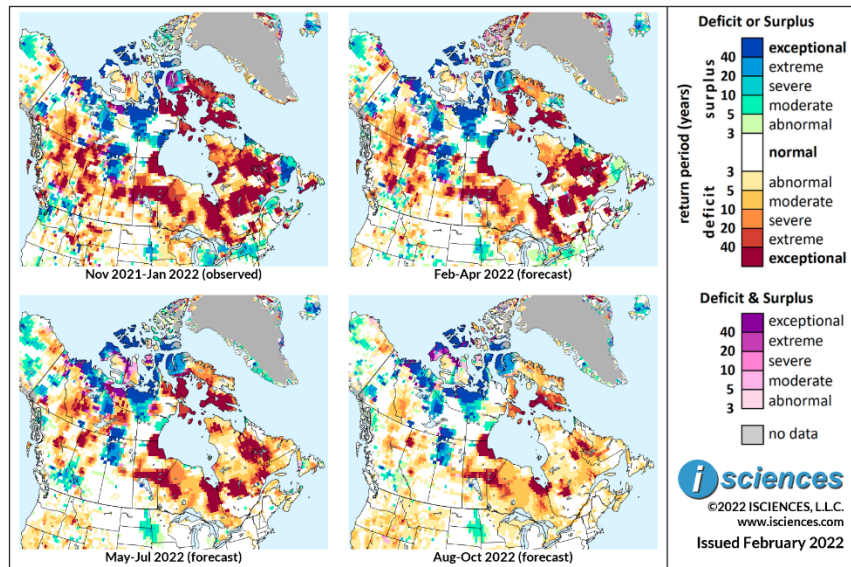
In the Prairie Provinces, nearly normal conditions are forecast across the south with deficits east of Winnipeg. Exceptional deficits will belt central Manitoba and are also forecast in the province's northeast reaching Hudson Bay. Central Saskatchewan can expect deficits, but surpluses are forecast in the northwest quadrant leading west to Fort McMurray, Alberta. Deficits of varying intensity are expected in the Middle Athabasca River region in Alberta, surpluses near Banff, and exceptional deficits in the province's northwest.

Surpluses are forecast in the Thompson River watershed of southern British Columbia and deficits at opposite ends of the province's southern region in Vancouver Island and in East Kootenay. The Upper Fraser River Watershed will see intense deficits as will much of British Columbia's far north, moderating as they reach well into Yukon.

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



**ISciences Water Anomalies Forecast  
Canada: November 2021 - October 2022**



Based on observed data through January 2022 and forecasts through October 2022

The forecast through April indicates conditions much like those observed in the prior three months: vast areas of deficit, less pervasive in the southern region of the Prairie Provinces, and surpluses west of Toronto, in southern British Columbia, and from northwestern Saskatchewan into Alberta. Surpluses in southern British Columbia will shrink. The forecast for the major metropolitan areas includes intense deficits from Montreal halfway to Quebec City; intense deficits west of Ottawa; moderate to severe surpluses near Toronto; moderate to severe deficits near Winnipeg; deficits west of Regina and north of Calgary; and near-normal conditions in Vancouver but deficits on Vancouver Island.

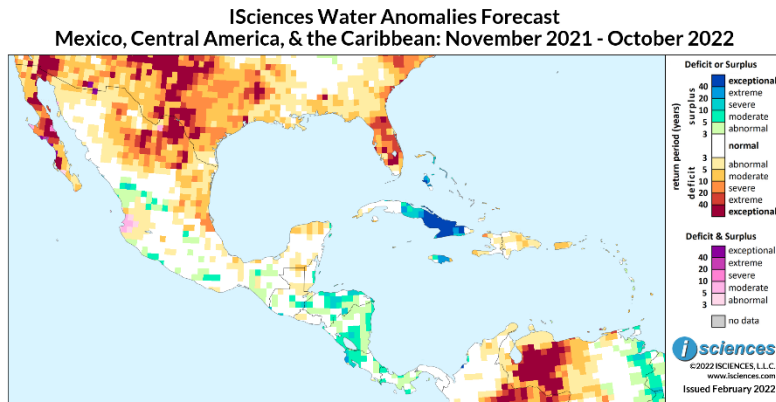
From May through July, deficits will shrink overall in the Prairie Provinces, retreating from southern regions. Deficits will also retreat between Montreal and Québec City and surpluses near Toronto will shrink. Surpluses in eastern Labrador and nearby regions of Quebec will disappear, transitioning to deficit in some areas. Moderate deficits will emerge on the Gaspé Peninsula. Surpluses will increase in southern British Columbia and deficits will retreat from Vancouver Island and shrink in the Upper Fraser River Watershed and in the province’s northern half.

The forecast for the final months – August through October – indicates that deficits in the eastern half of the nation will downgrade but remain widespread. Near-normal conditions are forecast in the southern region of the Prairie Provinces, but pockets of deficit will persist in central and northern Alberta and British Columbia, and intense surpluses in from Saskatchewan’s northwest quadrant into Alberta. Some areas of surplus will linger in southern British Columbia in the Middle Fraser River Watershed and Okanagan region.

Please note that WSIM forecast skill declines with longer lead times.

## Mexico, Central America, and the Caribbean

The 12-month forecast ending October indicates widespread water deficits of varying intensity in Mexico’s north-central and northeastern states and in the Baja Peninsula. Anomalies will be severe to exceptional in central Baja, the Colorado River Delta, eastern Chihuahua, Coahuila, and northern Nuevo León.

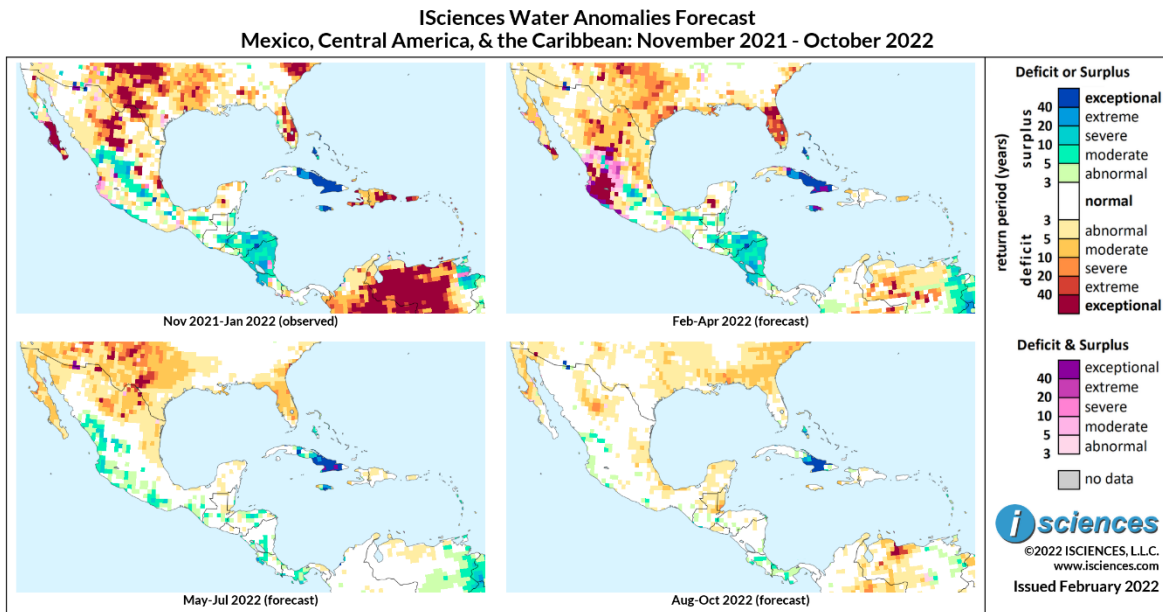


Based on observed data through January 2022 and forecasts through October 2022

Moderate deficits are forecast in Tamaulipas on the Gulf of Mexico, becoming severe in northern Veracruz. Yucatán State on its namesake peninsula can expect moderate deficits. Some pockets of moderate surplus are forecast from southern Durango into Zacatecas, in coastal Michoacán, and in Oaxaca.

In Central America, primarily moderate surpluses are expected in Honduras, Nicaragua, northern Costa Rica, and small pockets of Panama, Guatemala, and Belize. In the Caribbean, surpluses will be intense in Jamaica, Cuba, and the central Bahamas. Moderate deficits are forecast in pockets of Dominican Republic and Haiti.

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



Based on observed data through January 2022 and forecasts through October 2022

The forecast through April indicates the emergence of exceptional deficits in Jalisco on Mexico’s west coast with anomalies reaching into nearby states. Deficits will increase in north-central Mexico

becoming widespread though exceptional deficits will shrink. Deficits will be severe to exceptional in southern Chihuahua and pockets of exceptional deficit are expected in central Coahuila and eastern Durango. Moderate deficits will increase from Nuevo León into northern Veracruz. On the Baja Peninsula, exceptional deficits will shrink and downgrade, but moderate deficits will increase. Pockets of surplus will linger surrounding the Federal District in the center of the country and in pockets of the south including Chiapas. In Campeche on the Yucatán, a pocket of exceptional deficit will increase.

Widespread surpluses are forecast in Central America from Honduras into northern Costa Rica, and pockets of surplus are expected in Belize and Guatemala. Intense surpluses are forecast for Jamaica, central and eastern Cuba, and the central Bahamas, though transitions are also expected as deficits emerge. Deficits in Hispaniola will nearly disappear.

From May through July, deficits in Mexico will shrink and downgrade considerably, leaving moderate deficits in Baja and deficits of varying intensity in Chihuahua and Coahuila. Moderate surpluses will emerge in a broad path along the Pacific Coast from Sinaloa and Durango into Michoacán, transitioning from intense deficit in Jalisco. Surpluses will re-emerge in Zacatecas in the center of the country and emerge in the south from Guerrero into Oaxaca, while surpluses in Chiapas shrink. Some pockets of moderate surplus will persist in Central America and intense surpluses in Cuba and Jamaica. Surpluses in the Bahamas will moderate.

The forecast for the final three months – August through October – indicates generally moderate deficits in Baja California and moderate to severe deficits in Chihuahua and Belize. Surpluses will linger in Durango, Costa Rica, Panama, Cuba, and the Bahamas.

Please note that WSIM forecast skill declines with longer lead times.

## South America

The 12-month forecast through October indicates widespread deficits from western Venezuela into Colombia, and in central Peru, southeastern Brazil into Argentina, and throughout Chile. Widespread surpluses are forecast in the northern Amazon Basin.

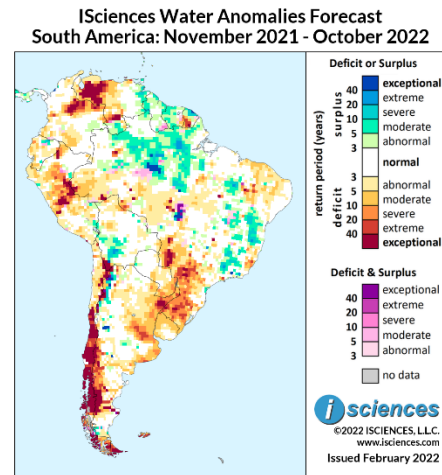
Deficits will be exceptional in the western Orinoco River watershed, but surpluses are forecast in the Orinoco Delta, Venezuela’s southern tip, and parts of the Guianas. A pocket of intense deficit is forecast in southern French Guiana.

In Brazil, surpluses of varying intensity will be widespread in the northern Amazon River Basin and will reach south of Manaus where an exceptional pocket is expected in the middle region of the Madeira River, a southern tributary. Some deficits are forecast in Brazil’s Northeast, particularly Piauí, but pockets of surplus will form a broken path from Maranhão through Bahia and Minas Gerais. Deficits reaching exceptional intensity are expected in Mata Grosso do Sul, Paraná, and Rio Grande do Sul.

Deficits will be widespread in much of Peru’s northern half and will be intense in the middle Ucayali River Watershed. Southwestern Bolivia can expect surpluses, severe to extreme east of Lake Poopó near the source of the Pilcomayo River. Generally moderate deficits are forecast in eastern Paraguay and northern Uruguay.

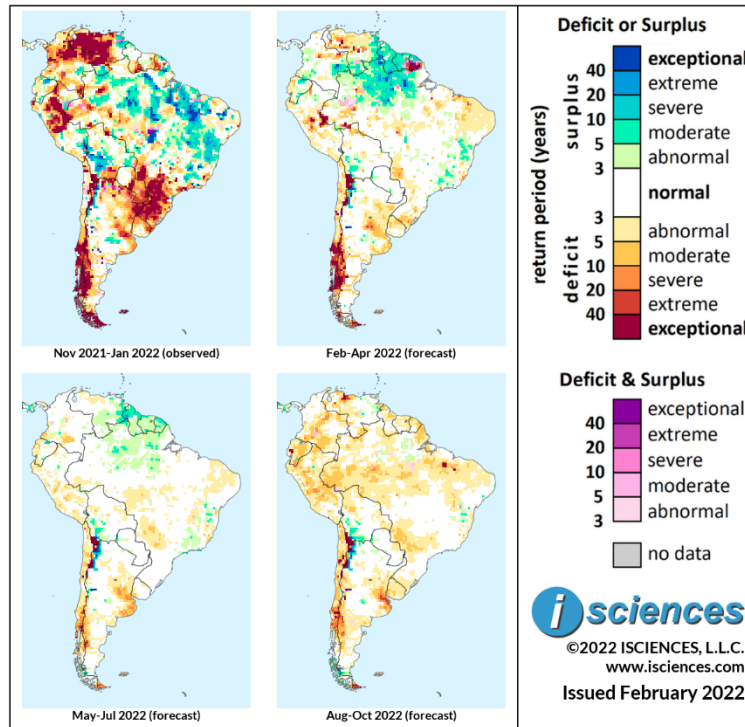
In eastern Argentina, deficits are forecast in the Iberá Wetlands of Corrientes Province where anomalies will be exceptional, moderating as they form a path to the south but intensifying again north of the Salado River in Buenos Aires Province. In Argentina’s far northwest, some pockets of surplus are predicted. Deficits are forecast throughout Chile with exceptional deficits in a vast path from La Serena in the north through most of the nation’s southern extent. Deficits in Chilean Patagonia will cross the border into Argentina, eventually downgrading though remaining intense on the Deseado and Chico Rivers. Deficits in the Falklands will be extreme.

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



Based on observed data through January 2022 and forecasts through October 2022

**ISciences Water Anomalies Forecast  
South America: November 2021 - October 2022**



Based on observed data through January 2022 and forecasts through October 2022

The forecast through April indicates widespread surpluses in the northern Amazon Basin and the Guianas, though exceptional deficits are expected in southern French Guiana. Surpluses are also expected in the Orinoco Delta, while deficits of varying intensity are forecast in much of the northern Orinoco Watershed. Some pockets of deficit are forecast near Brazil’s northeast coast, in Mato Grosso do Sul, and Rio Grande do Sul. Surpluses will persist in a pocket near Quito, Ecuador. In Peru, intense deficits are expected in Ucayali Department, reaching into neighboring regions of Peru and Brazil. Moderate surpluses will persist in southwestern Bolivia. Deficits are expected throughout much of Chile and will be exceptional from Concepcion to the Gulf of Corcovado, reaching into Argentina. Moderate deficits are forecast in northern Uruguay and eastern Argentina though deficits will be more intense in Córdoba Province, Argentina.

From May through July, much of the continent can expect near-normal water conditions. Moderate surpluses will linger in the Guianas, isolated pockets of the northern Amazon Basin, and southwestern Bolivia. Generally moderate to severe deficits are forecast in the eastern Pampas, southern Chile, Tierra del Fuego, and the Falklands.

The final quarter – August through October – indicates that moderate deficits will increase and surpluses in the Guianas and northern Amazon will nearly disappear as deficits emerge.

Please note that WSIM forecast skill declines with longer lead times.

## Europe

The 12-month forecast through October indicates widespread water deficits on the Iberian Peninsula and in France. Deficits will be exceptional throughout much of Portugal and western Spain. In France, deficits will be especially intense in the middle and lower regions of the Loire River and in the French Riviera.

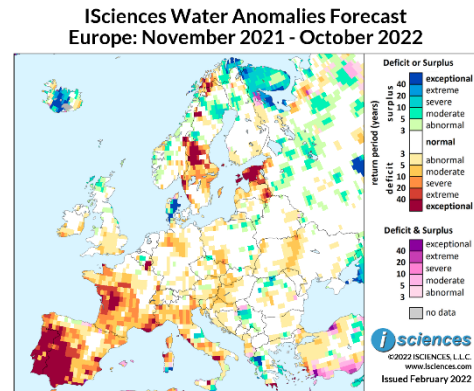
Deficits of varying intensity are forecast in northern Italy, along the Tyrrhenian Coast, and in the southern Apennines. Surpluses are expected in Umbria. Elsewhere in the Mediterranean,

exceptional surpluses are forecast in the Pindus Mountains in Greece and moderate deficits in central Albania. Surpluses are forecast surrounding Belgrade, Serbia, and in northern Romania.

Some pockets of moderate deficit are expected in Central and Eastern Europe including north-central Germany and from southwestern Poland into northern Croatia. In Ukraine, moderate deficits are forecast from Kyiv Reservoir in the north to the Dniester River in the south. Some surpluses are expected along Ukraine's eastern border. Moderate surpluses are forecast surrounding Brussels, but exceptional deficits are forecast in southern Belgium.

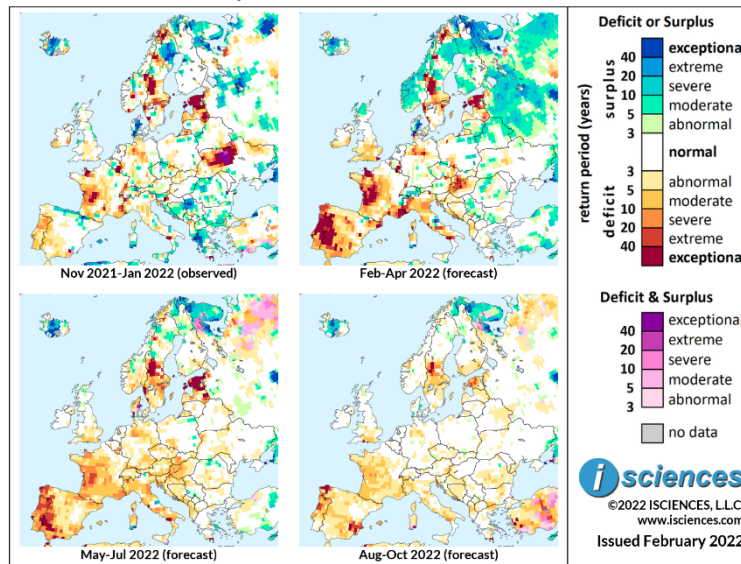
In Northern Europe, intense surpluses are forecast in Denmark, central Iceland, Arctic Norway, and Murmansk and the Middle Volga River Watershed in European Russia. Areas expected to have surpluses of lesser intensity include Norbotten region of Sweden, around the Gulf of Bothnia into Finland, and near the Rybinsk Reservoir in Russia. Exceptional water deficits are forecast in central Sweden's Dalälven River Watershed, moderating as they reach south. Intense deficits are also forecast in Estonia and eastern Latvia and moderate deficits in western Latvia.

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



Based on observed data through January 2022 and forecasts through October 2022

**ISciences Water Anomalies Forecast  
Europe: November 2021 - October 2022**



Based on observed data through January 2022 and forecasts through October 2022

The forecast through April indicates widespread water surpluses of varying intensity in European Russia with exceptional anomalies in the Middle Volga region and severe to extreme anomalies in Murmansk, from Lake Ladoga well past Rybinsk Reservoir, and in the northern Vychegda Lowland. Surpluses are also expected in Finland, northern Sweden, much of Norway, Iceland, Denmark, Belarus, and Lithuania. Intense deficits are forecast in the Upper Dalälven River Watershed in Sweden, and in Estonia, but deficits in Latvia will downgrade. Widespread deficits of varying intensity are expected in Spain, Portugal, and France with exceptional deficits in much of Portugal and western Spain, as well as Normandy, west-central France, and Provence. Deficits are also expected in northern Italy and pockets in the south, Hungary, northern Germany, England, Dublin and County Cork in Ireland, and pockets along the eastern shore of the Adriatic Sea. Areas with a forecast of surplus include the Scottish Highlands, Switzerland, and pockets in eastern Europe and the eastern Balkans.

From May through July, surpluses will shrink considerably, but deficits will persist. Widespread deficits will continue in Portugal, western Spain, and Italy, and moderate deficits will increase in Central Europe. Anomalies will remain exceptional in Estonia and central Sweden, severe to exceptional in Portugal and Spain, and moderate to extreme in France.

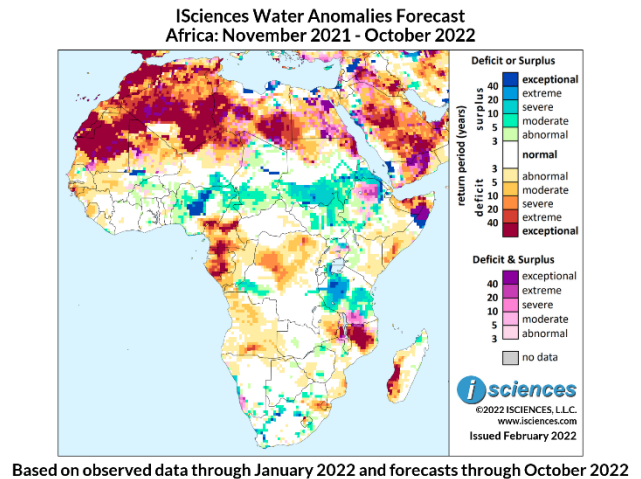
The forecast for August through October indicates that deficits will shrink in Central Europe but persist in the Iberian Peninsula, France, central Sweden, Estonia, and pockets elsewhere. Anomalies will be generally moderate though more intense in Portugal, Spain, Sweden, and Estonia. Surpluses are forecast in Iceland, Arctic Norway, and Murmansk.

Please note that WSIM forecast skill declines with longer lead times.

## Africa

The 12-month forecast through October indicates widespread water deficits in the north from Mauritania through Libya including many areas of exceptional deficit. Mixed conditions are expected in Egypt.

Surpluses are forecast in the central and eastern Sahel, dipping south well into Nigeria and South Sudan. Anomalies will be exceptional around Lake Débo in the Inner Niger Delta of central Mali and in central and north-central Nigeria, and severe in southeastern Niger's Zinder region. Widespread surpluses are forecast in southern Sudan and South Sudan. Surpluses will extend into Eritrea and the Tigray and Afar regions of northern Ethiopia.



Pockets of deficit are forecast in West Africa from Senegal through Sierra Leone. Along the Gulf of Guinea, deficits will be severe to exceptional from southeastern Nigeria reaching through central and southern Cameroon, Equatorial Guinea, and Gabon.

In the heart of the continent, widespread deficits are forecast in the eastern Congo River Basin in Democratic Republic of the Congo (DRC). Anomalies will be severe in the Ruki/Tshuapa River Watershed and will reach exceptional intensity the Upper Uele River region. Surpluses are expected in a path from Brazzaville and Kinshasa leading southeast.

In the Horn of Africa, deficits are forecast in Somaliland and southern Somalia, and will be especially intense in Somaliland. Transitional conditions (pink/purple) along with exceptional surpluses are forecast for the Nugaal Valley.

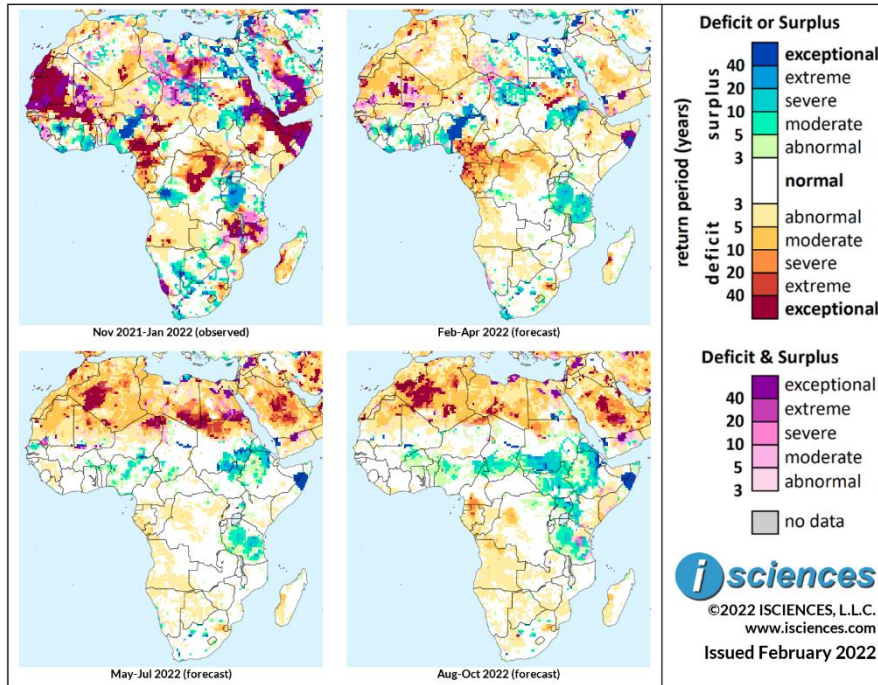
Widespread surpluses are expected in Tanzania, becoming extreme to exceptional in the west. Intense deficits are predicted for northern Mozambique and Malawi, downgrading in eastern Zambia. In Madagascar, deficits will be intense along the central and southwestern coast, and a pocket of surplus is forecast on the northwestern coast.

Elsewhere, pockets of deficit are forecast in northwestern and south-central Angola, from Eswatini to Johannesburg, and in western Lesotho. Some pockets of surplus are expected in the southern nations, particularly South Africa where areas of surplus include Western and Northern Cape and central Free State.

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



ISciences Water Anomalies Forecast  
Africa: November 2021 - October 2022



Based on observed data through January 2022 and forecasts through October 2022

The forecast through April indicates deficits in Africa’s northwestern nations, moderate overall but with some exceptional pockets. Surpluses are expected in Egypt and parts of coastal and northern Libya. Surpluses are also forecast throughout northern Chad and from Sudan’s southeastern quadrant into Eritrea, but deficits are predicted for central Sudan and will include exceptional anomalies. Nations along the northern coast of the Gulf of Guinea can expect pockets of surplus. Surpluses will be widespread in southwestern and central Nigeria, exceptional along the lower Niger River and from the center of the country into Niger, downgrading only slightly in Zinder Region. In southeastern Nigeria, however, deficits of varying intensity are expected and through much of Cameroon, Equatorial Guinea, and Gabon.

Moderate to extreme deficits are forecast for Republic of the Congo and northern DRC, though some surpluses will linger east of Kinshasa. Deficits in the Horn of Africa will nearly disappear, persisting in a pocket near Addis Ababa, Ethiopia. Widespread, severe surpluses are forecast in Tanzania. Surpluses will persist in Western Cape and several small pockets throughout South Africa. Deficits will persist in western Lesotho and Eswatini, with more intense anomalies in the Upper Vaal River region nearby in South Africa. Deficits will be exceptional in a pocket on Madagascar’s west-central coast on the Tsiribihina River.

The forecast for May through July indicates that deficits will increase in North Africa, transitioning from surplus in Egypt, and will include intense deficits in western Algeria, northern Niger, and southeastern Libya into Sudan and Egypt. Deficits will nearly disappear in the rest of Africa. Surpluses will persist in southeastern Sudan, increase in northern Eritrea, and emerge in northeastern South Sudan and

northern and central Ethiopia. Exceptional surpluses will re-emerge in Nugaal, Somalia. Surpluses will shrink but remain widespread in Tanzania. Along the Gulf of Guinea, surpluses will also shrink, persisting primarily in Nigeria while re-emerging in northern Senegal. Severe deficits are forecast in western Eswatini, moderating in the Upper Vaal River region. Small, isolated pockets of surplus will persist in South Africa.

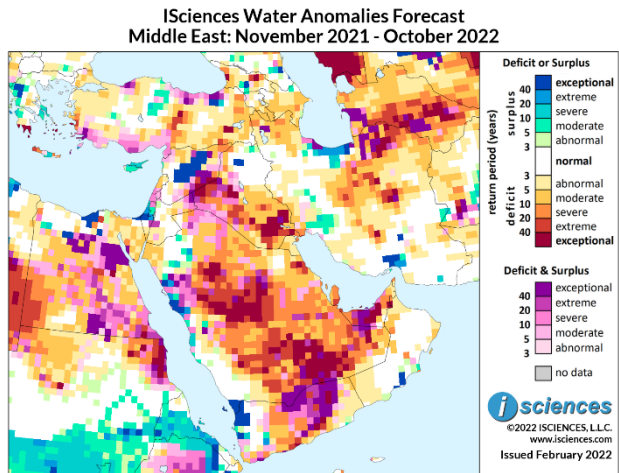
In the final quarter – August through October – deficits will persist in North Africa, shrinking somewhat in the east. Surpluses will increase, becoming widespread in southern Sudan, South Sudan, Ethiopia, Eritrea, and southern Chad. Surpluses are also forecast in Nugaal, western Kenya, northern Uganda, Tanzania, Nigeria, and Burkina Faso.

Please note that WSIM forecast skill declines with longer lead times.

## Middle East

The forecast for the 12-month period ending October indicates widespread water deficits in Saudi Arabia, Iraq, and central and northeastern Iran.

On the Arabian Peninsula, deficits of varying intensity, including exceptional, are forecast throughout much of Saudi Arabia though mixed conditions are expected in the provinces on the northern shore of the Red Sea. Deficits will be intense in United Arab Emirates and severe overall in Qatar. In Yemen, exceptional surpluses are forecast in the northeast corner and deficits along with transitional conditions (pink/purple) in the center of the country.



Based on observed data through January 2022 and forecasts through October 2022

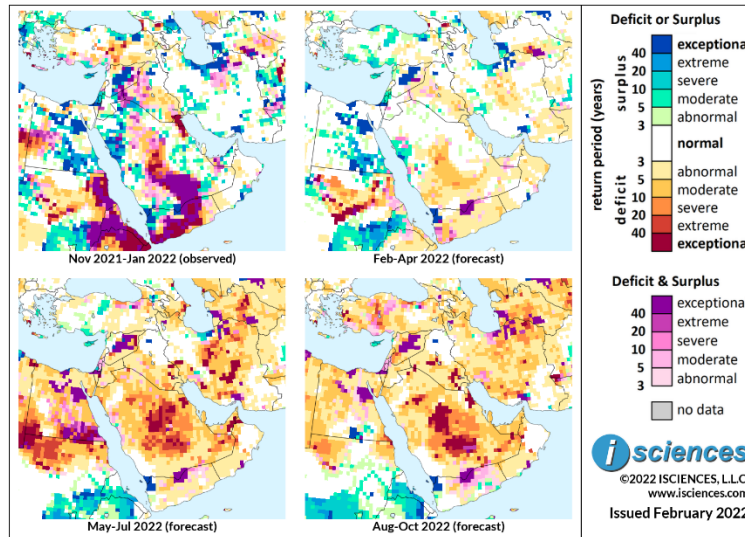
In Iraq, exceptional deficits are forecast in the south, deficits of varying intensity and transitional conditions west of the Euphrates, and moderate deficits around Baghdad. Iran can expect deficits reaching extreme and exceptional intensity in the northeast and central provinces, and generally moderate deficits in its northwest corner. Surpluses are expected from Tehran to the Black Sea Coast, in a pocket of the south near the Strait of Hormuz, throughout Kohgiluyeh and Boyer-Ahmad Province, and in the Hamoun Wetlands.

Turkey can expect mixed conditions, notably, deficits in the center of the country and in the east with intense pockets in Central Anatolia and southwest of Lake Van, and moderate surpluses in the Kizilirmak River Basin. Mixed conditions are forecast in the Levant including deficits in Lebanon and Syria, and surpluses in central Syria, central Israel, and Cyprus.

In Georgia, intense deficits are expected on the coast including Batumi and a pocket north of the Kura (Mtkvari) River, though surpluses are expected south of the river. Moderate deficits are forecast in Armenia and Azerbaijan.

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

**ISciences Water Anomalies Forecast  
Middle East: November 2021 - October 2022**



Based on observed data through January 2022 and forecasts through October 2022

The forecast through April indicates near-normal water conditions in many parts of the region. However, moderate deficits are forecast in Riyadh, Saudi Arabia and in Yemen’s southwest corner where transitions are also expected. Northwestern Yemen will continue to see intense surpluses. Deficits will be moderate in pockets of central Iran and central Iraq. Georgia can expect exceptional deficits on its central coast and north of Tbilisi. Surpluses are forecast in several regions of Turkey including the Kizilirmak River Basin and along both the Black Sea and Mediterranean Coasts. Intense surpluses will persist in central Syria. Other areas with a forecast of surplus include Cyprus, Israel, West Bank, Gaza, and Tabuk and Medina on the Red Sea Coast in Saudi Arabia. In Iran, surpluses will persist along the central Caspian Coast and into the northeast, the central Zagros Mountains, and near Bandar-e-Abbas in the south. In Georgia, surpluses are forecast south of the Kura River.

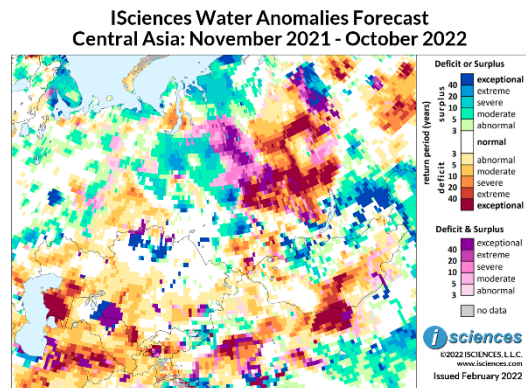
From May through July, surpluses in the region will shrink and deficits will increase, becoming widespread in Saudi Arabia and much of Iran. Deficits will be particularly intense in Riyadh, Saudi Arabia, and Esfahan and northern Kerman Provinces in Iran. Surpluses will persist on Iran’s central Caspian Coast. Deficits are forecast in southern Iraq and west of the Euphrates River. Deficits in Azerbaijan will increase while those in Georgia moderate. Surpluses will persist in the Kizilirmak River Basin of Turkey, along the central Mediterranean Coast, and in Cyprus, but deficits will emerge in northeastern Turkey near the coast.

In the final quarter – August through October – deficits will increase in the region, emerging in Turkey and the Levant as surpluses retreat.

Please note that WSIM forecast skill declines with longer lead times.

## Central Asia and Russia

The 12-month forecast through October indicates exceptional water deficits in western Kazakhstan’s Mangystau Region and in Turkistan Region in the far south, and generally moderate deficits elsewhere in the west and south. In Turkmenistan, deficits will be widespread with extreme to exceptional anomalies. While deficits in Uzbekistan will be less intense overall, they will extend through about two-thirds of the nation, with exceptional deficits in the Fergana Valley.



Based on observed data through January 2022 and forecasts through October 2022

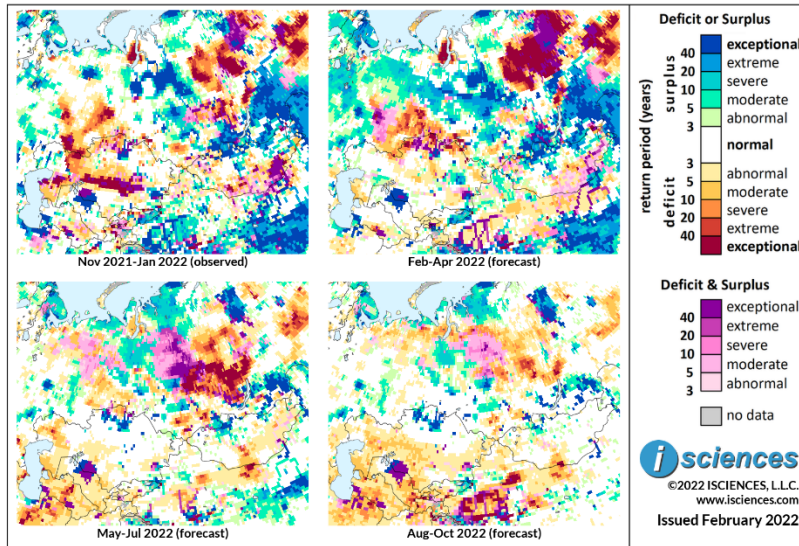
Northern Kazakhstan can expect intense surpluses in Akmola Region and in northern Kostanay. South of Lake Balkhash, moderate deficits are forecast though conditions will be mixed in the Alatau Mountains nearby and moderate surpluses are forecast near Kapchagay Reservoir on the Ile River. In Kyrgyzstan, surpluses are forecast in the east and intense deficits in the south. Tajikistan will see some extreme pockets of deficit in the east and moderate pockets in the west.

West of the Urals in Russia, moderate to severe deficits are forecast in the Lower Vyatka River Watershed in Trans-Volga, exceptional surpluses in the Middle Volga region, and moderate to extreme surpluses in the Volga Upland.

East of the Urals, deficits are forecast in the Tura River region reaching to Tyumen, and in the north spanning the Gulf of Ob. Widespread surpluses of varying intensity are forecast in much of the Western Siberian Plain with transitions at its eastern edge leading to widespread, intense deficits in the Central Siberian Plateau. Exceptional surpluses are forecast in the Plateau’s northeast between the Olenek and Lena Rivers. In Irkutsk Oblast north of Lake Baikal, severe to exceptional deficits are forecast. Surpluses of varying intensity are expected in a vast area from Lake Baikal through Russian regions bordering China, while intense deficits are forecast west of the Sea of Okhotsk.

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 2021 - October 2022**



Based on observed data through January 2022 and forecasts through October 2022

The forecast through April indicates that surpluses will increase in European Russia. Deficits will persist in Trans-Volga, though transitional are also forecast, and widespread deficits will continue from the southern Urals past Tyumen, pushing farther east. Exceptional deficits will persist on the Gulf of Ob, and widespread surpluses in the Western Siberian Plain. In the vast Central Siberian Plateau, exceptional deficits will increase and also in the Lower Lena River region and along the Laptev Sea. Deficits in Irkutsk Oblast will shrink. Widespread surpluses will persist from Lake Baikal through Russian regions bordering China and intense deficits will persist west of the Sea of Otkhosk.

In Central Asia, mixed conditions are expected near Kazakhstan’s north-central border though deficits will dominate. Moderate deficits will linger in Mangystau while deficits in central Kazakhstan shrink and downgrade considerably. Surpluses will increase north of Lake Balkhash and shrink southeast. Moderate deficits will emerge in the Tarbagatai Mountains in the east. In Kyrgyzstan, surpluses will persist in the east. Surpluses are also forecast spanning the north-central Uzbek border and in southwestern Turkmenistan. Deficits are expected around Ashgabat, Turkmenistan.

From May through July, surpluses in European Russia will shrink considerably. The Central Siberian Plateau will transition out of widespread, intense deficit while intense surpluses emerge in its eastern reaches. Deficits will moderate on the Gulf of Ob, transition to surplus in Trans-Volga, and shrink and moderate from the southern Urals past Tyumen. Widespread, intense deficits are expected to emerge in Irkutsk Oblast, reaching well north and west. Surpluses will shrink from Baikal through regions bordering Mongolia and China. Deficits will emerge in Turkmenistan and increase in western Kazakhstan. Surpluses will re-emerge in Akmola and Kostanay as deficits recede and surpluses will shrink in eastern Kyrgyzstan.

The forecast for the final months – August through October – indicates deficits in Turkmenistan, Uzbekistan, and western Kazakhstan. Deficits in Russia will downgrade. Please note that WSIM forecast skill declines with longer lead times.

## South Asia

The 12-month forecast through October indicates widespread water surpluses in India, Sri Lanka, Nepal, and Pakistan.

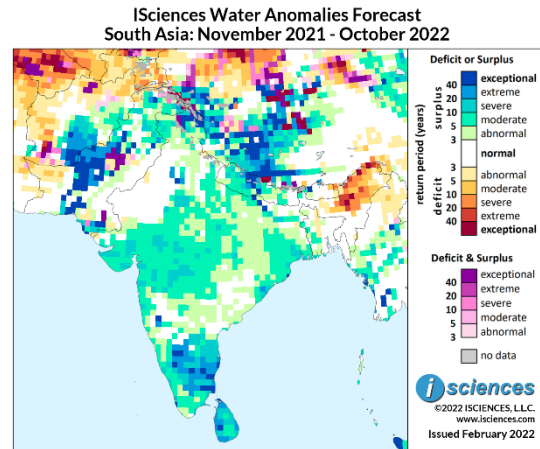
Across the breadth of India from Gujarat through the center of the nation, anomalies will be moderate to severe, as will surpluses in the eastern states of West Bengal, Jharkhand, and Odisha. In southern India, surpluses will be more intense, ranging from severe to exceptional in Karnataka and Tamil Nadu.

In the Gangetic Plain, moderate surpluses are forecast in Uttar Pradesh, but the northern states of Haryana and Jammu and Kashmir can expect severe to exceptional anomalies. Deficits are forecast in India's Far Northeast, ranging from moderate to exceptional.

Surpluses of varying intensity are expected throughout Sri Lanka. In Nepal, surpluses will be widespread, moderate overall but extreme to exceptional in the center of the county on the Gandaki River reaching into Bihar, India to join the Ganges River where surpluses will eventually moderate in the lower reaches of the Ganges.

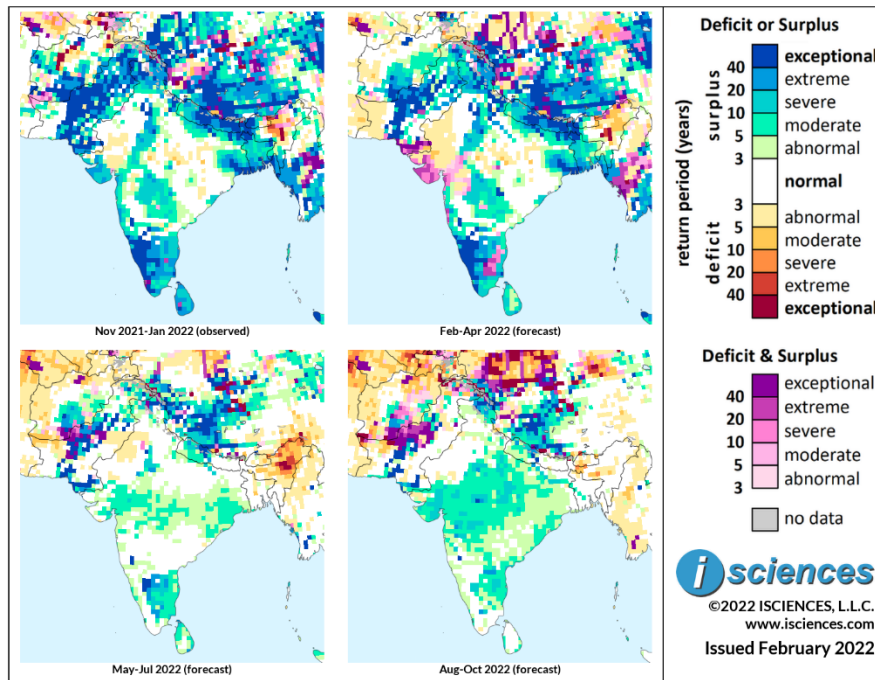
Pakistan's north, central region, and southeast will see surpluses, exceptional in eastern Balochistan. Surpluses in central Pakistan will reach across the border into Kandahar Province in Afghanistan where anomalies will be extreme to exceptional, moderating to the north near Kabul. Deficits are forecast in northern and western Afghanistan, and a few pockets in Pakistan's western corner.

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



Based on observed data through January 2022 and forecasts through October 2022

ISciences Water Anomalies Forecast  
South Asia: November 2021 - October 2022



Based on observed data through January 2022 and forecasts through October 2022

The forecast through April indicates surpluses of varying intensity in many regions. In India, surpluses are expected in the Far North, Haryana, and eastern Rajasthan; along the Ganges in Uttar Pradesh; in Maharashtra and Telangana; throughout the south; and in West Bengal and Jharkhand in the east. Exceptional anomalies will be particularly widespread in Karnataka and Kerala. Transitions (pink/purple) are expected in Gujarat as deficits emerge, and northern Tamil Nadu will also be in transition. Deficits will increase in the Far Northeast. Surpluses in Sri Lanka will downgrade. Widespread, intense surpluses are forecast in Nepal reaching into Bhutan, while Bangladesh will experience moderate to extreme anomalies. Surpluses, including exceptional surpluses, are expected throughout much of Pakistan though anomalies in the north will downgrade and transitions are forecast in the southeast. In Afghanistan, intense surpluses will persist in Kandahar Province and a pocket near Mazar-e Sharif, and moderate surpluses will increase around Kabul.

From May through July, surpluses will retreat from Bangladesh, eastern Nepal, and Bhutan. Deficits will increase in India's Far Northeast. Surpluses along much of India's west coast will retreat but moderate to exceptional anomalies will persist in the south. Moderate surpluses are forecast from eastern Gujarat into central India, and in the east in Odisha and its northern neighbors. In the Far North, Haryana, and eastern Rajasthan, surpluses will shrink. Surpluses will also shrink in northern Pakistan and around Kabul, persisting in central Pakistan and Kandahar Province, though transitions are also expected. Intense surpluses will re-emerge in southeastern Pakistan including Karachi.



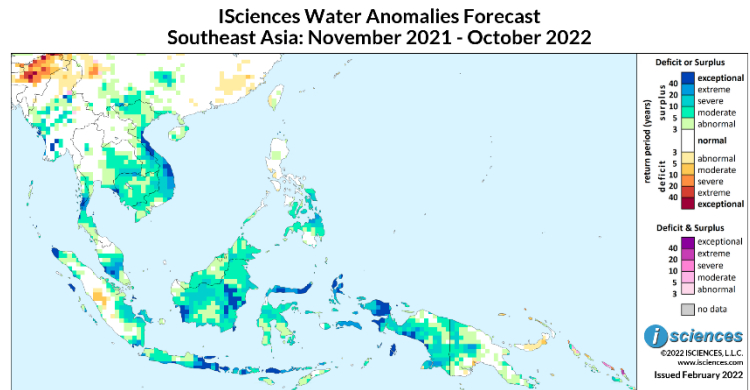
The forecast for the final months – August through October – indicates the emergence of widespread, moderate surpluses in India. Deficits in the Far Northeast will shrink. Transitions and surpluses are forecast from Pakistan into Afghanistan, and deficits will increase in northern and western Afghanistan.

Please note that WSIM forecast skill declines with longer lead times.

## Southeast Asia and the Pacific

The 12-month forecast through October indicates water surpluses of varying intensity in several regions in Southeast Asia and much of the Pacific.

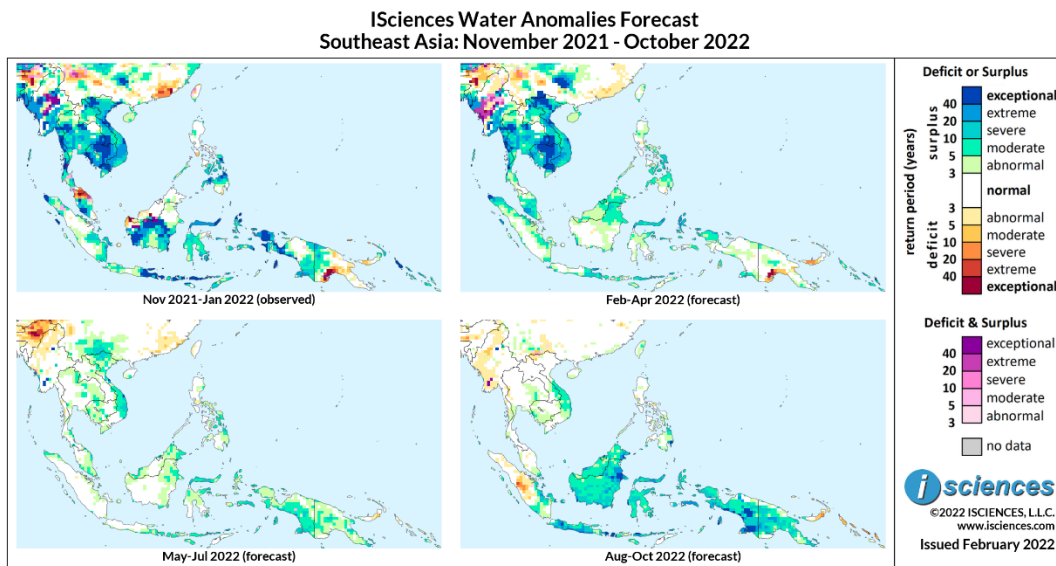
Widespread surpluses are expected in Vietnam, moderate overall but exceptional in the narrows and extreme to exceptional from the Highlands to the coast. Generally moderate surpluses are forecast in Cambodia and eastern and Peninsular Thailand. In Myanmar, pockets of surplus are expected in the center of the nation, the Irrawaddy Delta, the southwest, and trailing through the southernmost tip.



Based on observed data through January 2022 and forecasts through October 2022

The central and southern Philippines can expect moderate to extreme surpluses. Surpluses of varying intensity are forecast in Malaysia, many regions of Indonesia, and western Papua New Guinea. Areas with a forecast of exceptional surplus include Banda Aceh (Sumatra's northern tip); the Mahakam River watershed in East Kalimantan on Borneo; eastern Java; Flores Island; Sulawesi's northern arm; and the Bird's Head Peninsula on New Guinea. A pocket of moderate deficit is expected in central Sumatra.

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



Based on observed data through January 2022 and forecasts through October 2022

The forecast through April indicates that surpluses will remain widespread and intense in much of Southeast Asia but will shrink and downgrade in Indonesia and Pacific regions. Anomalies will be extreme to exceptional in the Lower Mekong River Basin through southern Laos, Cambodia, and Vietnam, and in the Hong (Red) River Basin in northern Vietnam. Widespread surpluses of varying

intensity are forecast in Thailand. Surpluses are forecast in eastern Myanmar and its states bordering Bangladesh, but transitional conditions (pink/purple) are expected in the center of the nation. In the central and southern Philippines, moderate to severe surpluses are predicted. Surpluses are also expected in Malaysia, Brunei, northeastern Indonesian Borneo, Banda Aceh and eastern Sumatra, from eastern Java through Flores Island, Sulawesi's northern arm, the Maluku Islands, and the Bird's Head Peninsula and Pulau Dolok Island of Papua, Indonesia. Intense deficits are forecast around the Gulf of Papua and the island of New Britain, and moderate surpluses in the Highlands of Papua New Guinea.

From May through July, surpluses will shrink and downgrade considerably. Moderate surpluses will linger in northern and central Vietnam and pockets of Cambodia, Thailand, and southern Myanmar. Generally moderate surpluses are also forecast in pockets of the central Philippines and pockets of Malaysia and Indonesia including Banda Aceh, northeastern Indonesian Borneo, Sulawesi, the Malukus, and many of the Lesser Sunda Islands. Surpluses will downgrade to mild in the Bird's Head Peninsula, but widespread moderate surpluses will emerge in Papua Indonesia and surpluses will increase in Papua New Guinea as deficits retreat.

The forecast for the final months – August through October – indicates surpluses in central Vietnam and widespread surpluses in many regions of Indonesia and Papua New Guinea. Deficits are forecast for central Sumatra.

Please note that WSIM forecast skill declines with longer lead times.

## East Asia

The 12-month forecast for East Asia through October indicates widespread severe to exceptional water surpluses in Northeast China from the Bohai Sea to the Russian border. This wide path of surplus will downgrade to the south through Beijing. In the vast Yellow River (Huang He) Watershed, surpluses of varying intensity are forecast.

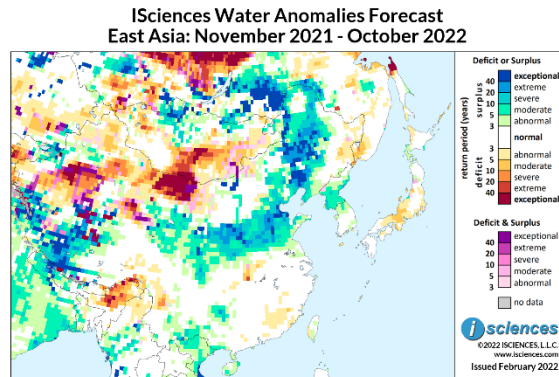
Western Inner Mongolia will experience exceptional deficits. In Xinjiang, deficits reaching exceptional intensity are forecast in the Tarim Basin along with transitional conditions (pink/purple). Surpluses are expected in western Tibet (Xizang) and will include exceptional surpluses on the Yarlung (Brahmaputra) River.

Near-normal conditions are forecast for much of southern China. Some surpluses are expected in southeastern Guizhou and eastern Yunnan, and a pocket of severe deficit in northern Yunnan. In central China, a pocket of deficit is forecast in Hubei.

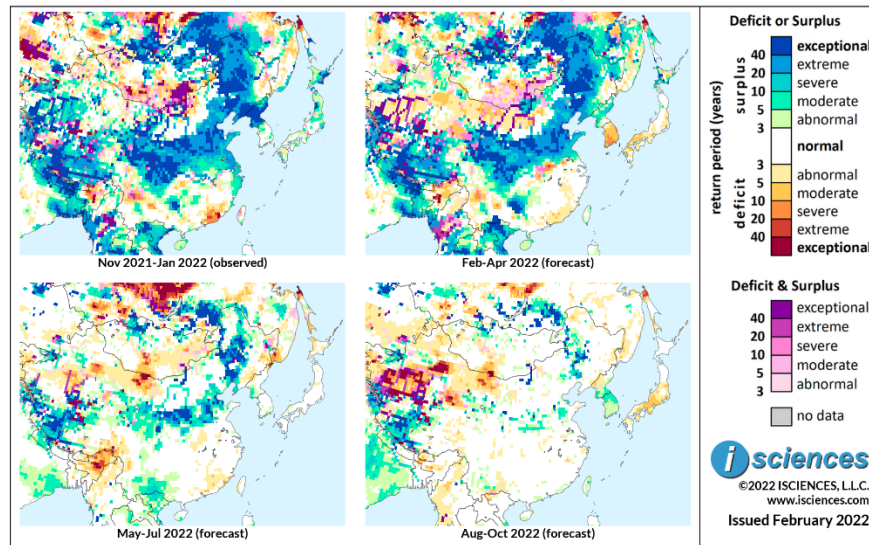
In Mongolia, deficits will be intense in the western Gobi Desert and pockets of deficit are expected in the lakes region of the nation's northwest. Surpluses are forecast surrounding Lake Khovsgol in the north and in the central Hangayn Mountains and the central Hentiyn Mountains.

Moderate surpluses will be widespread in North Korea and moderate deficits are forecast around Kyoto, Japan.

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



**ISciences Water Anomalies Forecast  
East Asia: November 2021 - October 2022**



Based on observed data through January 2022 and forecasts through October 2022

The forecast through April indicates persistent, widespread, extreme to exceptional surpluses from Northeast China through the North China Plain and much of the vast Yellow River Basin. Moderate deficits will emerge from western Inner Mongolia through northern Qinghai into Xinjiang. Between the Yellow and Yangtze River, deficits will emerge in the Huai River Watershed. In the Yangtze region, surpluses will be extreme to exceptional between Chongqing and Chengdu north of the river and severe in the Gorges. Further south, extreme to exceptional surpluses are forecast from Guizhou into Guangxi, and deficits in Southeast China will nearly disappear. Mixed conditions are expected in Yunnan and widespread surpluses in Tibet.

On the Korean Peninsula, surpluses will downgrade but remain widespread in the north, and moderate to severe deficits will emerge throughout the south. Moderate deficits will also emerge in southern Japan. In Mongolia, surpluses are forecast in the north, deficits and transitional conditions in the Gobi Desert.

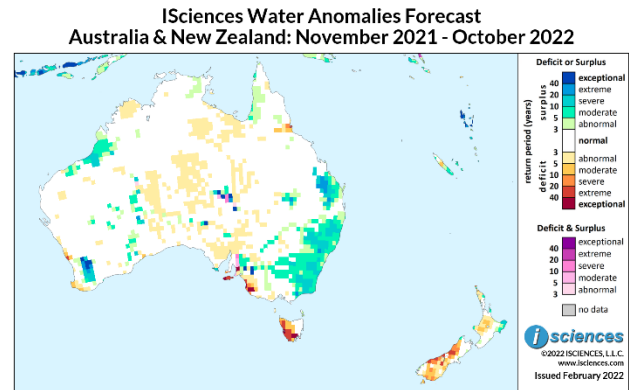
From May through July, surpluses, while shrinking considerably, will remain widespread in Northeast China and the Yellow River Basin and moderate surpluses will emerge on the Ordos Loop. Deficits will intensify in western Inner Mongolia and a pocket southeast of Urumqi in Xinjiang. In southern China, surpluses will retreat from Guizhou but increase in Yunnan, and deficits in Yunnan will shrink. Near-normal conditions are expected in Japan and Korea with some surpluses near Pyongyang.

The forecast for the final three months – August through October – indicates lingering pockets of surplus in Northeast China and parts of the Yellow River Watershed, widespread surpluses in western Tibet, and deficits in western Inner Mongolia and Xinjiang. Moderate surpluses will emerge in central Korea and moderate deficits in Honshu, Japan.

Please note that WSIM forecast skill declines with longer lead times.

## Australia & New Zealand

The 12-month forecast through October indicates widespread water surpluses in Australia’s east. Anomalies reaching extreme intensity are expected south of Rockhampton, Queensland, and a pocket in Paroo Shire in South West Queensland. Widespread moderate to severe surpluses are forecast in New South Wales and Victoria with surpluses expected from the eastern Murray-Darling Basin to the coast. Surpluses are also forecast along the paths of the Middle Darling and Lower Murray.



Based on observed data through January 2022 and forecasts through October 2022

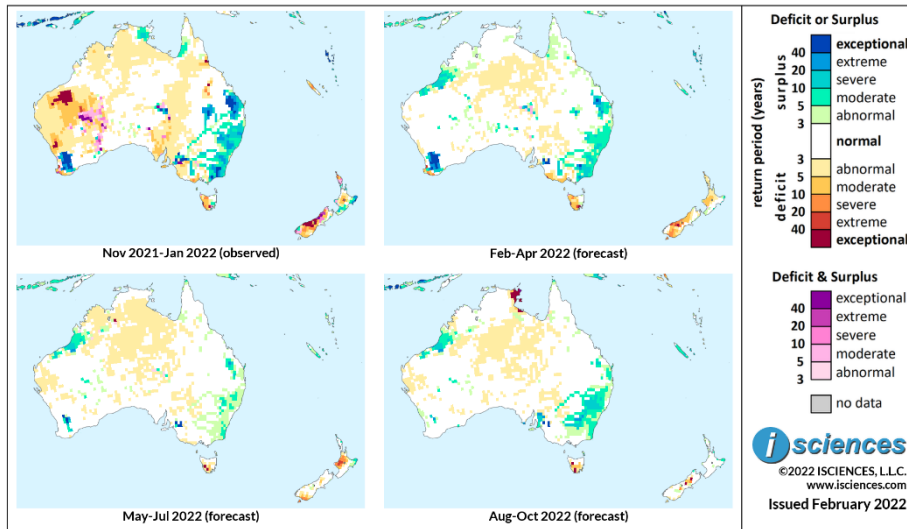
On Queensland’s northern coast a pocket of intense deficit is expected between Cairns and Townsville. Intense deficits are also expected in South Australia along the coast from Adelaide to the Victoria border and on Kangaroo Island. Extreme to exceptional deficits will dominate western Tasmania, the Derwent Estuary, and Hobart.

In Western Australia, extreme to exceptional water surpluses are forecast in the Avon River catchment leading south. A pocket of deficit is expected on the west coast between Geraldton and Perth, and also near Busselton. In the northwest, surpluses are forecast stretching from Eighty Mile Beach. In the nation’s vast Outback, pockets of surplus are forecast in the Gibson, Great Victoria, and Simpson Deserts.

In New Zealand, moderate to extreme deficits are predicted for South Island, particularly on the west coast. In North Island, moderate deficits are expected in the Waikato River catchment, and surpluses in East Cape. Mixed conditions are forecast in New Caledonia.

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

**iSciences Water Anomalies Forecast  
Australia & New Zealand: November 2021 - October 2022**



Based on observed data through January 2022 and forecasts through October 2022

The forecast through April indicates that, while downgrading overall surpluses will remain widespread in eastern Australia from Rockhampton through the Murray-Darling Basin. Anomalies will be intense south of Rockhampton. Surpluses on the path of the Darling River will retreat. Surpluses will persist in the Grampians of western Victoria. Moderate deficits are forecast on the coast from Melbourne into South Australia. In Tasmania, moderate deficits will persist in the state’s western half and intense deficits from the Derwent Estuary to Hobart. Western Australia (WA) will continue to see intense surpluses in the Avon River catchment. Deficits will persist along the coast around Busselton and south of the Blackwood River, but deficits elsewhere in the west will nearly disappear. A wide path of surplus will emerge on WA’s northwestern coast stretching from Eighty Mile Beach.

In New Zealand, deficits in South Island will downgrade but remain widespread. Moderate deficits will increase in North Island from the Waikato River through Taranaki region in the west. In New Caledonia, deficits will nearly disappear in the north and surpluses will emerge in the south.

From May through July, surpluses in eastern Australia will shrink considerably, lingering south of Rockhampton, in pockets of the eastern Murray-Darling Basin, and in the Lower Murray region. Some pockets of intense deficit will linger in western Tasmania, including around Lakes Pedder and Gordon. In WA, deficits will retreat from the southwestern tip, surpluses in the Avon River catchment will shrink, and surpluses spanning Eighty Mile Beach will moderate overall. Deficits will shrink considerably in South Island, New Zealand, persisting on the south coast and nearby Stewart Island (Rakiura). In North Island, however, deficits in the west will intensify and surpluses will increase in East Cape.

The forecast for the final months – August through October – indicates that surpluses will increase in the eastern Murray-Darling Basin, becoming widespread. Exceptional deficits will emerge in Arnhem Land, Northern Territory.

Please note that WSIM forecast skill declines with longer lead times.