

# Global Water Monitor & Forecast Watch List

April 15, 2022

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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 March 2022 and an ensemble of forecasts issued the last week of March 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.

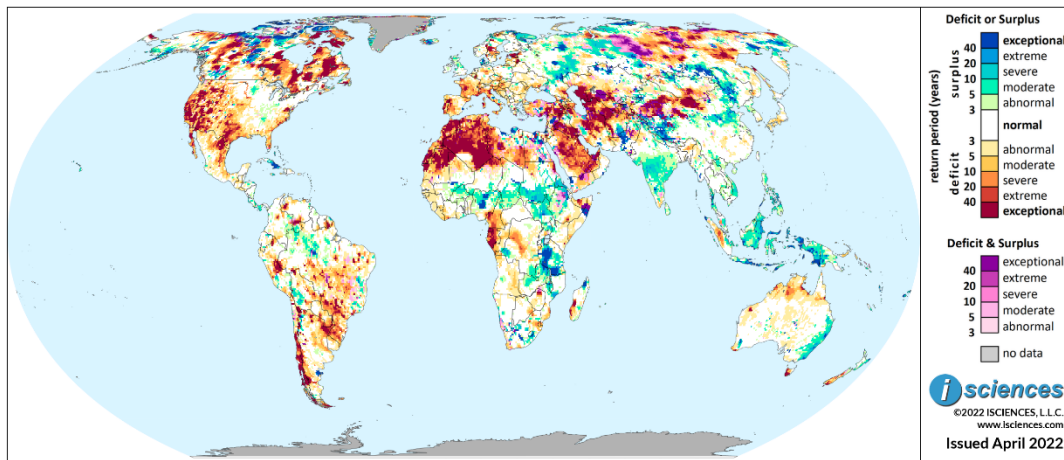
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## Worldwide Water Watch List

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

ISciences Water Anomalies Forecast: January 2022 - December 2022



Based on observed data through March 2022 and forecasts through December 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 June indicates widespread water deficits in the West, Southwest, and Texas with exceptional deficits, particularly in Texas and New Mexico. Deficits are also forecast in Virginia and the Carolinas, and surpluses from the Dakotas into Minnesota.

**Canada:** The forecast through June indicates that although water deficits will shrink somewhat, vast areas will persist nationwide. Near-normal conditions are forecast in southern regions of the Prairie Provinces. Surpluses will increase in southern British Columbia and the Rockies in southern Alberta.

**Mexico, Central America, and the Caribbean:** The forecast through June indicates widespread water deficits across northern Mexico and in some eastern states, with pockets of intense deficit in the north. Surpluses are expected in Central America.

**South America:** The forecast through June indicates widespread water deficits in central Brazil, exceptional in Tocantins. Surpluses are forecast in the central Amazon Basin of Brazil and in Colombia. Deficits will linger in northern Argentina, the Pampas, and Chile.

**Europe:** The forecast through June indicates that water deficits will downgrade on the Iberian Peninsula but increase in Central and Eastern Europe and the Balkans. Deficits will be widespread in France and southern Ukraine. Intense deficits will persist in Estonia.

**Africa:** The forecast through June indicates widespread water deficits across North Africa with large areas of exceptional deficit, but deficits in the Horn will shrink and downgrade. Areas of surplus include Nigeria, Sudan, Ethiopia, Eritrea, Tanzania, and Zambia.

**Middle East:** The forecast through June indicates widespread water deficits in the region with exceptional deficits in Iraq, Saudi Arabia, Syria, Jordan, and pockets of Iran and Turkey. Areas of surplus include Iran's central Zagros Mountains and near Lake Tuz in Turkey.

**Central Asia and Russia:** The forecast through June indicates widespread water surpluses in Russia from the Northern European Plain into the Yenisei River Watershed and in the eastern Volga River region. Exceptional deficits will emerge from Mangystau, Kazakhstan into Uzbekistan and Turkmenistan.

**South Asia:** The forecast through June indicates that water surpluses will shrink in the south but persist in many regions of India. Deficits are forecast in the Far Northeast, Punjab, and Rajasthan. Afghanistan can expect intense surpluses around Kandahar and deficits south of Herat and near Mazar-e Sharif.

**Southeast Asia and the Pacific:** The forecast through June indicates that water surpluses will downgrade in Southeast Asia but remain widespread, increase in the Philippines and New Guinea, and shrink in Indonesia. Deficits will emerge in Sumatra.

**East Asia:** The forecast through June indicates widespread, intense water surpluses in Northeast China and the Yellow River Basin. Surpluses will retreat from the Lower and Middle Yangtze River Basin but emerge in Yunnan. Intense deficits will emerge in Zhejiang, Jiangxi, and Hunan.

**Australia & New Zealand:** The forecast through June indicates that while downgrading, water surpluses will remain widespread in eastern Australia from Rockhampton, Queensland through East Gippsland, Victoria. Deficits are forecast in Tasmania and in South Island, New Zealand.

## Watch List: Regional Details

### United States

The 12-month forecast ending December indicates widespread water deficits in the western half of the U.S., along the East Coast reaching south from the nation’s capital and skirting the Gulf Coast.

Anomalies will be intense in Texas and many regions west of the Rockies. Areas of exceptional deficit include West Texas and the Dallas-Fort Worth Area, the Lower Colorado River Basin, California’s Central Valley, and Idaho’s Salmon River region.

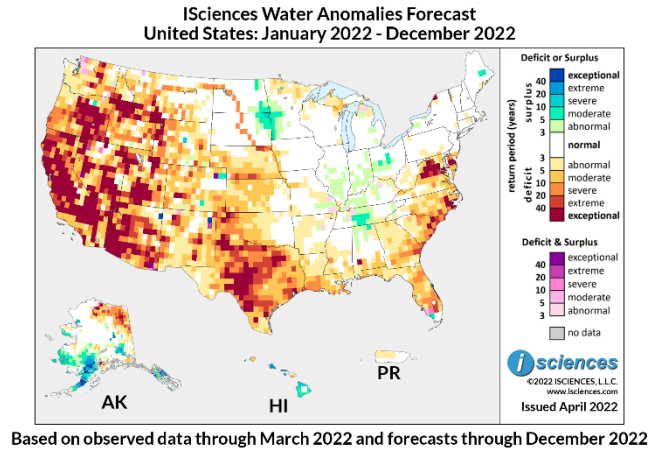
Generally moderate deficits are forecast in the Central Plains States and deficits of varying intensity in the Rocky Mountain States. Though the Dakotas will see near-normal conditions overall, severe deficits are expected along the Missouri River and surpluses from Fargo to Sioux Falls.

On the East Coast, deficits of varying intensity are forecast from the D.C. region through Florida. Anomalies will be exceptional in the Delmarva Peninsula, northern Virginia, and pockets in the coastal Carolinas. In the Gulf region, some moderate deficits are expected in southern Alabama and Mississippi, but deficits will be severe in southern Louisiana.

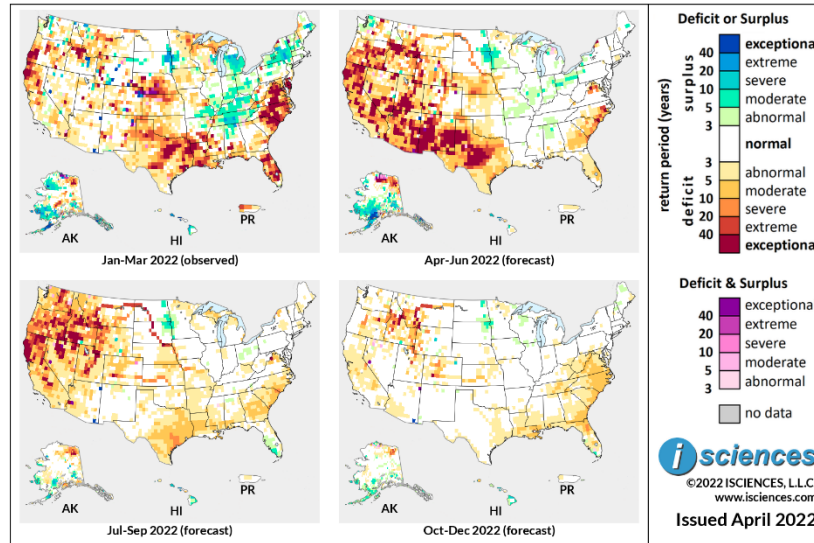
The Ohio River Basin will see some generally mild surpluses with moderate pockets in central Tennessee and central Ohio. In the Great Lakes Region, some mild to moderate deficits are predicted in Michigan’s Upper Peninsula and far northern Minnesota.

Outside the contiguous U.S., Alaska can expect deficits in the northeast, and surpluses near Juneau and Nome, west of Bethel, reaching from the Alaska Peninsula inland to the Kuskokwim River, and at the eastern end of the Alaska Range. Surpluses are forecast in Hawaii.

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



**ISciences Water Anomalies Forecast  
United States: January 2022 - December 2022**



Based on observed data through March 2022 and forecasts through December 2022

The forecast through June indicates widespread deficits of varying intensity west of the Rockies, and in Texas and parts of the Plains. Areas with a forecast of exceptional deficit include central Texas, much of New Mexico and the Llano Estacado into West Texas, southern Utah, northern California, and Idaho’s Salmon River region. Moderate surpluses are forecast in the North Cascades of Washington, but deficits are expected elsewhere in the Pacific Northwest. In the Plains, normal conditions are forecast in the Dakotas though severe deficits will follow the Missouri River into Montana and surpluses are expected from Fargo to Sioux Falls into Minnesota. Nebraska will see moderate to severe deficits. On the East Coast, deficits are forecast in northern Virginia and from the Carolinas into Georgia’s southern half. Moderate deficits are expected in Florida around Lake Okeechobee. States in the Upper Ohio River Basin can expect some pockets of moderate surplus.

From July through September, near-normal conditions will return to New Mexico and West Texas and much of Arizona. Deficits will persist in the West and increase in the Pacific Northwest as surpluses disappear. Exceptional deficits will increase north of San Francisco and in the Snake River region of southern Idaho. Deficits on the Missouri River will intensify, becoming extreme, and severe deficits will emerge on the Arkansas River from Kansas into Colorado. Surpluses spanning the Dakotas/Minnesota border will shrink. Moderate deficits will emerge in Michigan’s Upper Peninsula. Deficits from Virginia through Georgia will moderate, deficits in Florida will retreat, and surpluses will emerge in the western Everglades. Moderate deficits will be widespread in eastern Texas and will emerge in central Louisiana and pockets of southern Mississippi and Alabama. Deficits will be severe from Austin, Texas to the Gulf.

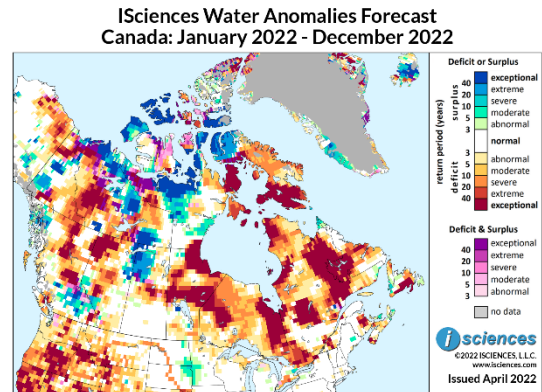
The forecast for the final months – October through December – indicates deficits in the northern Rockies and along the Missouri River through Montana, central Colorado and the Arkansas River, from Virginia into Florida, and southern Louisiana. Surpluses in the Dakotas will shrink.

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

## Canada

The 12-month outlook for Canada through December indicates widespread water deficits in the eastern half of the nation.

Deficits will be exceptional in many regions including southern Newfoundland, the Miramichi River watershed in east-central New Brunswick, the Smallwood Reservoir region in Labrador, the Manicouagan Reservoir region in Quebec, and a vast area near Lake Mistassini. Deficits will be only slightly less intense in Southern Ontario east of Georgian Bay, while a small pocket 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.



Based on observed data through March 2022 and forecasts through December 2022

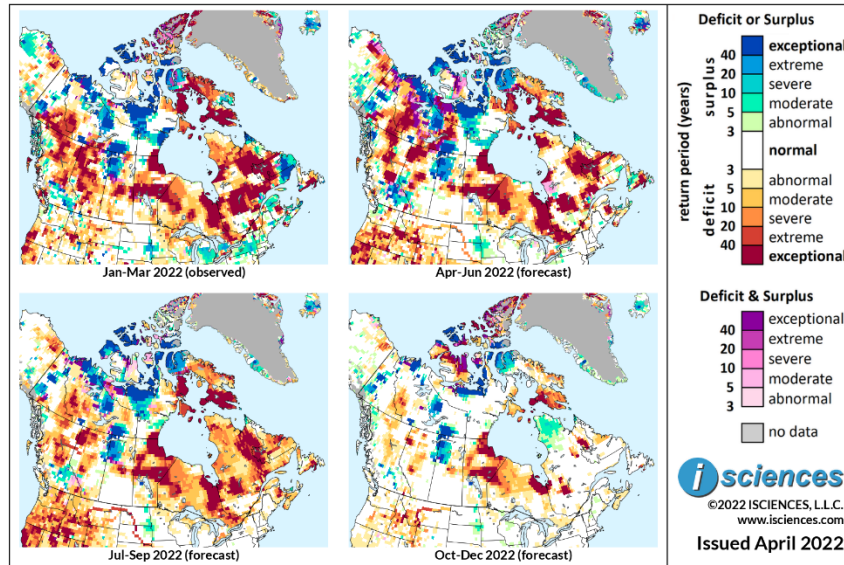
Widespread exceptional deficits will belt central Manitoba and are also forecast in the province's northeast reaching Hudson Bay. Some pockets of severe deficit are expected in southern Manitoba including Winnipeg. Elsewhere in the Prairie Provinces, nearly normal conditions are forecast across southern Saskatchewan. Central Saskatchewan can expect deficits, but widespread surpluses are forecast in the northwest quadrant leading west to Fort McMurray, Alberta. Exceptional deficits are expected in northwestern Alberta, deficits of varying intensity in the Middle Athabasca River region, and surpluses north of Banff.

Surpluses are forecast in the Thompson River Watershed of southern British Columbia leading east into the Columbia Watershed. Deficits are expected at opposite ends of the province's southern region in Vancouver Island and in East Kootenay. The Upper Fraser and Nechako River Watersheds will see intense deficits as will British Columbia's central far north from Williston Lake well into Yukon and Northwest Territories.

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



**ISciences Water Anomalies Forecast  
Canada: January 2022 - December 2022**



Based on observed data through March 2022 and forecasts through December 2022

The forecast through June indicates that although deficits in Quebec will shrink somewhat, vast areas of intense deficit will persist particularly from Quebec into Labrador and surrounding Lake Mistassini. Deficits will also persist in eastern Newfoundland, east-central New Brunswick, and the Lower St. Maurice River east of Montreal. Surpluses will retreat from eastern Labrador and the Gaspé Peninsula, emerge in northwestern Newfoundland, and linger near Toronto. In Southern Ontario, exceptional deficits will increase east of Georgian Bay and widespread deficits will persist in Northern Ontario. Conditions will continue to normalize in southern regions of the Prairie Provinces. Intense deficits will persist in central and northern Manitoba, pockets of central Saskatchewan, and central and northwestern Alberta. Surpluses will persist from northwestern Saskatchewan into Alberta and will increase in the Canadian Rockies of southern Alberta. Surpluses will also increase in southern British Columbia. Deficits will retreat from Vancouver Island but intensify in the Upper Fraser and Nechako River Watersheds and persist from Williston Lake in the far north into Yukon and Northwest Territories.

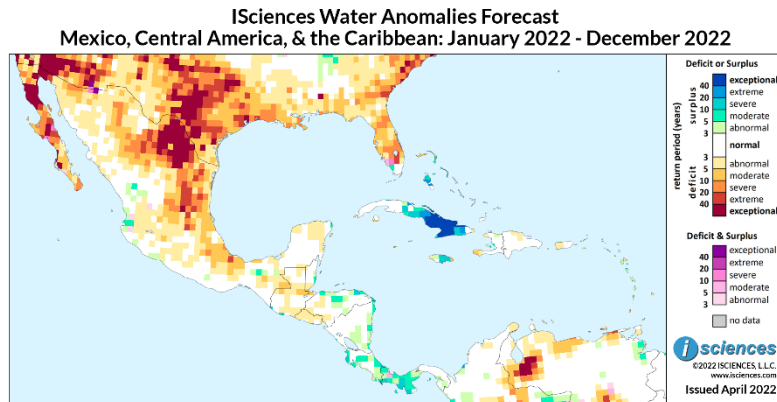
From July through September, moderate deficits will increase in eastern Canada and surpluses will nearly disappear. Deficits in southern Newfoundland and New Brunswick will downgrade slightly. Deficits will remain dominant in Manitoba’s northern half, conditions in southern Saskatchewan will become normal, and surpluses in southwestern Alberta will shrink as deficits elsewhere downgrade. In British Columbia, surpluses in the south will shrink and moderate, deficits will persist in East Kootenay, and deficits in the north will downgrade overall but intensify on the Peace River, becoming extreme.

The forecast for the final months – October through December – indicates that deficits will shrink overall, persisting primarily in Northern Ontario and Manitoba. Surpluses will shrink in southern British Columbia, persist in northwestern Saskatchewan, and emerge in Quebec’s Ungava Peninsula.

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

## Mexico, Central America, and the Caribbean

The 12-month forecast ending December indicates widespread water deficits of varying intensity in the Baja Peninsula and Mexico's north-central and northeastern states. Anomalies will be severe to exceptional in much of Baja and exceptional in the Colorado River Delta. Exceptional deficits are also expected in Coahuila and Nuevo León. Deficits of lesser intensity are forecast for Chihuahua and northern Durango.

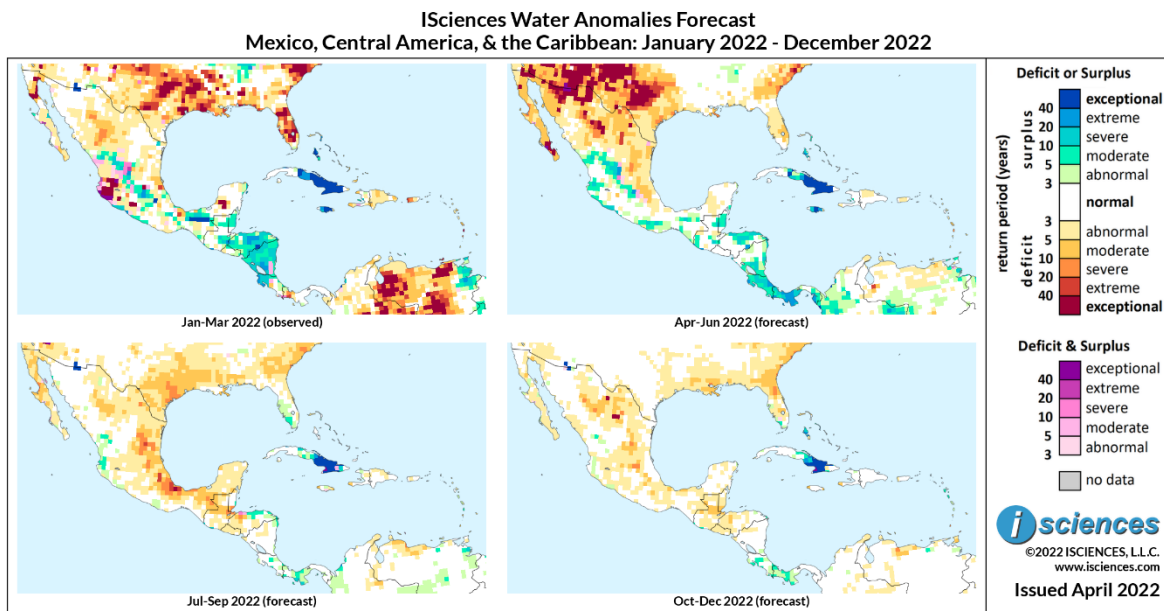


Based on observed data through March 2022 and forecasts through December 2022

From Tamaulipas on the Gulf of Mexico through the land-locked states of San Luis Potosi and Querétaro, deficits will reach extreme intensity, moderating to the south through Veracruz and Puebla, though anomalies will be extreme in the Papaloapan River region of Veracruz.

In Central America, surpluses are expected in western Panama and pockets of Costa Rica, northern Honduras, and along Nicaragua's east coast. Surpluses are also forecast in the Caribbean.

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



Based on observed data through March 2022 and forecasts through December 2022

The forecast through June indicates widespread deficits across northern Mexico and the Baja Peninsula. Deficits will be moderate overall but will reach exceptional intensity in southern Baja, the Lower Colorado River, and northern Sonora and Chihuahua. From central Chihuahua past the Conchos River

into the southeast, anomalies will be severe to exceptional. Moderate deficits are forecast in the east from Nuevo León and Tamaulipas reaching inland and south through San Luis Potosi into Puebla. In west-central Mexico, surpluses will form a path from southern Sinaloa on the Pacific Coast reaching inland through Durango and Zacatecas and south into the Federal District. Surpluses are also expected in coastal regions along the Pacific from Jalisco through Michoacán, and pockets in the southern states. Central America, too, can expect surpluses, widespread from southern Nicaragua through much of Panama where anomalies will reach extreme intensity; across northern Honduras; pockets of Guatemala; and most of Belize. Surpluses are also forecast in the Caribbean.

From July through September, deficits in Mexico will shrink and downgrade considerably. Moderate deficits will linger in northern Baja and southern Chihuahua. Deficits will intensify in the east from Nuevo León and Tamaulipas through Puebla becoming severe or even extreme in some pockets and will emerge in Veracruz and further south. Some pockets of moderate surplus will linger in the west in southern Durango and western Jalisco. Surpluses in Central America will shrink considerably, and some moderate deficits will emerge in pockets of the northern nations. Surpluses will shrink in the Caribbean as well.

The forecast for the final three months – October through December – indicates some primarily moderate deficits in Mexico's central north and in several of the land-locked states in the central east. A few pockets of moderate deficit are forecast in northern Central America and pockets of moderate surplus in the south and in the Caribbean.

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

## South America

The 12-month forecast through December indicates water surpluses in the central Amazon Basin in Brazil reaching into Venezuela's southern tip, deficits in central and southern Brazil, and mixed conditions in the nation's east.

Surpluses will be primarily moderate in the northern Amazon Basin but will reach exceptional intensity in eastern Amazonas in the central reaches of the Madeira River, a southern tributary of the Amazon. Deficits of varying intensity are forecast in the central states, but anomalies will become more intense in the south in Mato Grosso do Sul, along the Paraná and Paranapanema Rivers, and in Rio Grande do Sul. Some pockets of deficit are forecast for the small states in the far northeast and pockets of surplus in central Bahia and Minas Gerais in the east.

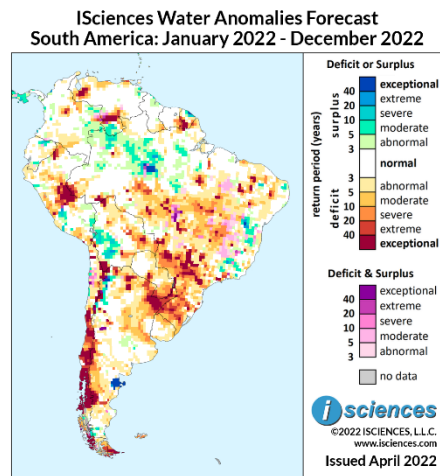
Across the northern arc of the continent, pockets of intense deficit are forecast north of Bogota, Colombia; around Merida, Venezuela, and a belt between the Orinoco and Ventuari Rivers in southern Venezuela; and the border region of Suriname and French Guiana. French Guiana's capital, Cayenne, can expect surpluses.

In Peru, exceptional deficits are forecast in the middle reaches of the Ucayali River Watershed, and deficits of varying intensity in pockets of the north, through the Cordillera Central region near Lima, and in the far south. Surpluses are expected near Huancayo in the central Peruvian Andes. Surpluses are also forecast from Lake Titicaca in the south through La Paz, Bolivia where anomalies will be severe, and past Lake Poopó where surpluses will be extreme in the Upper Pilcomayo River region. Deficits are forecast in pockets elsewhere in Bolivia, particularly in the east.

Deficits in Paraguay's eastern two-thirds will reach well into northern Argentina. Anomalies will be exceptional on the Paraná River downgrading to severe as it flows to the Atlantic, and exceptional around the Itaipu Dam reservoir and in the Iberá Wetlands of northeastern Argentina. Moderate deficits will skirt the eastern Pampas region. A pocket of exceptional surplus is forecast in coastal Chubut Province in Patagonia.

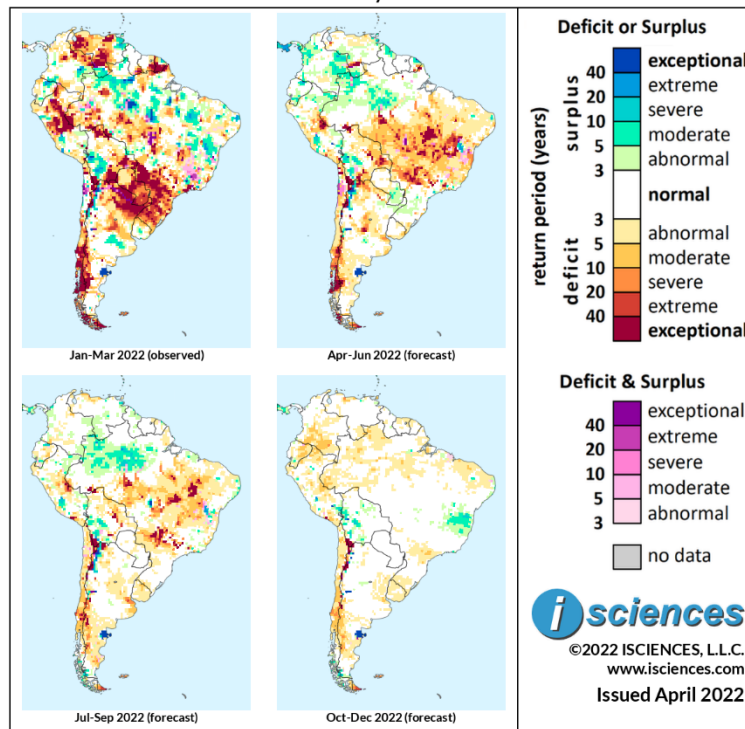
Mixed conditions are forecast in northern Chile and exceptional deficits in a vast path from La Serena through most of the nation's southern extent. Deficits in Chilean Patagonia will cross into Argentina. Exceptional deficits are forecast in Tierra del Fuego and severe deficits in the Falklands.

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



Based on observed data through March 2022 and forecasts through December 2022

**ISciences Water Anomalies Forecast**  
**South America: January 2022 - December 2022**



Based on observed data through March 2022 and forecasts through December 2022

The forecast through June indicates widespread deficits of varying intensity in central Brazil. Deficits will be especially intense in Tocantins, Bahia west of the São Francisco River, and eastern Mato Grosso do Sul. Extreme surpluses are forecast in a pocket of central Bahia and moderate surpluses in the central Amazon Basin. Surpluses are also forecast in several regions of Colombia and pockets in Ecuador and coastal region of Guyana and French Guiana. Intense deficits are expected in eastern French Guiana and in southern Venezuela between the Orinoco and Ventuari Rivers.

In Peru, surpluses will emerge in the northeast and persist near Huancayo; deficits will linger in the center of the county with exceptional deficits in the Department of Ucayali in the Amazon rainforest. Bolivia can expect deficits in the northeast and southeast, and surpluses will persist in pockets of the southwest including La Paz. Mixed conditions are forecast in northern Chile and deficits in the southern half of the country, spilling into Argentina. Some deficits will linger in Argentina on the Pilcomayo and Bermejo Rivers in the north, in Córdoba Province, and near Buenos Aires. A pocket of intense surplus will persist in coastal Chubut.

From July through September, anomalies will retreat from much of the northern arc of the continent. Deficits will downgrade in central Brazil but remain widespread with intense pockets, primarily in Tocantins, Piauí, and Mato Grosso do Sul, and moderate surpluses are forecast in the central Amazon Basin. In Peru, deficits will persist in Ucayali and intensify in Arequipa, and surpluses will persist near Huancayo. Deficits will shrink in Bolivia, downgrade in Chile, and retreat from northern Argentina and the central Pampas, lingering near Buenos Aires. Surpluses will persist in coastal Chubut and emerge in

the Southern Patagonia Icefield. Deficits will linger in Patagonia near the Chilean border and in Tierra del Fuego and the Falklands.

The final quarter – October through December – indicates moderate deficits from southern Colombia into Ecuador and Peru, and in Chile. Moderate surpluses will linger in western Bolivia and Chubut, and will increase from southern Bahia, Brazil, into Minas Gerais.

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

## Europe

The 12-month forecast through December indicates widespread water deficits in Portugal, Spain, France, and northern Italy. Deficits will be severe to exceptional in Portugal and western Spain, and severe in Catalonia in Spain's northeast. In France, deficits will cover nearly the entire nation with the exception of the northernmost regions. Deficits will be especially intense in the Vienne River region, a tributary of the Loire, and in the French Riviera.

Many regions of Italy can also expect deficits.

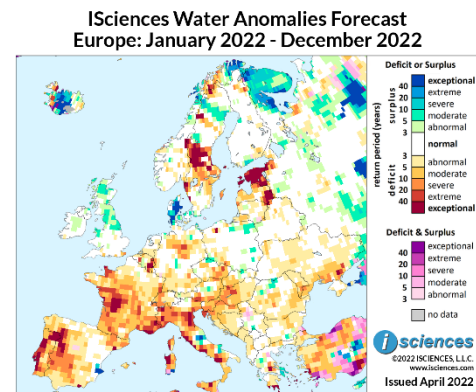
Deficits of varying intensity are forecast in northern Italy, along the Tyrrhenian Coast, in the southern Apennines, and in Sicily and Sardinia. Deficits will be extreme to exceptional in the Lower Po River region. Intense surpluses are expected in Umbria.

Deficits are forecast for many areas in Central Europe with exceptional deficits in southern Belgium and deficits of varying intensity in western Switzerland, north-central Germany, eastern Czech Republic, western Slovakia, throughout Hungary, and from southern Austria into northern Bosnia and Herzegovina.

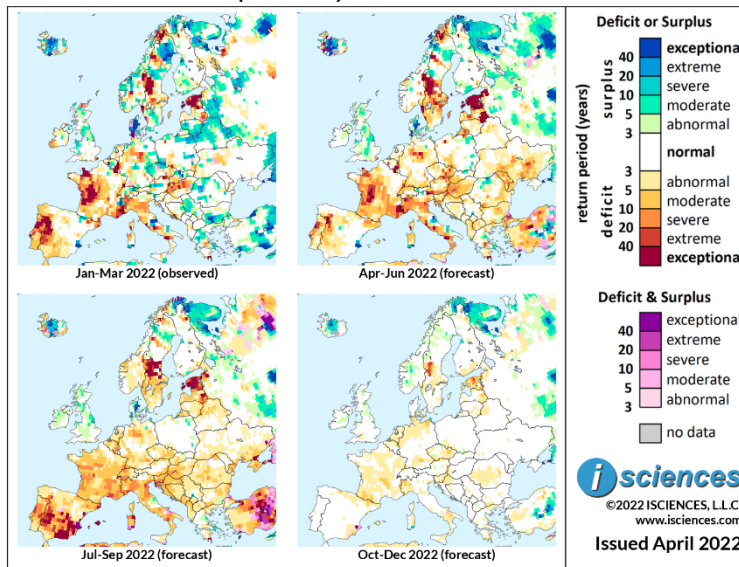
In Eastern Europe, deficits are forecast from southern Ukraine into Moldova, and pockets of moderate deficit are predicted for Romania and Bulgaria. Mixed conditions are expected in Greece. Scattered pockets of moderate surplus are forecast in Central and Eastern Europe, particularly in Poland and northern Romania. Moderate surpluses are also forecast in Wales, Northern England, and Scotland.

In Northern Europe, exceptional water deficits are forecast in central Sweden's Dalälven River Watershed and Estonia, and deficits of varying intensity in Latvia. Intense surpluses are forecast in Denmark, central Iceland, and Arctic Norway, and in European Russia in Murmansk, the Middle Volga River region, and Vychegda Lowland. Areas expected to have surpluses of lesser intensity include southern Norbotten in Sweden and the Svernaya Dvina River Watershed in northern Russia.

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



**ISciences Water Anomalies Forecast  
Europe: January 2022 - December 2022**



Based on observed data through March 2022 and forecasts through December 2022

The forecast through June indicates that water deficits will downgrade somewhat on the Iberian Peninsula but increase in Central Europe and several areas in Eastern Europe and the Balkans as surpluses shrink. Widespread deficits will persist in France with intense anomalies in the Vienne River region and the Upper Durance River region in the French Alps. Severe deficits will increase in northern Italy in the Po River Watershed and deficits are forecast on the Tyrrhenian Coast. Other areas with a forecast of deficit include Czech Republic, Slovakia, Hungary, Austria, and Germany, pockets in the Balkans, throughout Moldova, and central and southern Ukraine. Anomalies will be intense on the Drava River in Austria. Northern Europe can expect deficits in the Baltics and much of Sweden’s southern half with exceptional deficits in Estonia, eastern Latvia, and central Sweden. Surpluses are forecast in European Russia, Denmark, central Iceland, and pockets of the U.K.

From July through September, deficits will persist in Portugal and increase in Spain, covering the nation’s southern half, and will include exceptional anomalies. Deficits will remain widespread in France but will downgrade, becoming moderate to severe overall. Deficits of similar intensity are expected in Italy and Switzerland, and generally moderate deficits in Central Europe and the Balkans. Deficits will shrink in Ukraine, increase in Crimea, and persist in central Sweden, Estonia, and Latvia. Surpluses will downgrade somewhat in Murmansk and will shrink in European Russia as moderate deficits emerge in the north.

The forecast for October through December indicates surpluses in Iceland, and in Murmansk, the Vychedga Lowland, and the Volga Upland and Trans Volga regions of Russia. Deficits will linger in Estonia and central Sweden.

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



## Africa

The 12-month forecast through December indicates widespread water deficits throughout the northwest from Mauritania through Morocco, Algeria, and Tunisia well into Libya and will include many areas of exceptional deficit. Mixed conditions are expected elsewhere in Libya and in Egypt.

Surpluses are forecast in the central and eastern Sahel, dipping south well into Nigeria and through South Sudan. Anomalies will be exceptional around Lake Débo in the Inner Niger Delta of central Mali; in central Nigeria surrounding the capital, Abuja; and near the city of Kano in northern Nigeria. Surpluses are forecast along the Nile and Atbara Rivers in Sudan and will be widespread in southern Sudan and South Sudan, and northern Uganda. Anomalies will extend into Eritrea and the Tigray and Afar regions of northern Ethiopia, while transitions (pink/purple) are expected in the Ethiopian Highlands.

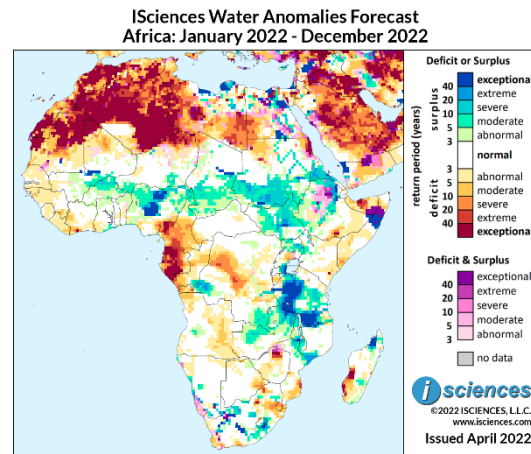
In the Horn of Africa, intense deficits are forecast in Somaliland and a pocket south of the Genale River in southern Ethiopia, and moderate to severe deficits in southern Somalia. Transitional conditions along with exceptional surpluses are forecast for the Nugaal Valley.

Along the Gulf of Guinea, deficits will be widespread through Cameroon, becoming exceptional in Equatorial Guinea and Gabon. In the heart of the continent, severe deficits are forecast in the Tshuapa River region of the Congo Basin in Democratic Republic of the Congo (DRC). Surpluses are expected in Brazzaville and Kinshasa in the west, along the Lukuga River in eastern DRC near Lake Tanganyika, and in the southeast.

Widespread surpluses are expected in Tanzania, exceptional in the west and south. Surpluses of generally lesser intensity are forecast for Zambia, Malawi, and central Mozambique. Deficits are predicted north of Harare in Zimbabwe, and in southeastern Botswana, southeastern Mozambique, southwestern Madagascar, Eswatini and nearby regions in South Africa. Anomalies will be intense near Harare. In Angola, moderate deficits are forecast in the northwest and central east.

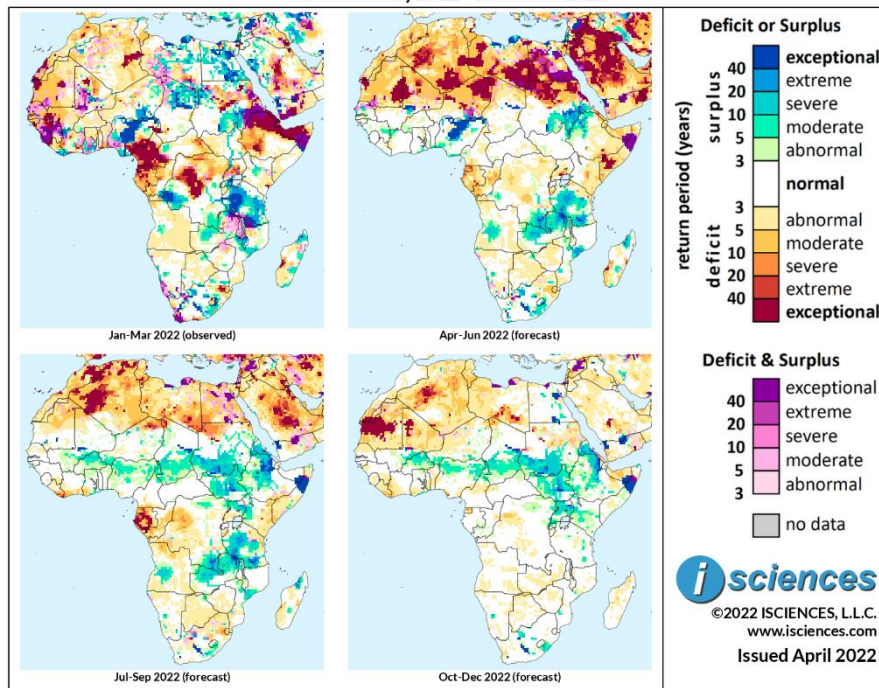
Many pockets of surpluses are forecast in South Africa particularly in Northern Cape and Eastern Cape and into Lesotho. A pocket of intense surplus is forecast in northern Madagascar and a moderate pocket around Fianarantsoa in the south.

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



Based on observed data through March 2022 and forecasts through December 2022

ISciences Water Anomalies Forecast  
Africa: January 2022 - December 2022



Based on observed data through March 2022 and forecasts through December 2022

The forecast through June indicates widespread deficits across North Africa with large areas of exceptional deficit, surpluses in coastal Libya, and transitional conditions in parts of Egypt. Intense surpluses will persist in north-central Nigeria and surpluses are forecast from southeastern Sudan into Ethiopia and western Eritrea as deficits in the Horn shrink and downgrade. A pocket of exceptional deficit will emerge in southern Somalia. Deficits will retreat from Cameroon and downgrade in its southern neighbors. Some pockets of deficit are expected in central DRC, southern Uganda, and Kenya. Surpluses are forecast for Tanzania, Zambia, and southeastern DRC, and will increase in Angola around Huambo. Surpluses elsewhere include central Mozambique, northern Madagascar, Lesotho, Eastern Cape and pockets in Western and Northern Cape, South Africa. Moderate deficits are forecast for Eswatini and nearby regions in South Africa, and deficits will persist in southwestern Madagascar.

The forecast for July through September indicates exceptional deficits in northern Morocco and Algeria while deficits elsewhere in the north downgrade. Deficits in Gabon will become exceptional, and deficits will emerge in southern Liberia and from coastal Côte d'Ivoire into Ghana. Surpluses are expected in a belt from Burkina Faso through Eritrea, becoming widespread in southern Sudan, South Sudan, and western Ethiopia. Surpluses will emerge from northern Uganda into Kenya; persist in Tanzania, Zambia, southern DRC, central Mozambique, and Huambo, Angola; and linger in northern Madagascar, Lesotho, and pockets in South Africa.

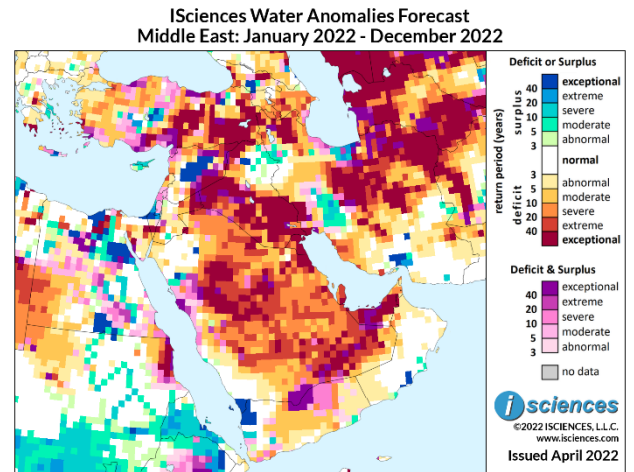
In the final quarter – October through December – deficits are forecast from Mauritania into southern Libya, and surpluses will persist from Burkina Faso into Ethiopia and through Uganda.

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

## Middle East

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

On the Arabian Peninsula, severe to exceptional deficits are forecast throughout much of Saudi Arabia though mixed conditions are expected in the provinces on the central shore of the Red Sea. In Yemen, exceptional surpluses are forecast northeast of Sanaa, and deficits and transitional conditions (pink/purple) in the center of the country. Extreme deficits are expected in Qatar, and exceptional deficits overall in United Arab Emirates.



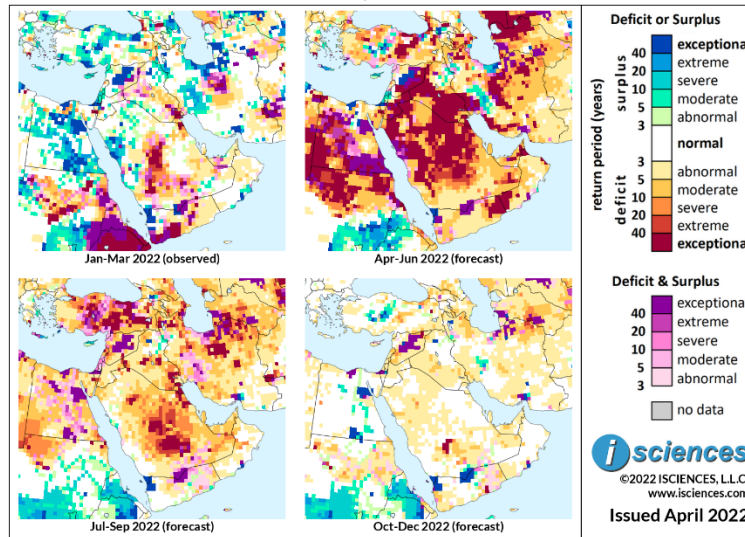
In Iraq, extreme to exceptional deficits are forecast west of the Euphrates and in the south leading through Kuwait. Deficits will be severe near Baghdad, and pockets of moderate surplus are forecast north of Kirkuk. Iran can expect exceptional deficits in the central provinces and in the far northwest. Surpluses are expected from Tehran to the Caspian Sea Coast, in a pocket of the south near the Strait of Hormuz, and in the central Zagros Mountains.

Mixed conditions are forecast in the Levant including surpluses in central Israel, Cyprus, and central Syria with deficits elsewhere in Syria. In Turkey, moderate to severe deficits are forecast in the northwest, surpluses from Konya past Lake Tuz, and exceptional deficits in a large area west of the Keban Dam and also southwest of Lake Van.

Mixed conditions are forecast in Georgia, and deficits in Armenian and Azerbaijan.

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

**ISciences Water Anomalies Forecast  
Middle East: January 2022 - December 2022**



Based on observed data through March 2022 and forecasts through December 2022

The forecast through June indicates widespread deficits in the region, especially intense in Saudi Arabia and Iraq. Anomalies will be exceptional in many regions of Saudi Arabia and spanning the border of Yemen and Oman. Exceptional deficits will also be dominant west of the Euphrates River in Iraq and in the nation’s south, while mixed conditions are forecast in the northeast. In Iran, deficits are expected along the Persian Gulf, from the Kuh Rud Mountains through the vast northeast, and in the far northwest. Deficits will be exceptional in Isfahan Province in the center of the country, Bushehr Province on the Persian Gulf, and east of Lake Urmia. Surpluses are forecast along the central Caspian Coast and through the central Zagros Mountains. In the Levant, intense deficits are expected in Jordan and eastern Syria, surpluses in central Syria, West Bank, northern Israel, Gaza, and Cyprus. Deficits are forecast throughout much of Turkey including exceptional deficits from the Upper Cehan River region in Anatolia to the Upper Kelkit River region. Surpluses are expected from Konya past Lake Tuz. Mixed conditions are forecast in Georgia and deficits in Armenia and Azerbaijan.

From July through September, transitional conditions are forecast in many areas of former surplus as deficits increase. Deficits will downgrade overall but intense anomalies are forecast in Riyadh Province, Saudi Arabia; Isfahan Province, Iran; Kuwait; Baghdad; and many pockets in Turkey, notably around Ankara and Istanbul. Surpluses are forecast near Bandar-e-Abbas, Iran; north of Sanaa, Yemen; pockets in northeastern Iraq; Cyprus; and central Georgia on the Kura River. Deficits in the Lesser Caucasus region will range from mild to extreme.

In the final quarter – October through December – deficits are expected to shrink, returning many areas to normal water conditions. Surpluses will re-emerge in pockets of Turkey, Iran, and Yemen.

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

## Central Asia and Russia

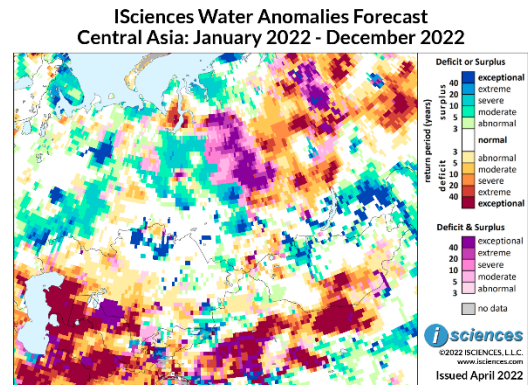
The 12-month forecast through December indicates exceptional water deficits in western Kazakhstan’s Mangystau Region and in the Middle and Lower Reaches of the Syr Darya River in the south. In both regions, deficits will downgrade as they reach north. Exceptional surpluses are expected in Akmola and Kostanay Regions in far northern Kazakhstan, and moderate deficits in the nation’s northernmost tip.

South of Lake Balkhash, moderate deficits are forecast though conditions will be mixed in the

Alatau Mountains nearby and severe surpluses are forecast near Kapchagay Reservoir, moderating as they follow the Ili River to the Chinese border. Deficits will be intense throughout much of Turkmenistan and several regions of Uzbekistan though surpluses are expected around Aydar Lake in southeastern Uzbekistan. In Tajikistan, deficits and transitional conditions (pink/purple) are forecast. Mixed conditions are expected in Kyrgyzstan including surpluses in the east near Lake Issyk Kul.

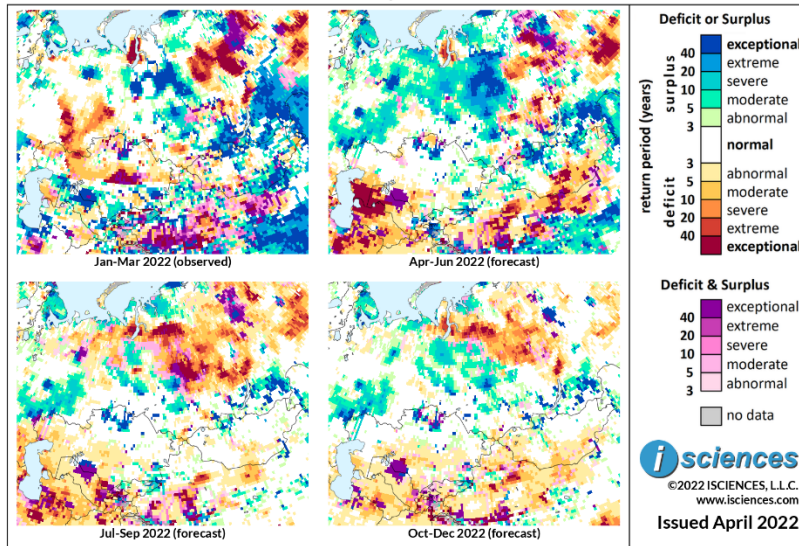
West of the Urals in Russia, surpluses are forecast in the Vycheгда Lowland and coastal north, the Middle Volga River Region, Trans-Volga, and Volga Uplands. Anomalies will be exceptional in the Vycheгда Lowland, Middle Volga, and southeast of Saratov. East of the Urals, moderate deficits are forecast in the Tura River region reaching to Tyumen, and extreme deficits in the north spanning the Gulf of Ob. Widespread surpluses are forecast in much of the Western Siberian Plain with transitions at its eastern edge leading to widespread deficits of varying intensity in the Central Siberian Plateau. In Irkutsk Oblast north of Lake Baikal, severe to exceptional deficits are forecast, but surpluses of varying intensity are expected from Baikal through Russian regions bordering China. 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.



Based on observed data through March 2022 and forecasts through December 2022

**ISciences Water Anomalies Forecast  
Central Asia: January 2022 - December 2022**



Based on observed data through March 2022 and forecasts through December 2022

The forecast through June indicates the emergence of widespread surpluses in Russia from the Northern European Plain into the Yenisei River Watershed and in the eastern Volga River region, a transition from prior deficit. Widespread, intense surpluses will increase from the Vakh River through the Lower Yenisei Watershed. Anomalies will also be intense in the Middle Volga east of Nizhny Novgorod. Intense deficits spanning the Gulf of Ob will shrink and downgrade somewhat and deficits in the Central Siberian Plateau will shrink. In Irkutsk Oblast, however, deficits will increase. Surpluses are forecast east of Baikal and widespread, intense deficits will increase west of the Sea of Okhotsk. In Kazakhstan, moderate to exceptional deficits are forecast in Mangystau Region and moderate deficits in the Middle and Lower Reaches of the Syr Darya River in the south and in the nation’s northernmost tip. Areas of surplus include pockets in northern Kostanay and northern Akmola Regions, the Alatau Mountains, and along the Ile River. Western Uzbekistan and Turkmenistan will see exceptional deficits, moderating in the east. Mixed conditions are expected in Tajikistan and surpluses in eastern and southwestern Kyrgyzstan.

From July through September, surpluses in Russia will shrink considerably and deficits, including exceptional anomalies, will increase in the Central Siberian Plateau and Irkutsk Oblast becoming widespread. Deficits will emerge in the Pechora River Watershed in the tundra, transitioning from surplus, and in southern Russia near the Caucasus. Deficits will downgrade considerably in Mangystau, Uzbekistan, and Turkmenistan though intense deficits will emerge in eastern Uzbekistan. Surpluses will downgrade somewhat in Kyrgyzstan and mixed conditions are forecast in Tajikistan.

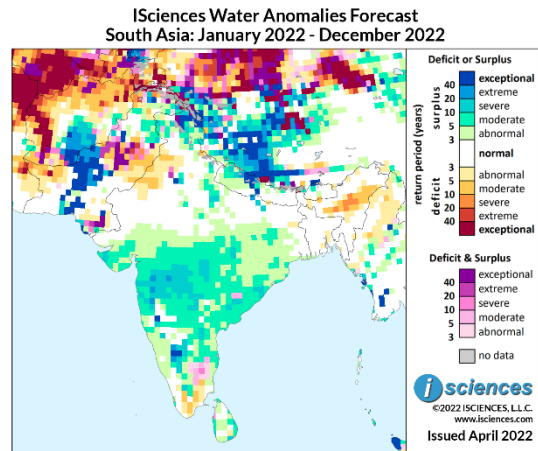
The forecast for the final months – October through December – indicates deficits in Russia from the Gulf of Ob well into the Central Siberian Plateau, and surpluses in the Western Siberian Plain, Vychedga Lowland, and eastern Volga Region. Some pockets of generally moderate deficit are forecast in southern Central Asia, and surpluses in eastern Kyrgyzstan.

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

## South Asia

The 12-month forecast through December indicates widespread water surpluses in central India and parts of the south from Gujarat to the Bay of Bengal and Madyha Pradesh through Karnataka. Surpluses will be moderate overall but severe in Maharashtra and exceptional in east-central Karnataka. Other areas of surplus include the far north, pockets in Haryana and Uttar Pradesh, and along the Gandak River in Bihar.

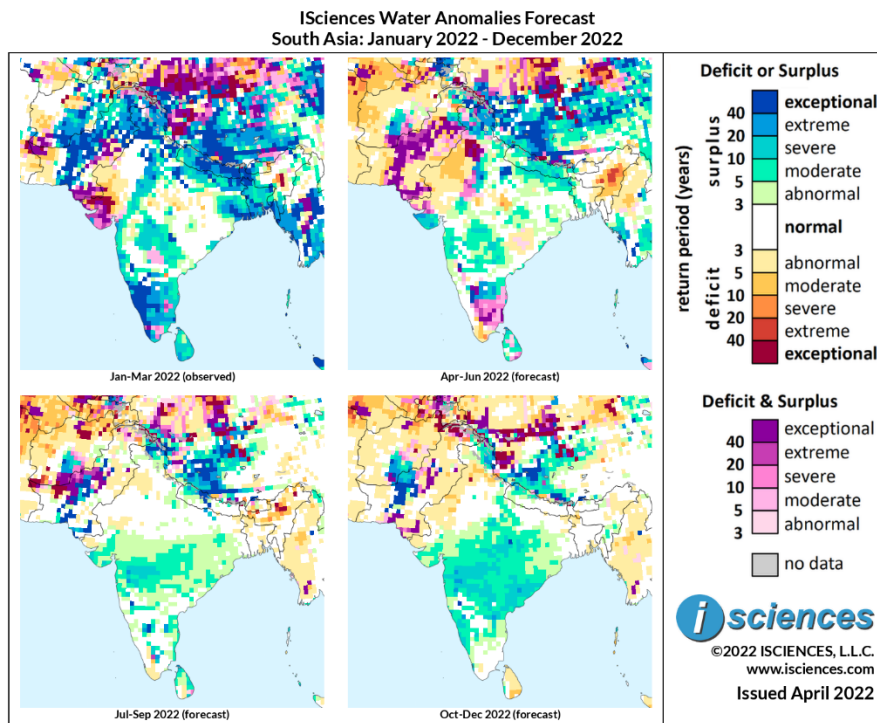
Moderate to severe deficits are expected in the Far Northeast and moderate deficits from northwestern Rajasthan into Punjab, and pockets in Tamil Nadu.



Based on observed data through March 2022 and forecasts through December 2022

Moderate surpluses are forecast in parts of coastal Sri Lanka; surpluses in western Nepal, intense on the Gandak River; and near-normal conditions in Bangladesh. Pakistan’s forecast indicates pockets of moderate surplus in the north including Islamabad, deficits and transitional conditions (pink/purple) in the center of the nation, exceptional surpluses in Balochistan Province surrounding Quetta, and deficits in the southwest. Surpluses in Balochistan will reach into Kandahar Province in Afghanistan where anomalies will be extreme. Deficits are forecast elsewhere in Afghanistan including exceptional deficits in the southwest.

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



Based on observed data through March 2022 and forecasts through December 2022

The forecast through June indicates that, while shrinking in southern India, surpluses will persist in many regions and will include intense anomalies in the far north, central Uttar Pradesh and Rajasthan's eastern corner, and pockets of southern Karnataka. Surpluses of generally lesser intensity are expected in southern Gujarat, Maharashtra and south into its southern neighbors, Bihar, and other pockets. Exceptional deficits will emerge in Punjab and Haryana and moderate deficits will increase in northern Rajasthan. Moderate to extreme deficits will increase in India's Far Northeast. Deficits will increase in a pocket of northeastern Madhya Pradesh and will emerge in India's southern tip as transitions occur.

Surpluses will downgrade in Nepal though remain widespread, but will shrink considerably in Bangladesh, persisting with moderate intensity in the region of the Lower Ganges' tributaries. In Pakistan, surpluses are forecast in the far north, and deficits and transitional conditions in the remainder of the nation. Afghanistan can expect intense surpluses around Kandahar and deficits south of Herat and near Mazar-e Sharif.

From July through September, conditions will normalize in much of India's northern half and in Bangladesh and eastern Nepal. Deficits are forecast in India's Far Northeast and surpluses in Gujarat, Maharashtra into Madhya Pradesh, and pockets throughout the south. Moderate surpluses are forecast around the coast arc of Sri Lanka's northern half. Surpluses and transitional conditions are predicted in central Pakistan and exceptional deficits will emerge in Balochistan Province near the Afghan border. In Afghanistan severe surpluses will persist around Kandahar, moderate deficits in the west, and pockets of exceptional deficit will emerge in the north and the border region of the southwest.

The forecast for the final months – October through December – indicates widespread, coast-to-coast moderate surpluses in central India, pockets of deficit in northern regions of Afghanistan and Pakistan, and surpluses from southeastern Afghanistan well past Quetta, Pakistan.

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



## Southeast Asia and the Pacific

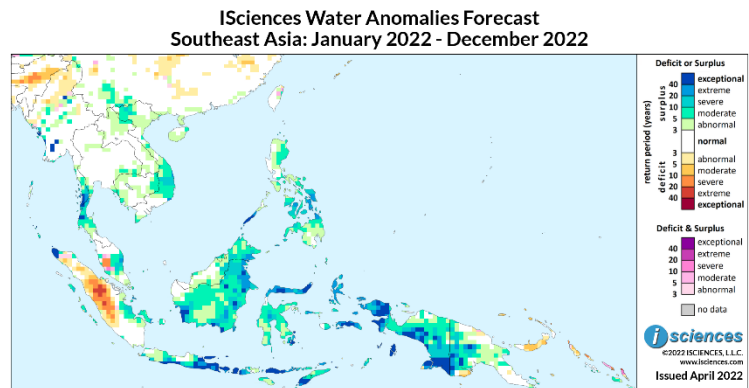
The 12-month forecast through December indicates near-normal water conditions in much of Southeast Asia and surpluses of varying intensity in many regions in the Pacific though deficits are expected in Sumatra.

In Southeast Asia, moderate to extreme surpluses are forecast in Vietnam from the Central Highlands to the coast and in the nation's far northwestern corner.

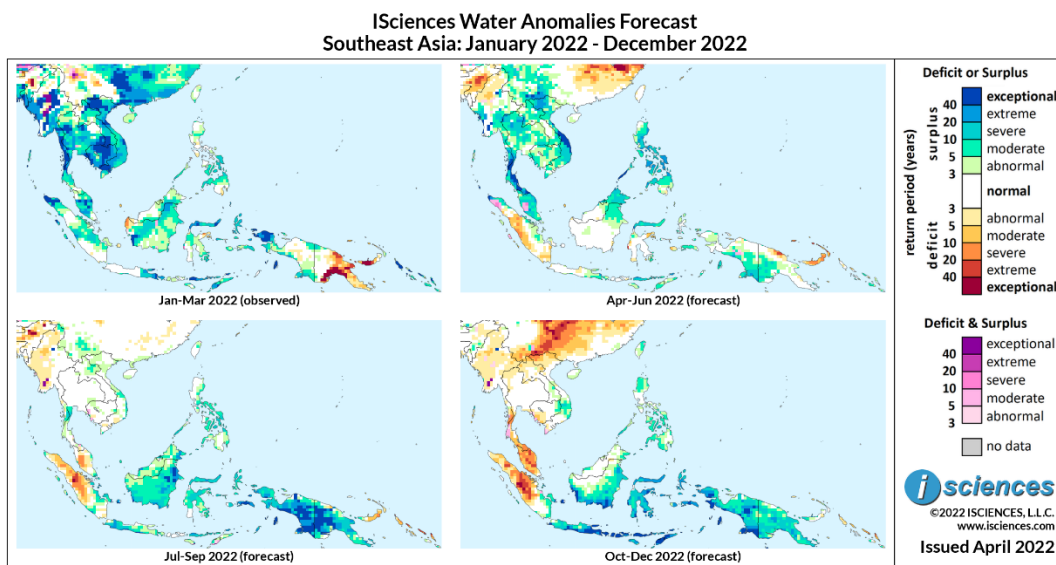
Intense surpluses are expected in Peninsular Myanmar, moderating in Peninsular Thailand. Scattered small pockets of surpluses are expected in central Myanmar, along the western coast, and in the lower Irrawaddy region.

Mixed conditions are predicted for Peninsular Malaysia and surpluses in northern Malaysian Borneo and throughout Indonesian Borneo. In Sumatra, widespread deficits are forecast in the center of the island, exceptional surpluses in its northern tip, and moderate to extreme surpluses on the southeast coast. Surpluses of varying intensity are expected throughout Indonesia, the Lesser Sunda Islands, the Maluku, much of New Guinea, and many regions in the Philippines. Surpluses in the central Philippines will be severe to extreme. Elsewhere, anomalies will be exceptional in many pockets including eastern Java, Flores Island, and the Bird's Head (Doberai) Peninsula of Papua Indonesia. The island of New Britain will see moderate deficits.

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



Based on observed data through March 2022 and forecasts through December 2022



Based on observed data through March 2022 and forecasts through December 2022

The forecast through June indicates that surpluses will downgrade somewhat in Southeast Asia though remain widespread, increase in the Philippines and New Guinea, and shrink in Indonesia. Surpluses will be exceptional along Vietnam's central coastline including Da Nang and pockets in Peninsular Myanmar and Peninsular Thailand. Moderate deficits will emerge northwest of Mandalay, Myanmar but surpluses are expected in Rakhine State in the southwest and in the east along much of the Thai border. Surpluses will be widespread in the Philippines, extreme in the Visayas. Surpluses of lesser intensity are expected in northeastern Borneo, Sulawesi's northern arm, the Lesser Sunda Islands, and in New Guinea from the central Highlands to the south spanning the border of Papua, Indonesia and Papua New Guinea. Deficits will emerge in Sumatra's namesake West and North Provinces and will persist in New Britain and in a pocket on Papua New Guinea's north-central coast.

From July through September, surpluses will nearly disappear in Southeast Asia with a few pockets lingering in Vietnam, northern Laos, and peninsular regions of Thailand and Myanmar. Moderate deficits will persist in a pocket of northwestern Myanmar and will emerge in Peninsular Malaysia near Kuala Lumpur. Deficits will increase in Sumatra though surpluses are expected in some coastal areas of the south. Surpluses will shrink and moderate in the Philippines, persisting primarily in the central region. Surpluses will increase in Indonesia and New Guinea, becoming widespread in Indonesian Borneo and intense in many regions of New Guinea. Deficits in New Britain will shrink and moderate.

The forecast for the final months – October through December – indicates widespread deficits in the Malay Peninsula and Sumatra, and a few pockets in Southeast Asia. Surpluses will be widespread throughout much of Indonesia and New Guinea, and will increase in the Philippines. Moderate surpluses are expected in central Vietnam.

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

## East Asia

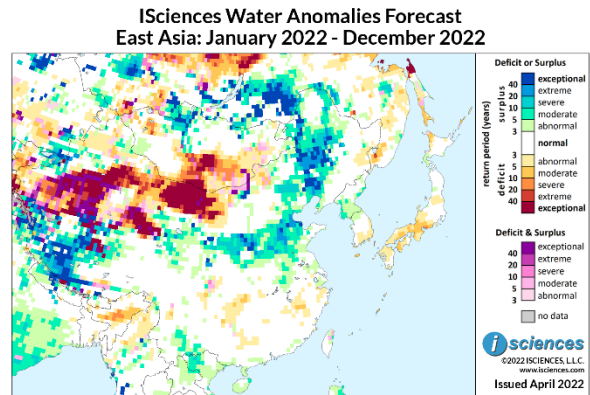
The 12-month forecast for East Asia through December indicates widespread severe to exceptional water surpluses in Northeast China. Anomalies will be particularly intense from eastern Inner Mongolia into Heilongjiang, Jilin, and Liaoning.

Surpluses of varying intensity are forecast in the vast Yellow River (Huang He) Watershed and into the North China Plain, though nearly normal conditions are expected along the river's Ordos Loop. Near-normal water conditions are also expected in the Yangtze River Watershed with a few pockets of moderate deficit in northwestern Hunan and eastern Jiangxi. In the south, some pockets of moderate surplus are forecast in Yunnan.

Widespread, intense deficits will reach from western Inner Mongolia through northern Qinghai and a vast belt across Xinjiang Uygur where transitional conditions (pink/purple) are also forecast. In Tibet (Xizang), surpluses of varying intensity will dominate the western half of the region and will include exceptional anomalies along the Yarlung (Brahmaputra) River.

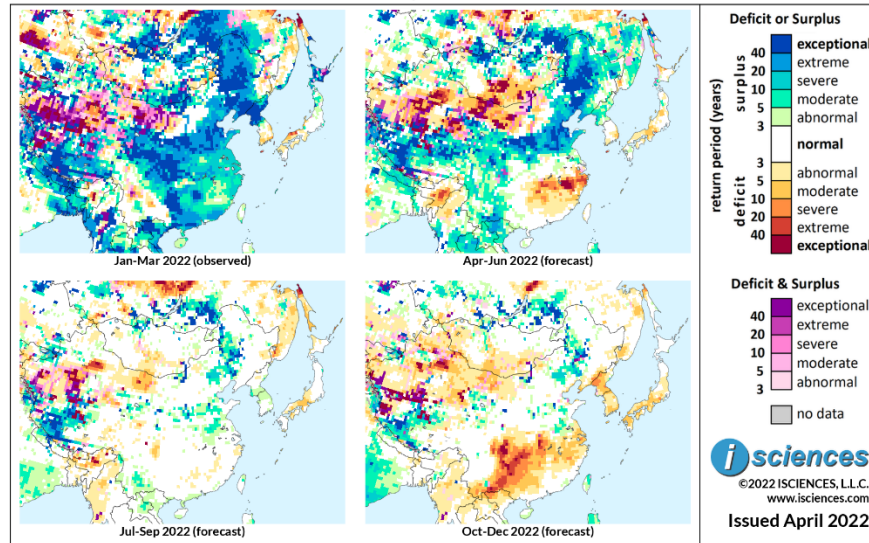
North Korea can expect some moderate surpluses on Korea Bay in the Yellow Sea and along the northeastern coast on the Sea of Japan. Moderate deficits are forecast in southern Honshu, Japan, in Shikoku, and in Hokkaido's northwestern tip. In Mongolia, deficits will be exceptional in the western Gobi Desert and severe in the lakes region in the nation's northwest. Surpluses are forecast in the Khovsgol region in the north and in the central Hangayn Mountains and the central Hentiyn Mountains.

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



Based on observed data through March 2022 and forecasts through December 2022

ISciences Water Anomalies Forecast  
East Asia: January 2022 - December 2022



Based on observed data through March 2022 and forecasts through December 2022

The forecast through June indicates persistent, widespread surpluses from Northeast China through the North China Plain and much of the vast Yellow River Basin. Surpluses will be extreme to exceptional in many regions, particularly in the Northeast. Surpluses will retreat from the Lower and Middle Yangtze River Watershed and from South China but will emerge throughout much of Yunnan and will be intense in the southeast. Deficits will emerge in Zhejiang, Fujian, Jiangxi, and Hunan with exceptional anomalies east of Poyang Lake in Jiangxi. In Tibet, surpluses will shrink in the east but persist in the west. Widespread deficits of varying intensity are forecast from western Inner Mongolia through northern Qinghai and across the breadth of Xinjiang Uygur, mingled with transitional conditions. Deficits will reach north through the Gobi Desert in Mongolia, trailing as far as Ulaanbaatar. Surpluses are forecast in the Hentiyn, Hangayn, and Altai Mountains of Mongolia and in Khovsgol region. North Korea can expect moderate surpluses though anomalies will be severe along Korea Bay. Moderate deficits are forecast in a pocket on South Korea's southeastern coast; pockets in Honshu, Japan; and in Hokkaido's northwestern tip.

From July to September, anomalies will shrink considerably though surpluses will persist in Northeast China, pockets in the Yellow River Watershed, and western Tibet. Moderate surpluses will emerge in northern Anhui and central Yunnan. Deficits from Inner Mongolia through Xinjiang Uygur will shrink and downgrade, and a pocket of moderate deficit will emerge in southeastern Sichuan. Moderate deficits will linger in southern Honshu, centered on Kyoto.

The forecast for the final three months – October through December – indicates widespread deficits in China from Yunnan and Sichuan through Guizhou, extending to Shanghai on the coast. Deficits are also forecast for southern Japan, the Korean Peninsula, and pockets in northwestern China. Surpluses will persist in Northeast China, western Tibet, and pockets of Shandong, Anhui, and Qinghai.

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

## Australia & New Zealand

The 12-month forecast through December indicates widespread water surpluses in eastern Australia from Rockhampton, Queensland through eastern Victoria. Anomalies will be widespread in New South Wales reaching extreme to exceptional intensity in the North Coast region and around Sydney, as well as in East Gippsland, Victoria.

Deficits are expected across northern Australia, intense in some regions. Deficits will be severe to exceptional in the Hammersley Range and Kimberley region of Western Australia, the Victoria River catchment and along the Gulf of Carpentaria in Northern Territory, and the Gregory Range and a pocket north of Townsville in Queensland.

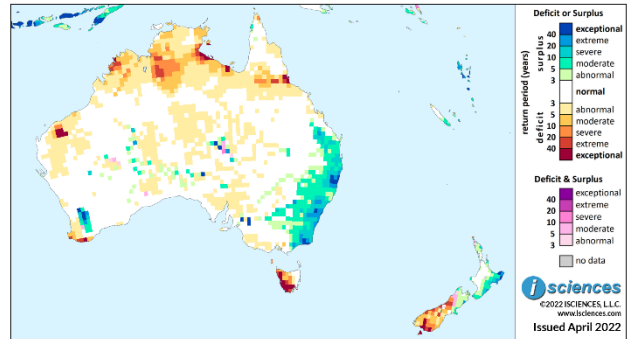
In the nation's southwest corner, severe to exceptional water surpluses are forecast in the Avon River catchment leading south, and deficits will skirt the coast from Busselton to Albany.

Severe to exceptional deficits will dominate western Tasmania, the Derwent Estuary, and Hobart.

In New Zealand, deficits of varying intensity are predicted for South Island's southern half. Anomalies will be exceptional in Southland. Surpluses are expected in North Island from Wellington through East Cape. In New Caledonia, moderate surpluses are forecast in the south.

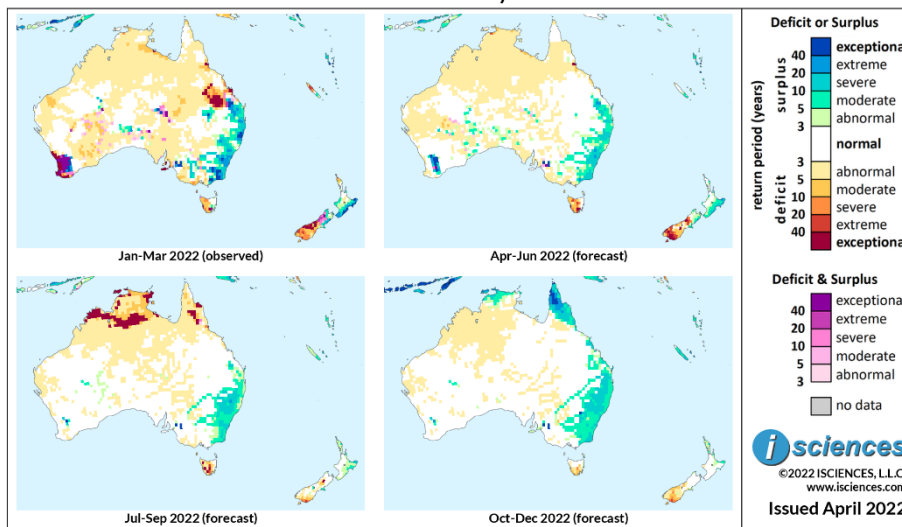
The 3-month maps (below) show the evolving conditions in greater detail.

ISciences Water Anomalies Forecast  
Australia & New Zealand: January 2022 - December 2022



Based on observed data through March 2022 and forecasts through December 2022

ISciences Water Anomalies Forecast  
Australia & New Zealand: January 2022 - December 2022



Based on observed data through March 2022 and forecasts through December 2022

The forecast through June indicates that while downgrading, surpluses will remain widespread in eastern Australia from just south of Rockhampton on Queensland's coast through the Murray-Darling Basin and coastal regions into East Gippsland, Victoria. Anomalies will be moderate to severe and will include widespread, severe surpluses near Sydney and moderate surpluses on the Lachlan River. Western Australia will see intense surpluses re-emerge in the greater Avon River catchment leading south. Deficits will increase in Tasmania with exceptional deficits persisting in Hobart and the Derwent Estuary. In New Zealand, deficits will increase in South Island's southern half as they creep north, and anomalies will be exceptional in Southland and nearby Stewart Island. Northern coastal areas of the island can expect surpluses. Across Cook Strait in North Island, surpluses will shrink and downgrade, persisting from Wellington through East Cape. Surpluses are also forecast in the southern half of New Caledonia.

From July through September, surpluses in eastern Australia will shrink somewhat in Queensland but will remain widespread in eastern New South Wales, increasing between Dubbo and Armidale where anomalies will be severe. Moderate surpluses will persist on the Lachlan River and emerge on the Darling, and surpluses in East Gippsland, Victoria will shrink and moderate. Across northern Australia deficits will emerge, exceptional in the Kimberley region of Western Australia; near Darwin, the Victoria River Watershed, and east Arnhem Land in Northern Territory; and some pockets of Far North Queensland including the Upper Mitchell River region. Surpluses Western Australia's Avon River Watershed will shrink. In Tasmania, deficits will persist, downgrading in Hobart but intensifying around Lakes Gordon and Pedder. Anomalies in New Zealand will shrink considerably with some lingering deficits in South Island and lingering surpluses in Hawke's Bay and East Cape, North Island.

The forecast for the final months – October through December – indicates that surpluses will increase in eastern Australia and will emerge throughout the Cape York Peninsula in Far North Queensland and in coastal Top End, Northern Territory. Deficits will retreat from northern Australia but linger in southern Tasmania, and increase somewhat in South Island, New Zealand. Surpluses are forecast throughout New Caledonia.

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