

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 September 2021 and an ensemble of forecasts issued the last week of September 2021. 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.

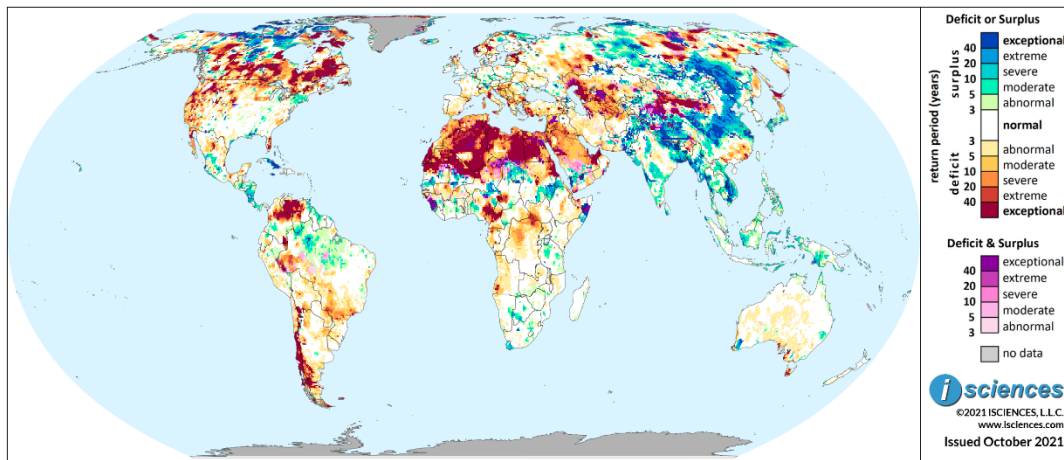
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Worldwide Water Watch List

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

ISciences Water Anomalies Forecast: July 2021 - June 2022



Based on observed data through September 2021 and forecasts through June 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 December indicates that water deficits, while shrinking overall, will persist in the Rockies and Upper Midwest and will increase in the Carolinas and Florida. Surpluses will shrink considerably in the Gulf Coast Region and Northeast but increase in Michigan.

Canada: The forecast through December indicates that water deficits will shrink, most notably in southern regions of the Prairie Provinces and British Columbia, though vast areas of deficit will persist nationwide.

Mexico, Central America, and the Caribbean: The forecast through December indicates water deficits in north-central Mexico, pockets along the Gulf of Mexico, and in the south. Surpluses are forecast from southern Durango through Morelos, and in Nicaragua, Costa Rica, and Jamaica.

South America: The forecast through December indicates that widespread water deficits will shrink considerably and deficits on the Paraná River will become merely mild. However, widespread deficits will persist in Chile. Surpluses will increase in the northern Amazon Basin.

Europe: The forecast through December indicates that water deficits will shrink in the Nordic nations, France, Spain, and Italy, but increase from the Balkans to the Black Sea. Surpluses will shrink in England and Central Europe but persist in southeastern Ukraine.

Africa: The forecast through December indicates widespread water deficits in the continent's northwest quadrant and exceptional deficits from southeastern Nigeria through central Cameroon. Areas of surplus include southeastern Sudan, Botswana, Western Cape, and several regions in eastern South Africa.

Middle East: The forecast through December indicates that water deficits will shrink and downgrade in Turkey, the Levant, northern Saudi Arabia, and northern Iran. Exceptional deficits will emerge in southern Oman and deficits will intensify in Riyadh Province, Saudi Arabia.

Central Asia and Russia: The forecast through December indicates that widespread water deficits will retreat from Central Asia and the Volga River Basin but persist in the Tura River Watershed to Tyumen and in the Central Siberian Plateau. Surpluses are forecast in the Yenisei Basin.

South Asia: The forecast through December indicates that water surpluses will persist in many regions of India and throughout Nepal and Bangladesh. Surpluses will increase south of Bangalore and intensify in Gujarat and from Maharashtra into Telangana. Deficits in northern Afghanistan will downgrade.

Southeast Asia and the Pacific: The forecast through December indicates that water surpluses will remain widespread though intense anomalies will shrink, persisting in the Mekong River region from southern Laos through eastern Cambodia.

East Asia: The forecast through December indicates widespread, intense water surpluses from Northeast China through the Yellow River Basin and the northern Yangtze Basin. Deficits are forecast in South and Southeast China, and surpluses in North Korea and southern Japan.

Australia & New Zealand: The forecast through December indicates water surpluses in the Macintyre River region of New South Wales and the Avon River catchment in Western Australia. Deficits are forecast from Perth past Busselton, and in Tasmania and New Caledonia.

Watch List: Regional Details

United States

The 12-month forecast ending June 2022 indicates water deficits of varying intensity in the U.S. West, Pacific Northwest, and parts of the Rockies and Upper Midwest. Areas where deficits will be exceptional include Spokane, Washington through the Salmon River region in Idaho; the Willamette Valley in Oregon; and northern California's border region.

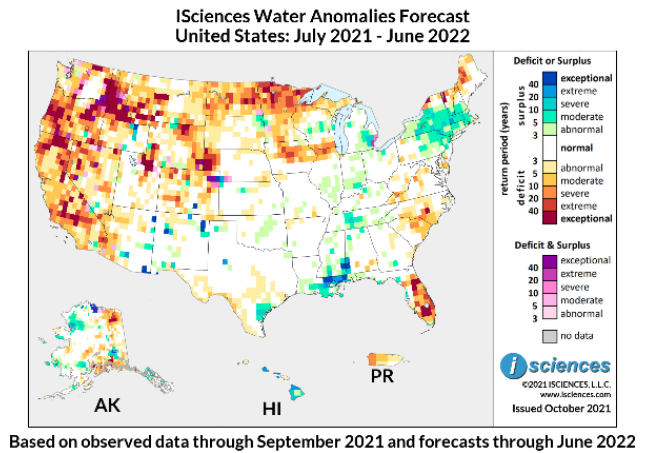
North Dakota can expect deficits throughout much of its extent, more intense in the east, and severe to exceptional deficits are forecast in Minnesota's northern half, moderating in the south. The intensity of deficits will pick up again in central Iowa reaching east through the Wisconsin/Illinois border area. Surpluses are forecast in southeastern Michigan and a few pockets in central Wisconsin and near the source of the Red River in South Dakota.

In the U.S. Northeast, surpluses, primarily moderate, will reach through much of New York into nearby eastern regions to the Atlantic. Deficits are forecast along the St. Lawrence River in New York and will extend through northern Vermont and New Hampshire and western Maine. Anomalies will be exceptional around Lake Champlain. Some pockets of deficit are forecast in Virginia and deficits will span the border of the Carolinas, reaching the coast. In Peninsular Florida, deficits will be widespread and will include exceptional anomalies near Lake George in the north and Lake Okeechobee in the south.

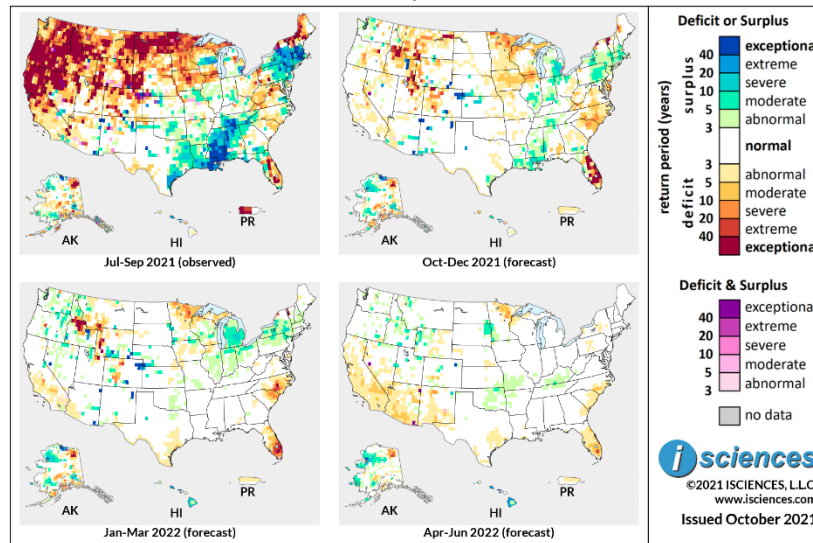
In the Gulf States, surpluses, including intense anomalies, are expected in southeastern Louisiana and southern Mississippi reaching into Alabama to the Tombigbee River. To the north, moderate surpluses are forecast in central Tennessee. In Texas, the Corpus Christi metropolitan area can expect surpluses while moderate deficits will follow the Rio Grande on either side of Amistad Reservoir.

Outside the contiguous U.S., Alaska can expect intense deficits in the northeast and near Anchorage and Valdez in the south. Areas of surplus include the central Arctic Coast east of Barrow, Noatak National Preserve, and the eastern reaches of the Alaska Range. Surpluses are expected in Hawaii, and moderate to severe deficits in Puerto Rico.

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



ISciences Water Anomalies Forecast
United States: July 2021 - June 2022



Based on observed data through September 2021 and forecasts through June 2022

The forecast through December indicates that anomalies will shrink considerably. Deficits will persist in the Rockies, Oregon, and on the Missouri River. Moderate to severe deficits are forecast in Minnesota, Iowa, Wisconsin, northern Illinois, and Michigan’s Upper Peninsula. Surpluses are expected in southeastern Michigan, northeastern Indiana, northern Ohio, and southern Indiana and Illinois. Moderate surpluses will linger in the Susquehanna River Watershed in Pennsylvania, the Finger Lakes Region of New York, and pockets reaching to the Atlantic. Deficits will persist on the St. Lawrence River, around Lake Champlain, and west of Moosehead Lake, Maine. Deficits are also forecast from Delaware through the Carolinas, and Peninsular Florida where anomalies will be intense. In the Gulf Region, moderate surpluses are expected in southern Louisiana and Mississippi and moderate deficits in southeastern Alabama. Surpluses will linger in central Tennessee and Corpus Christi. Other areas of surplus include pockets of the Southwest and the upper South Fork Republican River in Colorado.

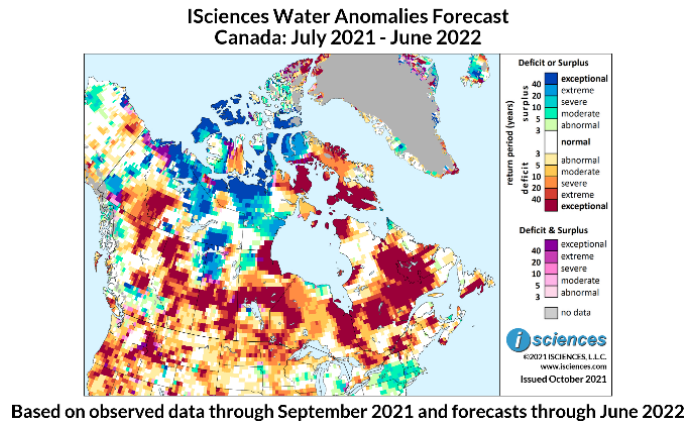
From January through March 2022 deficits are expected in central Idaho and pockets in the Rockies. Moderate surpluses are forecast in the Northwest, south-central Wyoming, and the North Platte and South Fork Republican Rivers. Deficits are also expected in northern Minnesota, the Carolinas, and southern Florida. Anomalies will be intense in the Salmon River Mountains, the Green River Watershed in Wyoming, the middle Cape Fear River region in North Carolina, and around Lake Okeechobee in Florida. Surpluses will be widespread in Michigan’s Lower Peninsula, reaching across its southern border; will emerge in pockets of southern Minnesota and central Wisconsin; and will linger in New York. Deficits will persist around Lake Champlain.

The forecast for the final months – April through June 2022 – indicates deficits, moderate overall, in Southern California, the Southwest, northeastern Minnesota, the Carolinas, and southern Florida. Moderate surpluses are forecast in northeastern South Dakota and scattered, small pockets in the Rockies. Please note that WSIM forecast skill declines with longer lead times.

Canada

The 12-month outlook for Canada through June 2022 indicates widespread water deficits of varying intensity throughout the provinces including vast areas of exceptional deficit.

In the eastern half of the nation, deficits will be exceptional in southern Newfoundland, eastern New Brunswick, northeastern Quebec including the Manicouagan Reservoir region and reaching into western Labrador, from Gouin Reservoir past Lake Mistassini in Quebec, and around Montreal.



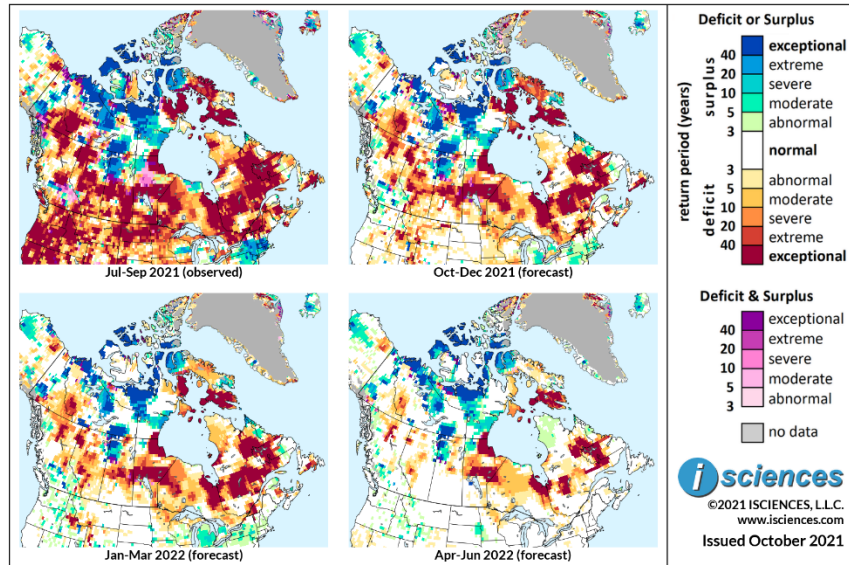
Deficits of varying intensity are expected in much of Southern Ontario; exceptional deficits are expected in a broad column along the border with Quebec reaching James Bay; and deficits will be widespread in Northern Ontario though surpluses will sketch the coastline on Hudson Bay.

In the Prairie Provinces, deficits of varying intensity are forecast across the south including exceptional deficits around Winnipeg (Manitoba), Regina (Saskatchewan), and Calgary (Alberta). Severe to exceptional deficits will belt the central regions. In the provinces' northern reaches, surpluses will dominate from Fort McMurray in Alberta through Saskatchewan's northwest quadrant and in northwestern Manitoba. However, deficits will frame these surpluses with widespread, exceptional anomalies in Manitoba near Hudson Bay and in Alberta's northwestern corner and the Middle Athabasca River region.

Central Vancouver Island in British Columbia can expect intense deficits while deficits of varying intensity are forecast near the province's southern border. Surpluses of varying intensity are expected in the southern Cariboo Region, but intense deficits are forecast farther north in the Fraser River Watershed near Prince George. Deficits will also be intense in the central north, expanding as they reach well into the Yukon and the Northwest Territories. Surpluses are forecast in the Stikine River Watershed in northern British Columbia.

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

**ISciences Water Anomalies Forecast
Canada: July 2021 - June 2022**



Based on observed data through September 2021 and forecasts through June 2022

The forecast through December indicates that deficits will shrink, most notably in southern regions of the Prairie Provinces and British Columbia, though vast areas of deficit will persist nationwide. In the east, exceptional deficits will persist in southern Newfoundland, eastern New Brunswick, Nova Scotia’s southern tip, vast areas of Quebec, and Montreal. In Southern Ontario between Toronto and Ottawa, exceptional deficits will downgrade. West of Toronto, moderate surpluses will emerge in the Grand River Watershed and deficits north of Lake Erie will moderate. Deficits will persist in Northern Ontario, downgrading in some areas, and surpluses near Hudson Bay will nearly disappear. In the Prairie Provinces, deficits will shrink in the south, returning some areas of Saskatchewan and Manitoba to normalcy. Intense deficits will persist in the central regions of the Prairies though the extent of exceptional anomalies will shrink in Alberta and Saskatchewan; deficits in the north will shrink somewhat as surplus patterns remain much the same. In British Columbia, deficits will shrink overall, and surpluses will increase somewhat in the south.

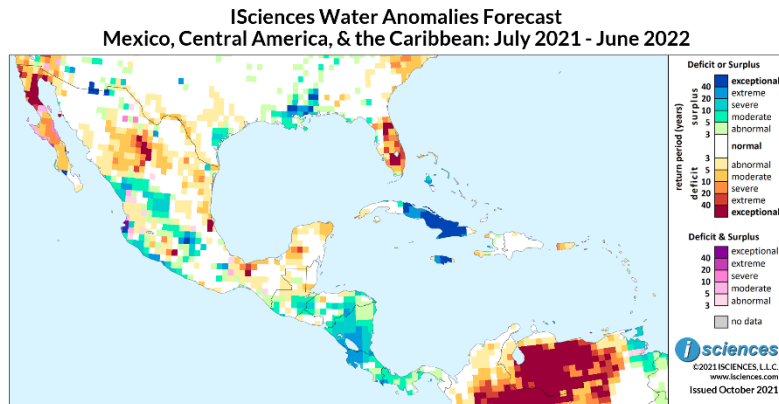
From January through March 2022, deficits will shrink and downgrade from Toronto to Montreal and deficits north of Lake Erie will disappear as surpluses increase. Deficits will downgrade slightly in the Prairie Provinces and shrink in southern regions. Surpluses in Manitoba’s northwestern corner will diminish. Deficits will retreat from Vancouver Island and downgrade in the Fraser Watershed near Prince George and in British Columbia’s far north.

The forecast for the final months – April through June 2022 – indicates that deficits will shrink overall, particularly in the west, though large pockets of intense deficit will persist in Manitoba, Ontario, Quebec, and Labrador. Surpluses will increase in northwestern Manitoba.

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

Mexico, Central America, and the Caribbean

The 12-month forecast ending June 2022 indicates water deficits of varying intensity in Mexico's Baja Peninsula including exceptional anomalies in Baja California. In the mainland north, moderate to exceptional deficits are expected in a broad region at the intersection of Chihuahua, Coahuila, and Durango. Small, scattered pockets of deficit will pepper the northeastern states.

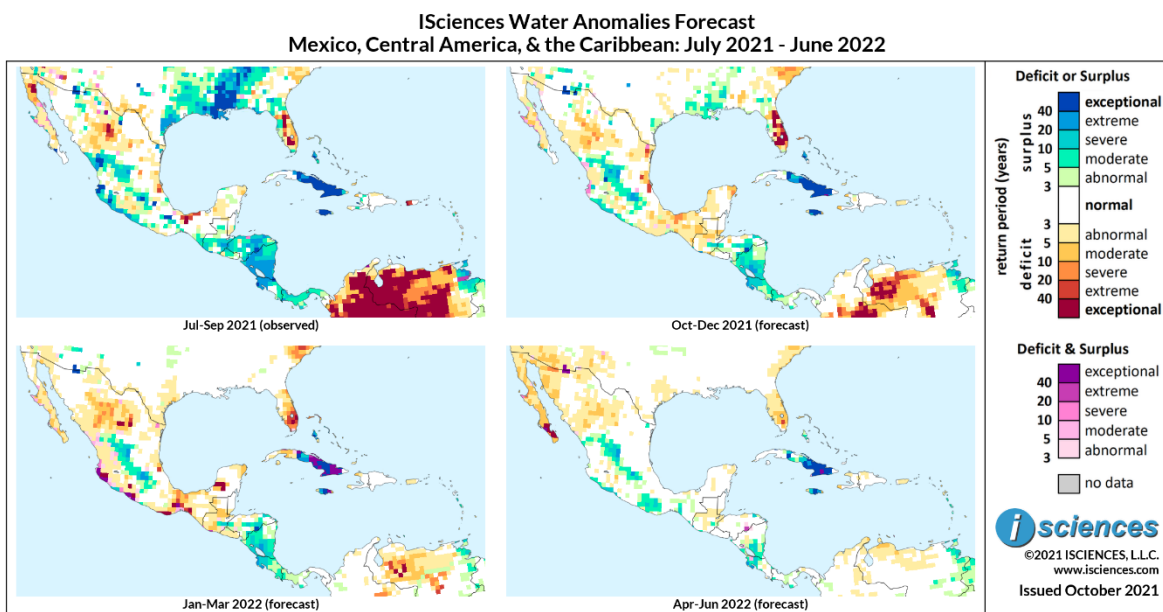


Based on observed data through September 2021 and forecasts through June 2022

Surpluses are forecast from coastal Sinaloa into neighboring southern Durango and land-locked Zacatecas leading south through the state of Mexico, where anomalies will be intense, and into Morelos. Surpluses are also forecast along the central Pacific Coast and in northern Oaxaca. On the Gulf of Mexico, pockets of deficit are expected along the southern coast in Veracruz and into the Yucatán.

In Central America and the Caribbean, severe to extreme surpluses are forecast from Nicaragua through Costa Rica. Surpluses of generally lesser intensity are forecast for many regions of Honduras, pockets of southern Guatemala, and Panama. Intense surpluses are expected in Jamaica and Cuba.

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



Based on observed data through September 2021 and forecasts through June 2022

The forecast through December indicates that deficits will retreat from the northern Baja Peninsula in Mexico and will moderate in the mainland from southern Chihuahua into northern Durango. Surpluses will persist in a path from southern Durango through Morelos but will shrink on the central Pacific Coast. On the Gulf of Mexico, deficits will emerge in northern Tamaulipas, increase in Veracruz's northern tip, downgrade from southern Veracruz into Tabasco, and intensify somewhat at the tip of the Yucatán Peninsula. Mild to moderate deficits will emerge in the southern states and into central Guatemala and southern Belize. Surpluses in Central America will shrink and downgrade but remain widespread in Nicaragua and Costa Rica. Surpluses are forecast for Jamaica, Cuba, and the central Bahamas.

From January through March, deficits will increase in north-central Mexico from southern Chihuahua into Coahuila and northern Durango with exceptional deficits in Coahuila. Surpluses will persist in a path through the center of the nation from Zacatecas through Morelos, downgrading slightly, while the central Pacific Coast transitions away from surplus. Along the northern shore of the Gulf of Mexico, deficits will nearly disappear. Deficits in the Isthmus of Tehuantepec will intensify, becoming exceptional in pockets of Oaxaca. Deficits in the Yucatán's tip will moderate but a pocket of exceptional deficit will emerge in Campeche. Moderate deficits are forecast in some pockets of Guatemala, but surpluses are expected in the southeast, in parts of Honduras, and throughout much of Nicaragua and Costa Rica. Jamaica and Cuba will begin to transition away from surplus as deficits emerge.

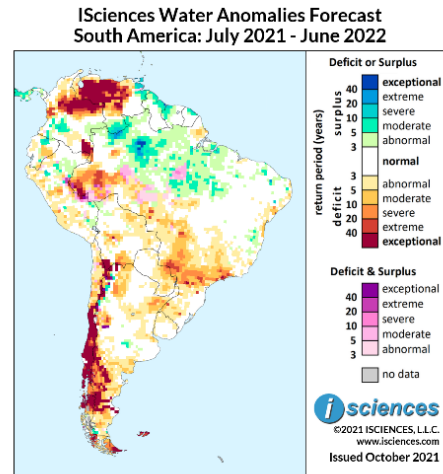
The forecast for the final three months – April through June 2022 – indicates that deficits will emerge in Baja and western Sonora, shrink in the north-central states, and nearly disappear elsewhere in Mexico. Surpluses will persist in the central states, re-emerge on the central Pacific Coast, and emerge in Oaxaca. Surpluses will persist from southern Nicaragua into Costa Rica, and in Jamaica and Cuba.

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

South America

The 12-month forecast through June 2022 indicates exceptional water deficits across northern Colombia and Venezuela throughout the vast Orinoco River watershed. Deficits will also be intense in Colombia's southern corner.

Elsewhere across the northern arc of the continent, pockets of surplus, primarily moderate, are expected spanning the central border of Ecuador and Colombia including Quito and in Colombia east of Cali. Moderate deficits are forecast south of Ecuador's capital. Surpluses are also forecast in Venezuela's southern tip reaching across the border into Brazil, and in northeastern Venezuela including the Orinoco Delta and northern regions of the Guianas.



Based on observed data through September 2021 and forecasts through June 2022

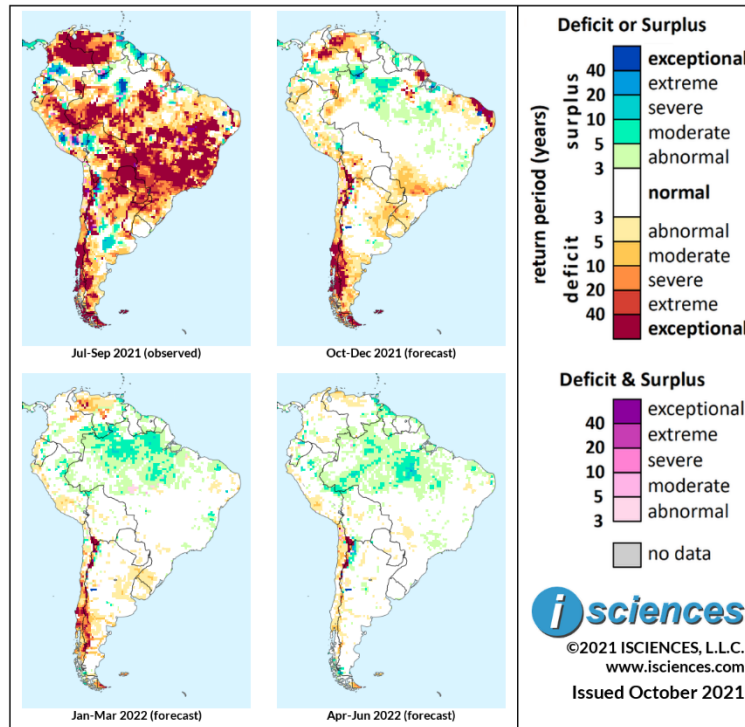
Brazil can expect surpluses in the northern and eastern Amazon River Basin, mild to moderate overall but reaching exceptional intensity in a pocket northwest of Manaus. Severe to extreme deficits are forecast for western Amazonas, becoming exceptional in Acre. Deficits are also forecast in Brazil's Central West and Southeast regions and will be severe to extreme in Mato Grosso do Sul, Paraná, and São Paulo States.

Nearly all of Chile will experience deficits with exceptional anomalies dominating the nation from La Serena through Valparaiso and Santiago to the Gulf of Corcovado. Deficits in Patagonia will extend across the border into Argentina, eventually downgrading though remaining intense along several southern rivers. Deficits will also be intense in Tierra del Fuego and the Falklands. Elsewhere in Argentina, deficits are forecast in San Juan Province in the west, several provinces in the northwest, and Corrientes Province in the northeast.

In Bolivia, deficits are forecast in the south, east of La Paz, and in the northeast. Neighboring Paraguay can expect deficits in its eastern half. A mixture of conditions is forecast in Peru though anomalies will generally be mild.

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

ISciences Water Anomalies Forecast
South America: July 2021 - June 2022



Based on observed data through September 2021 and forecasts through June 2022

The forecast through December indicates that widespread deficits observed in the prior three months will shrink considerably, returning normal water conditions to many regions of Brazil. However, intense deficits will persist in northwestern Pará and Amapá and deficits in the nation's eastern tip will become exceptional. Deficits are also forecast for Maranhão, western Amazonas, Mato Grosso do Sul, São Paulo State, Paraná, and Rio Grande do Sul, and will be severe in Paraná. Surpluses will increase in the northern Amazon Basin, mild to moderate overall.

In northern nations, deficits are forecast from Bogota, Colombia into western and central Venezuela; in the Japurá (Caquetá) River Watershed in southern Colombia; and a pocket in eastern Ecuador. Anomalies will be exceptional north of Bogota and around Merida, Venezuela. Surpluses will persist but downgrade in pockets of Colombia, southern Venezuela, and from the Orinoco Delta through the Guianas. Deficits are expected throughout Chile, exceptional from Concepcion past the Gulf of Corcovado, reaching into Argentina before moderating to the Atlantic Coast. Intense deficits will persist in Tierra del Fuego and the Falklands. Moderate deficits are expected north of the Salado River in Buenos Aires Province, in the northeastern provinces reaching into Uruguay, and along the Bermejo River. Intense deficits on the Paraná River will become merely mild and surpluses in the central Pampas will nearly disappear. Deficits are forecast in pockets of southern Bolivia and relatively mild mixed conditions in much of Peru with moderate surpluses north of Lake Titicaca.

From January through March 2022, deficits will continue to shrink and downgrade, persisting primarily in western and central Venezuela, a pocket in northeastern Colombia, and Chile. Some exceptional

deficits will persist in border areas of northern Chile and moderate to extreme deficits from central Chile to O'Higgins/San Martin Lake in the south, reaching into Argentina. Moderate surpluses will become widespread in the northern Amazon Basin, persist in the Orinoco Delta, and shrink in the Guianas.

The final quarter – April through June 2022 – indicates that surpluses will shrink north of the Amazon, increase between the Tapajos and Xingu Rivers, and emerge on the Purus River. Surpluses elsewhere include the Orinoco Delta and northern Guyana. Deficits are forecast in Chilean border areas and northern Chile and will linger in Tierra del Fuego and the Falklands.

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

Europe

The 12-month forecast through June 2022 indicates that Northern Europe can expect exceptional water deficits in Finnish Lapland, central Sweden’s Dalälven River Watershed, Norway’s Vestland, and Estonia, downgrading as they reach through Latvia. Surpluses are forecast in Norrbotten region of Sweden and from Arctic Norway into Murmansk, Russia.

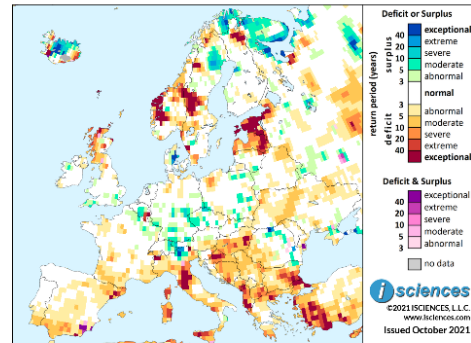
Elsewhere in European Russia, intense surpluses are expected in the Vychegda Lowland in the north and deficits in the Middle Volga River region and Trans-Volga (not shown).

Framing the North Sea, deficits are forecast in Scotland and surpluses in eastern Denmark. Scattered pockets of surplus are expected in Central Europe, moderate overall but more intense at the intersection of Switzerland, Austria, and Italy, particularly north of Italy’s Lake Garda. Surpluses are also forecast in north-central and southeastern Romania. In Belgium, surpluses are forecast west of the Meuse River while intense deficits are expected east of the river. Deficits, primarily moderate, are also forecast in northeastern Belarus, a pocket in northwestern Poland, and a path bisecting Ukraine from Kyiv’ske Reservoir in the north to the Dniester River.

Widespread deficits of varying intensity are forecast in Italy and the Balkans, reaching north through Hungary and east into Romania and through Bulgaria. Regions where deficits are expected to be exceptional include Tuscany and Bologna in Italy; around Zabreb, Croatia; and Albania. Moderate deficits are forecast in southern France and a few pockets elsewhere in the nation, but deficits will be more intense reaching into northeastern Spain. Moderate to severe deficits are forecast in southern Spain from Cordoba past Seville, and moderate deficits in Portugal’s southern tip.

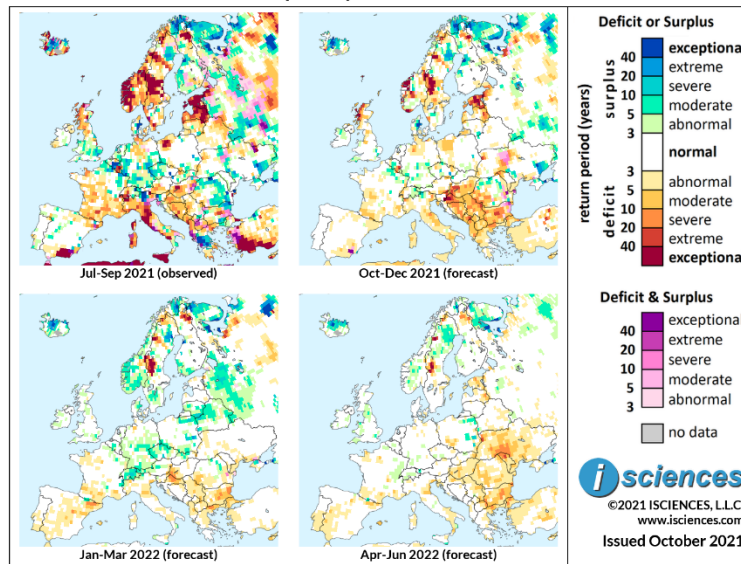
The 3-month composites (below) for the same 12-month period show the evolving conditions.

ISciences Water Anomalies Forecast
Europe: July 2021 - June 2022



Based on observed data through September 2021 and forecasts through June 2022

**ISciences Water Anomalies Forecast
Europe: July 2021 - June 2022**



Based on observed data through September 2021 and forecasts through June 2022

The forecast through December indicates that deficits will shrink in the Nordic nations and Baltics but remain intense in Estonia, the Dalälven River Watershed in Sweden, and Norway's Vestland. Surpluses will persist in Murmansk, Arctic Norway, southern Norrbotten, pockets along the eastern Gulf of Bothnia, and eastern Denmark. In European Russia, anomalies will shrink but surpluses will persist in the Vychegda Lowland and north of Rybinsk Reservoir and will re-emerge in Lipetsk Oblast. Deficits in Scotland will shrink. Many regions in Central and Eastern Europe and the Iberian Peninsula can expect near-normal conditions as anomalies shrink. However, pockets of surplus will linger in Central Europe, northern Romania, and Zaporizhzhia Oblast in southeastern Ukraine where anomalies will be extreme. In Southern Europe, deficits will shrink and moderate in France and Italy but will increase in the Balkans, Hungary, southwestern Romania, and Bulgaria. Anomalies will be exceptional surrounding Zagreb, Croatia.

From January through March 2022, deficits in Northern Europe will shrink but intense anomalies will persist in the western Dalälven River Watershed and Västerbotten, Sweden, and Finnish Lapland. Surpluses will persist in the Vychegda Lowlands, Rybinsk Reservoir, Murmansk, Arctic Norway, and Norrbotten, Sweden. Moderate surpluses will emerge in southern and coastal Norway, southern Sweden and southern Finland, from St. Petersburg to Bryansk in Russia, Lithuania, Belarus, and pockets of eastern Poland. Surpluses will increase in Central Europe, particularly Switzerland. Deficits will shrink from the Balkans to the Black Sea and will emerge in northeastern Spain.

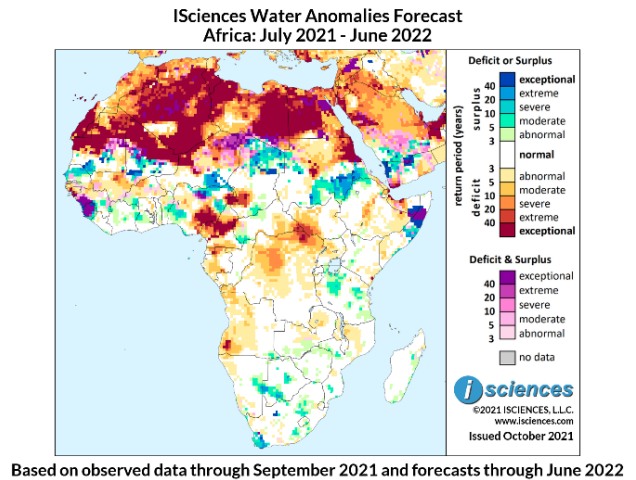
The forecast for April through June 2022 indicates deficits from Ukraine through Bulgaria and pockets in Estonia, Latvia, Lapland, and central Sweden. Areas of surplus include Murmansk, Vychegda, northern Sweden, and pockets of eastern Poland.

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

Africa

The 12-month forecast through June 2022 indicates widespread water deficits across northern Africa with exceptional deficits in many regions including southern Morocco, Algeria, southern Tunisia, Libya, and Egypt.

Surpluses are forecast in large pockets of the Sahel and will be extreme to exceptional around Lake Débo in the Inner Niger Delta of central Mali and extreme in southeastern Niger's Zinder region. Southeastern Sudan can also expect surpluses, particularly intense between the White Nile and the Atbara Rivers and reaching into Eritrea.



A patchwork of water conditions is forecast in West Africa including deficits from Guinea Bissau east into Burkina Faso, and pockets of moderate surplus scattered in nations along the northern Gulf of Guinea.

In Nigeria, surpluses are expected in the southwest and in the east at the intersection of the Benue and Gongola Rivers. Exceptional deficits are forecast in northeastern Nigeria downgrading slightly as they reach into Chad, and deficits will be exceptional in the nation's southeast quadrant reaching across central Cameroon. Generally moderate deficits will extend from southern Cameroon through western Angola, but a few pockets will be more intense including in Equatorial Guinea and surrounding Lubango in southwestern Angola.

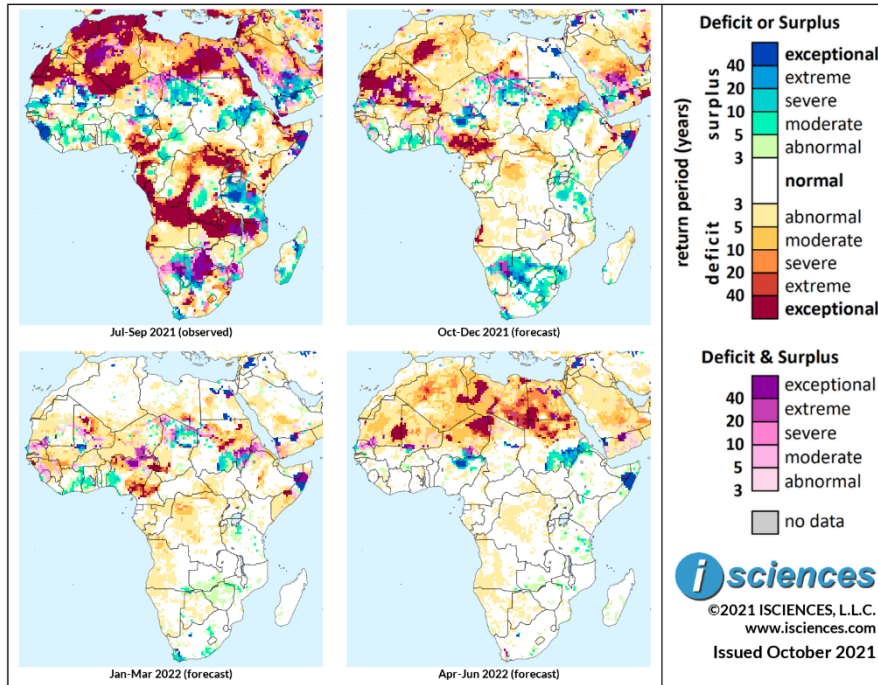
In the heart of the continent, moderate to severe deficits are forecast from eastern Central African Republic into western South Sudan and through the northern half of the Democratic Republic of the Congo (DRC), becoming extreme to exceptional in northeastern DRC between the Upper Mbomou and Uele Rivers. Some pockets of moderate deficit are forecast in central Uganda.

In the Horn of Africa, deficits are forecast in southern Eritrea, Djibouti, western Somaliland, and central Ethiopia including Addis Ababa. Exceptional surpluses along with transitional conditions (pink/purple) are forecast for the Nugaal Valley in Somalia and surpluses of lesser intensity from there to the Shabelle river. In East Africa, moderate surpluses are forecast in several large pockets in Tanzania

In southern Africa, surpluses are forecast in the Kalahari Desert of eastern Namibia and Botswana and surrounding Lake Xau in central Botswana. Western Cape, South Africa, can expect surpluses and pockets are also forecast north of the Orange River in Northern Cape, in Eastern Cape, and from northern Orange Free State to Pretoria.

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

ISciences Water Anomalies Forecast
Africa: July 2021 - June 2022



Based on observed data through September 2021 and forecasts through June 2022

The forecast through December indicates deficits in the continent's northwest quadrant, moderate overall but exceptional in northwestern Algeria and from Mauritania into Niger's western corner. Surpluses in West Africa will shrink though moderate anomalies are forecast along the northern Gulf of Guinea. From southeastern Nigeria into Cameroon, intense deficits will increase while intense surpluses re-emerge in north-central Nigeria joining those in Zinder, Niger. Surpluses will increase in northern Chad and northeastern Niger. In Sudan, surpluses will persist in the southeast and into Eritrea, but deficits are expected in the northeast. Deficits will downgrade in Africa's Horn and surpluses will persist in Nugaal. Moderate to extreme deficits are forecast in northern DRC and Central African Republic. Surpluses will shrink and moderate in Tanzania, reaching into its northern neighbors. In southern Africa, deficits will retreat. Surpluses are forecast in Western Cape and north of the Orange River, Botswana and Namibia, and southern Mozambique. Exceptional deficits will skirt Angola's southeastern coast.

The forecast for January through March 2022 indicates normal water conditions in much of northern, central, and southern Africa. Deficits will shrink somewhat in Nigeria and Cameroon but will intensify in central Sudan. Surpluses are forecast along the northern Gulf of Guinea and will persist in southern Sudan while transitioning east of the Blue Nile. Deficits will linger in northern DRC and central Ethiopia and will intensify in a pocket of central Somalia near the Ethiopian border. Surpluses in southern Africa will shrink considerably, persisting in Western Cape and a few other pockets in South Africa.

In the final quarter – April through June 2022 – deficits are forecast across North Africa and surpluses in north-central Nigeria, from southeastern Sudan into Eritrea, and in Nugaal, Somalia.

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

Middle East

The forecast for the 12-month period ending June 2022 indicates widespread water deficits of varying intensity in the Levant, much of Saudi Arabia, and the small nations on the Persian Gulf. Turkey, too, can expect deficits including exceptional deficits in the west and in the east near Lake Van.

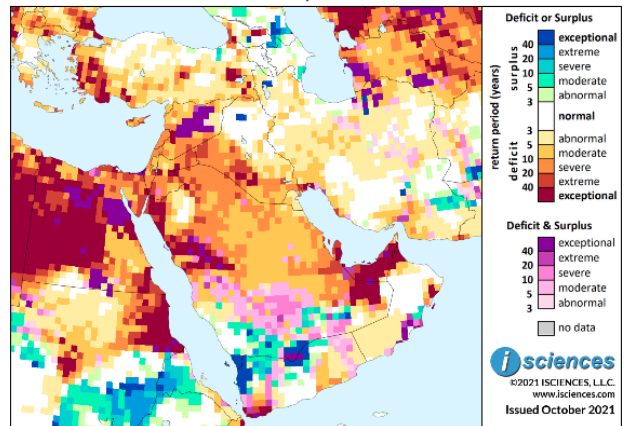
Deficits will be severe overall in the Levant, reaching extreme or exceptional intensity in pockets of Jordan and Iraq west of the Euphrates River. Severe to exceptional deficits area also forecast in northern and southeastern Saudi Arabia, separated by moderate anomalies. Transitional conditions (pink/purple) and some surpluses are expected in the southwest. Extreme to exceptional deficits will dominate United Arab Emirates, Qatar, and Bahrain. Mixed conditions are forecast in Yemen including intense deficits near the Bab-el-Mandeb Strait and surpluses northeast of Sanaa.

In Iran, deficits are expected at the northern end of the Gulf, near the Strait of Hormuz, pockets in Esfahan Province in the center of the country, and following the Qezel Ozan River in the north. In the nation’s southeast, surpluses are forecast in a belt across Sistan and Baluchestan Province.

In Georgia, intense deficits are expected on the coast including Batumi, and north of the Mtkvari (Kura) River. Surpluses are forecast south of the river and in nation’s eastern tip.

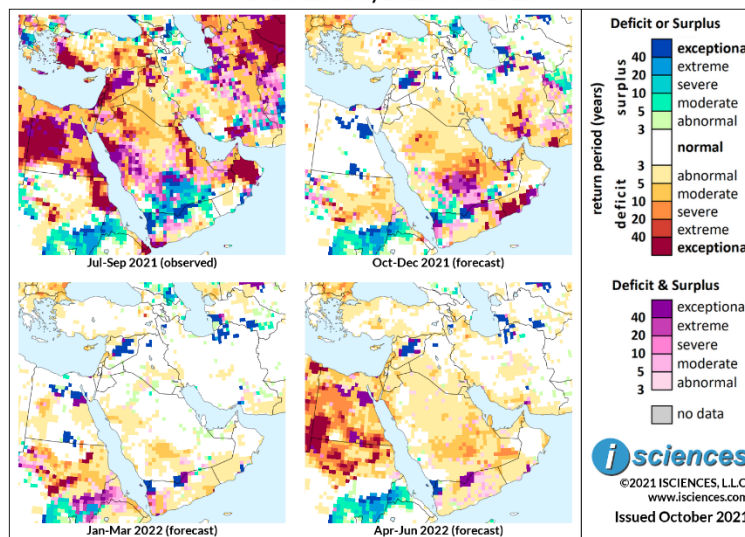
The 3-month maps (below) show the evolving conditions in greater detail.

ISciences Water Anomalies Forecast
Middle East: July 2021 - June 2022



Based on observed data through September 2021 and forecasts through June 2022

ISciences Water Anomalies Forecast
Middle East: July 2021 - June 2022



Based on observed data through September 2021 and forecasts through June 2022

The forecast through December indicates that deficits will shrink and downgrade in Turkey, persisting primarily in the Upper Ceyhan River Watershed of central Turkey and the Kizilirmak River in the north. Deficits from the Levant through northern Iran will retreat, though generally mild anomalies are forecast in Iraq. Surpluses will re-emerge in northern Syria and around Mosul, Iraq. In Saudi Arabia, primarily moderate deficits are expected in Ha'il Province in the north. In the central south including Riyadh, deficits will be more intense, and transitions are expected as surpluses shrink. Surpluses will persist along much of Yemen's border with Saudi Arabia and exceptional deficits will emerge in southern Oman. In Iran, deficits will increase in the south leading into central provinces and will include some pockets of exceptional deficit. Conditions in northern Iran will be normal overall with pockets of surplus near Lake Urmia, Tehran, and the northeast near the coast.

From January through March 2022, much of the region will return to normal water conditions. However, intense surpluses will persist in northern Syria, around Mosul, and in northeastern Iran near the coast. Surpluses will also persist in pockets of Yemen near the Saudi border. Moderate deficits are expected in southern Riyadh Province and near Sanaa.

In the final quarter – April through June 2022 – mild to moderate deficits will increase in the region, and moderate to severe anomalies in Riyadh Province and southeastern Saudi Arabia. Surpluses will persist in northern Syria, northwestern Yemen, and northeastern Iran.

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

Central Asia and Russia

The 12-month forecast through June 2022 indicates widespread water deficits in western and southern Kazakhstan, Uzbekistan, and Turkmenistan. Anomalies will be exceptional in the Caspian Basin of western Kazakhstan and in southern Qaraghandy Region.

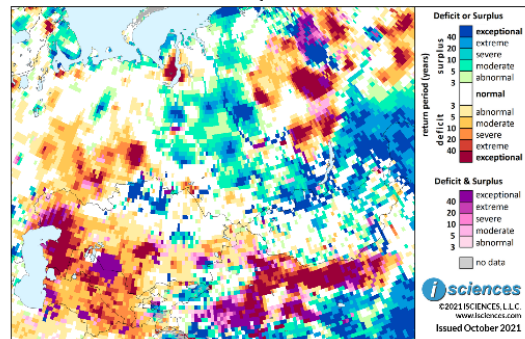
Exceptional surpluses are forecast in the Ishim River Watershed of northern Kazakhstan and severe surpluses in the nation's capital, Nur-Sultan.

Surpluses are also forecast in the Kazakh Upland north of Lake Balkhash. In Kyrgyzstan, surpluses are forecast in much of the east and in the far south reaching into central Tajikistan. Deficits are expected in western Tajikistan and pockets in the east.

In Russia, deficits are forecast from the Middle Volga region through TransVolga and the southern Ural Mountains reaching past Tyumen. Anomalies will be exceptional west of Tyumen. Widespread surpluses are forecast from the eastern portion of the Ob River Watershed through much of the Yenisei River Watershed. In the Central Siberian Plateau, exceptional deficits are expected in the middle reaches of the Vilyuy River, a tributary of the Lena River, including the area surrounding the Vilyuy Reservoir, and spanning the southern edge of the plateau and the region north of Lake Baikal. Exceptional surpluses are forecast in the plateau's northeast between the Markha and Tyung Rivers. Intense surpluses are also forecast in a vast area from Lake Baikal through Russian regions bordering China.

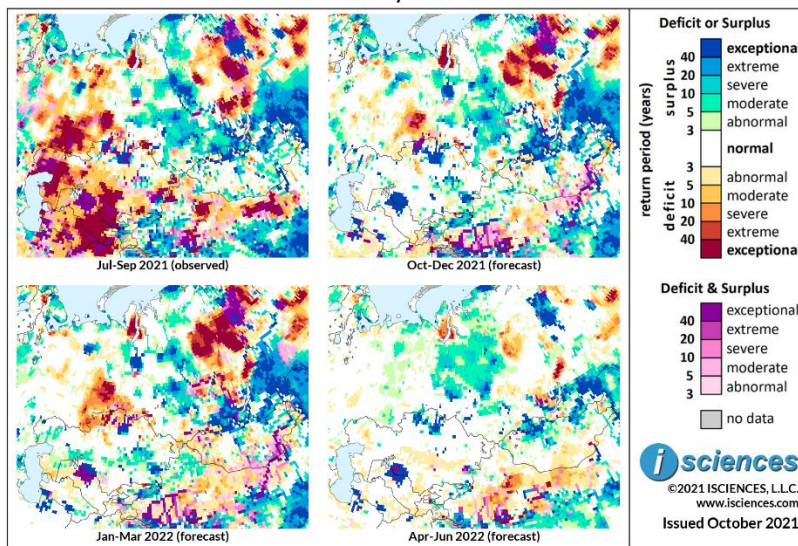
The 3-month composites (below) for the same 12-month period show the evolving conditions in more detail.

ISciences Water Anomalies Forecast
Central Asia: July 2021 - June 2022



Based on observed data through September 2021 and forecasts through June 2022

ISciences Water Anomalies Forecast
Central Asia: July 2021 - June 2022



Based on observed data through September 2021 and forecasts through June 2022

The forecast through December indicates that widespread, intense deficits in Kazakhstan, Uzbekistan, and Turkmenistan will retreat. Surpluses are forecast in the Ishim River Watershed of northern Kazakhstan, in the Kazakh Upland north of Lake Balkhash and in the region to the southeast of the lake. Surpluses are also expected along the Naryn River in Kyrgyzstan and in the nation's east and south, leading into central Tajikistan; spanning the north-central border of Uzbekistan; and several pockets in southern Turkmenistan.

In Russia, deficits in the Volga River Basin will shrink considerably while intense deficits persist in the Tura River Watershed to Tyumen. Widespread surpluses will persist from the Ob River's eastern watershed into the Yenisei River Watershed, and intense deficits will increase in the Central Siberian Plateau. Surpluses will intensify along the Lena River from Lensk to Yakutsk and in the region of the Lena's southern tributaries where surpluses will stretch through Russian areas bordering China. Intense deficits will persist near the Sea of Okhotsk.

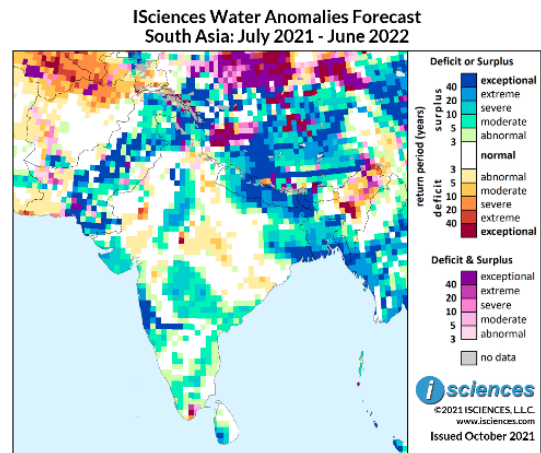
From January through March 2022, deficits will increase from the southern Urals through the Tura River Watershed past Tyumen to Omsk and from the Ural River Watershed to the Ishim River in northern Kazakhstan. Surpluses will shrink from the eastern Ob Watershed to the Yenisei, but persist in a widespread region from Lake Baikal to Northeast China. Deficits will intensify in the Central Siberian Plateau. In Kazakhstan, surpluses will increase north of the Caspian Sea, north of the Aral Sea, and in pockets reaching east to Lake Balkhash. Surpluses will persist in eastern Kyrgyzstan and pockets of southern Turkmenistan.

The forecast for the final months – April through June 2022 – indicates that deficits will retreat from northern Kazakhstan through the southern Urals and will shrink considerably in the Central Siberian Plateau. Widespread surpluses, primarily moderate, will emerge between the Ob and Yenisei Rivers.

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

South Asia

The 12-month forecast through June 2022 indicates water surpluses of varying intensity in several regions of India. In the west, surpluses will be severe in western Gujarat and will reach exceptional intensity from Mumbai into Karnataka. Widespread moderate to severe surpluses are forecast from central Maharashtra past Hyderabad in Telangana. A path of moderate anomalies will lead from eastern Andhra Pradesh on the Bay of Bengal reaching southeast through Tamil Nadu to Kerala's coast on the Arabian Sea.



Based on observed data through September 2021 and forecasts through June 2022

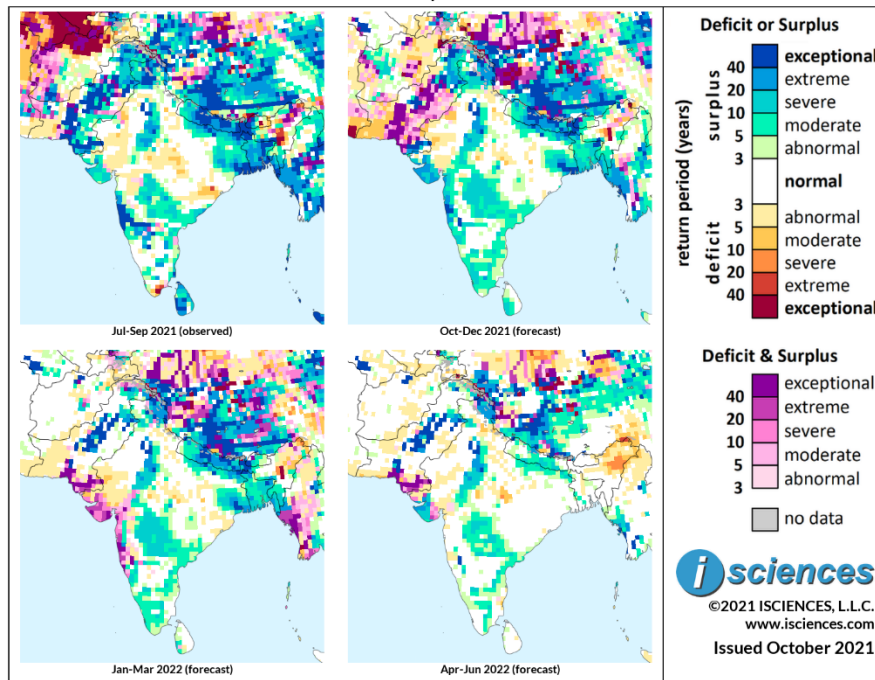
Widespread surpluses are expected from West Bengal through Jharkhand and Bihar into the region of Uttar Pradesh north of the Ghaghara River. Anomalies will be exceptional in the Ganges Delta and Kolkata, and on the Gandaki River in Bihar. Severe to extreme surpluses are expected in the Chambal River Watershed in Rajasthan, and anomalies will be even more intense in Haryana and the far north.

In India's Far Northeast, deficits of varying intensity are forecast including exceptional deficits in Assam. Transitional conditions (pink/purple) are also expected in pockets of the Far Northeast. Elsewhere in India, deficits are forecast in a pocket around Jodhpur in Rajasthan and small pockets in northern Uttar Pradesh and Madhya Pradesh.

Severe to extreme surpluses will be widespread throughout Bangladesh, exceptional in some areas including the delta. Extreme to exceptional surpluses will dominate much of Nepal and reach into western Bhutan. In Sri Lanka, surpluses are expected in the nation's southwest corner. Many regions of Pakistan will experience surpluses including exceptional anomalies west of the Jhelum and Indus Rivers and south of Hyderabad. In Afghanistan, deficits will be severe in the provinces surrounding Mazar-e Sharif in the north; mixed conditions are forecast in the west; and surpluses in the far south.

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

ISciences Water Anomalies Forecast
South Asia: July 2021 - June 2022



Based on observed data through September 2021 and forecasts through June 2022

The forecast through December indicates that surpluses will increase in India with moderate to severe anomalies emerging in greater extent south of Bangalore and in the Eastern Ghats. Surpluses will persist in many regions, becoming extreme in Gujarat and severe from Maharashtra into Telangana. Persistent surpluses on the west coast from Mumbai into Karnataka will downgrade on the western portion of the Krishna River and retreat from the Tungabhadra River Watershed. Surpluses will increase in the Upper Chambal River Watershed, joining a path of surplus leading north into Haryana, while surpluses in the far north shrink slightly. In the Ganges Plain, surpluses will persist north of the Ghaghara River in Uttar Pradesh though West Bengal, shrinking somewhat in southern Bihar. Deficits will retreat from Odisha, but some small pockets of deficit are forecast in eastern Madhya Pradesh and western Rajasthan. In the Far Northeast, deficits will shrink as transitions occur, but intense anomalies are expected in Assam.

In Sri Lanka, surpluses will retreat to the southwest corner and downgrade. Surpluses will also downgrade in Bangladesh though remain widespread, and will be intense throughout much of Nepal and into Bhutan. Pakistan's northern third will continue to see surpluses of varying intensity; moderate deficits will emerge in the southeast; and transitional conditions are forecast for much of the remainder of the country. In Afghanistan, deficits in the north will downgrade, moderate deficits and transitional conditions are forecast west of Kabul, and surpluses will re-emerge in the nation's west

From January through March 2022, the distribution of surpluses will remain much the same as in the prior three month's forecast for India, Bangladesh, and Nepal though anomalies in far north India will shrink and transitional conditions are expected from Gujarat through coastal Maharashtra. Deficits will persist in Assam. In Pakistan, surpluses will shrink in the north and re-emerge in the Indus River

Watershed in the center of the country. Deficits in the southwest will become mild and the southeast will begin to transition out of surplus. Anomalies in Afghanistan will generally retreat.

The forecast for the final months – April through June 2022 – indicates that surpluses will retreat from much of Bangladesh and West Bengal, shrink and downgrade from Nepal into India, re-emerge in western Gujarat, and persist in many other areas of India. Severe deficits are forecast in the Far Northeast. Surpluses will persist in central and northern Pakistan, and conditions in Afghanistan will be nearly normal.

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

Southeast Asia and the Pacific

The 12-month forecast through June 2022 indicates water surpluses of varying intensity in many regions of Southeast Asia. Anomalies will be extreme to exceptional in the Mekong River Watershed through southern Laos, Cambodia, and Vietnam, and widespread though less intense elsewhere in those nations.

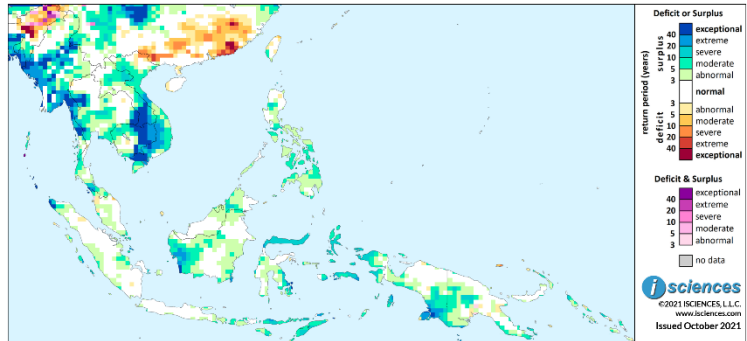
Surpluses will also be widespread in Myanmar, extreme in the southwestern states and extreme to exceptional in the southeast leading into Thailand. Surpluses in central and southern Thailand will be moderate overall.

Moderate surpluses are forecast in many pockets in the Philippines.

In Indonesia, Banda Aceh at the northern tip of Sumatra can expect intense surpluses. Surpluses of varying intensity are forecast in Western Indonesian Borneo and in the north. Moderate to severe anomalies are forecast for Sulawesi's northern arm and southeastern leg, the Maluku Islands, the Lesser Sunda Islands, and the Bird's Head Peninsula (Doberai) of New Guinea. Widespread surpluses are forecast throughout southern Papua, Indonesia, the Highlands region of Papua New Guinea, and scattered pockets along the coast of the Papuan Peninsula.

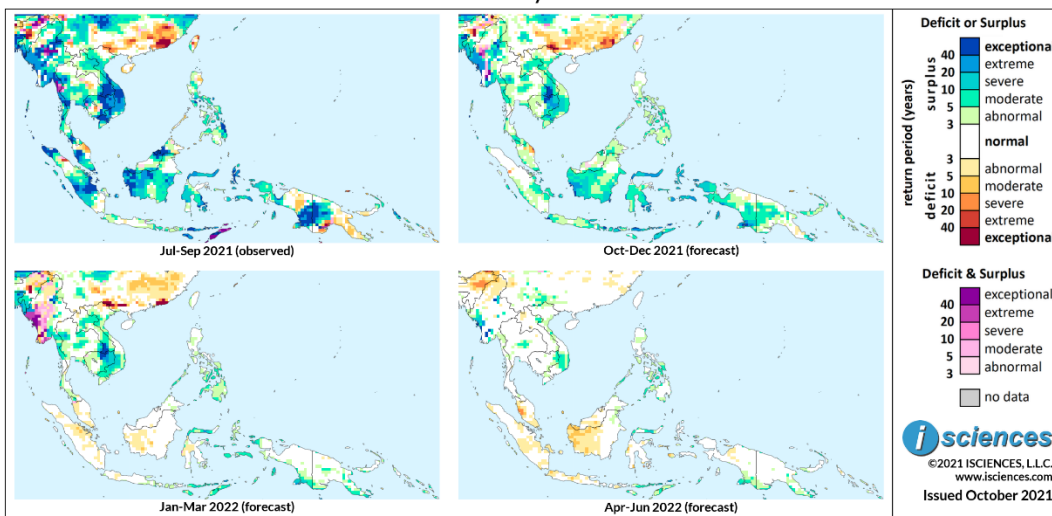
The 3-month maps (below) show the evolving conditions in more detail.

ISciences Water Anomalies Forecast
Southeast Asia: July 2021 - June 2022



Based on observed data through September 2021 and forecasts through June 2022

ISciences Water Anomalies Forecast
Southeast Asia: July 2021 - June 2022



Based on observed data through September 2021 and forecasts through June 2022

The forecast through December indicates that surpluses will shrink slightly but remain widespread, though the extent of intense anomalies will shrink. In Myanmar, surpluses will shrink in the north and east but persist elsewhere, particularly in the west where anomalies will be extreme, while transitional conditions are forecast in parts of the Middle Irrawaddy River and between the Myittha and Chidwin Rivers. Deficits will retreat from Thailand and surpluses will persist, primarily in central regions. Extreme to exceptional surpluses will persist from southern Laos through eastern Cambodia in the Mekong River region, and severe anomalies are expected in Vietnam's Central Highlands. Surpluses of generally lesser intensity are forecast in many other regions of Vietnam and Laos.

In the Philippines, mild to moderate surpluses are forecast in central and southern regions. Surpluses will shrink and downgrade in Malaysia and Sumatra, but remain widespread in much of Indonesian Borneo, Sulawesi, and the Maluku Islands. A pocket of deficit will persist on Peninsular Malaysia's northeastern coast. Moderate surpluses are forecast at either end of Java, and severe to exceptional surpluses in the Lesser Sunda Islands. Deficits will nearly disappear in New Guinea while surpluses in the Bird's Head Peninsula elevate to severe and surpluses from southern Papua, New Guinea into the center of the island moderate.

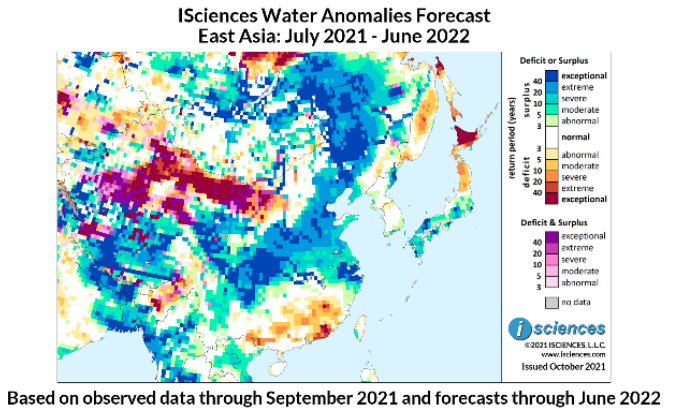
From January through March 2022, transitional conditions will increase in Myanmar as surpluses shrink, but many areas of surplus will persist elsewhere in Southeast Asia and anomalies will remain extreme to exceptional from southern Laos into Cambodia in the Mekong region. In the Philippines, some pockets of moderate surplus are forecast in the central islands and Mindanao. Surpluses will retreat from Malaysia, Indonesian Borneo, Sumatra, and Java as some mild deficits emerge. Surpluses will also retreat from southern Sulawesi while anomalies in its northern arm shrink and downgrade. Surpluses will shrink and moderate in the Lesser Sunda Islands, the Malukus, and New Guinea.

The forecast for the final months – April through June 2022 – indicates that surpluses will re-emerge in western and southern Myanmar and moderate surpluses will linger in central Thailand, from the Central Highlands of Vietnam into Cambodia, the central Philippines, northern Sulawesi, the Lesser Sunda Islands, and pockets along New Guinea's southern coast. Mild to moderate deficits are forecast for pockets of Malaysia, Sumatra, Java, and western Borneo.

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

East Asia

The 12-month forecast for East Asia through June 2022 indicates widespread extreme to exceptional water surpluses in Northeast China in the Songhua River Watershed and extending across the Russian border. This vast path of intense surplus will continue through the North China Plain, the Lower and Middle Yellow River (Huang He) Watershed, Shaanxi Province south of the Ordos Loop, and much of the river's upper basin.

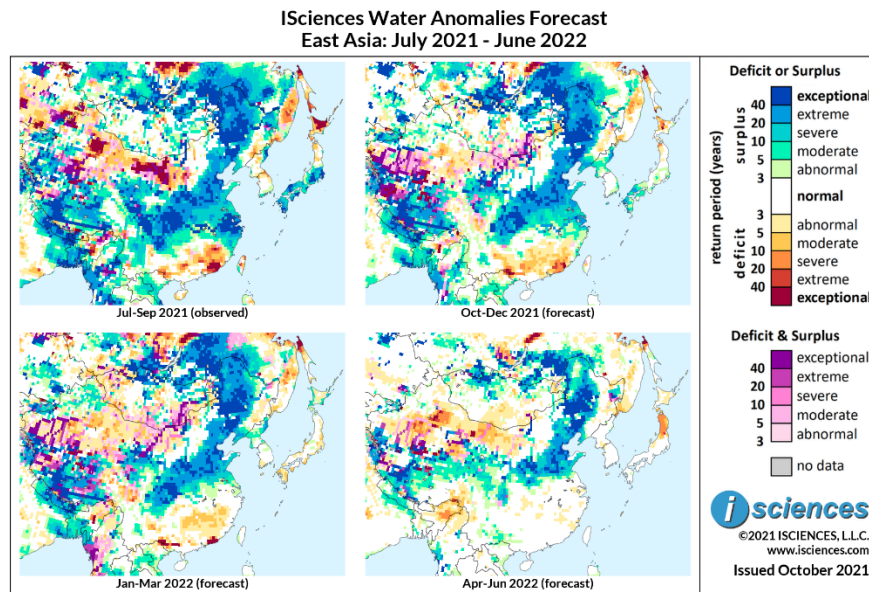


In the Yangtze region, surpluses will be widespread in the northern portion of the basin. Anomalies will be exceptional in the lower watershed and along the river's path from Wuhan past Chongqing and in the drainage basin of Three Gorges Dam, and of varying intensity in the Yangtze's upper basin. Much of Tibet (Xizang) will see surpluses, exceptional tracing the Yarlung (Brahmaputra) River.

Widespread, exceptional deficits are forecast from western Inner Mongolia into Xinjiang. In South and Southeast China, deficits are forecast in Guangxi, Guangdong, southern Hunan, Jiangxi, and Fujian. Anomalies will be exceptional in eastern Guangdong.

Nearly normal conditions are forecast for Korea with intense surpluses in the northeast. Exceptional deficits are expected in Hokkaido, Japan; moderate to severe deficits in northern Honshu; and surpluses elsewhere. In Mongolia, surpluses are forecast in the north, east, and in the Hangayn Mountains.

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



Based on observed data through September 2021 and forecasts through June 2022

The forecast through December indicates persistent, widespread, intense surpluses from Northeast China through the North China Plain and much of the vast Yellow River Basin, with anomalies downgrading somewhat in the far reaches of the upper basin. Conditions in western Inner Mongolia will begin to transition away from intense deficit and anomalies in Xinjiang will moderate. In the vast Yangtze River region, surpluses will remain widespread in the northern portion of the basin. Anomalies will be exceptional in the drainage area of Three Gorges Dam, severe to extreme in the lower basin, and moderate in the Fuchun River region south of Shanghai. In South and Southeast China, deficits will increase from Guangxi through much of Fujian, moderate overall but intense in southwestern Guangxi and eastern Guangdong. Anomalies will nearly disappear in Taiwan. Surpluses are forecast throughout most of Tibet.

Surpluses are forecast in North Korea and southern Japan, deficits in Japan's northern extremes. In Mongolia, a complicated patchwork of water conditions is expected with surpluses in the north.

From January through March 2022, widespread surpluses will persist in China in a distribution pattern similar to the prior three months, but anomalies in the Lower Yangtze Basin will nearly disappear. Deficits in South and Southeast China will shrink but exceptional deficits are forecast in the Zuo and Yong River regions of Guangxi including Nanning, and between Hong Kong and Shantou on the southeast coast. Surpluses will persist in North Korea. In Japan, deficits will retreat from Hokkaido and coastal surpluses will emerge, while surpluses retreat elsewhere and moderate deficits emerge in Kyushu and coastal pockets in Shikoku and Honshu.

The forecast for the final three months – April through June 2022 – indicates surpluses in Northeast China, the North China Plain, the Yellow River Watershed, and central Tibet. Deficits are forecast from western Inner Mongolia into central Xinjiang. Severe deficits will emerge in northern Honshu, Japan.

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

Australia & New Zealand

The 12-month forecast through June 2022 indicates extreme to exceptional water surpluses in Western Australia in the Avon River catchment. Deficits are forecast along the southwestern coast, severe near Geraldton and extreme to exceptional from Busselton around the nation's southwestern tip.

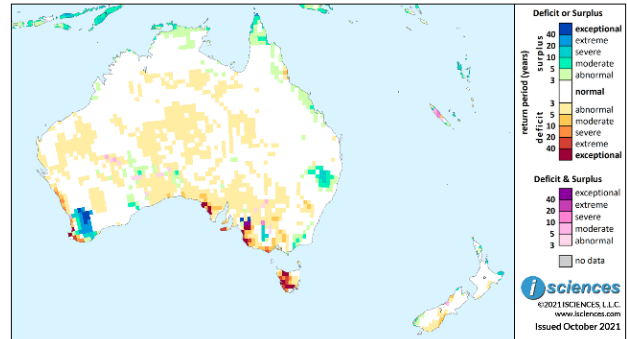
Deficits are also expected in pockets of the coastal south on the Eyre Peninsula, Kangaroo Island, and nearby on the mainland to Melbourne, and will be intense in some areas. Intense deficits are forecast in western and southern Tasmania. In South Australia near the Lower Murray River, surpluses and transitional conditions are expected. Severe surpluses are expected in the Grampians region of western Victoria, and pockets of moderate surplus in the Australian Alps.

In eastern Australia, moderate to severe surpluses are forecast for the Macintyre River region of northeastern New South Wales. In the nation's north, surpluses are expected at the tip of the Cape York Peninsula in Far North Queensland and in the islands off Top End in Northern Territory.

Normal water conditions are expected overall in New Zealand with a small area of moderate deficit north of Dunedin and severe surpluses on the points framing the Bay of Plenty. Mixed conditions are forecast in New Caledonia.

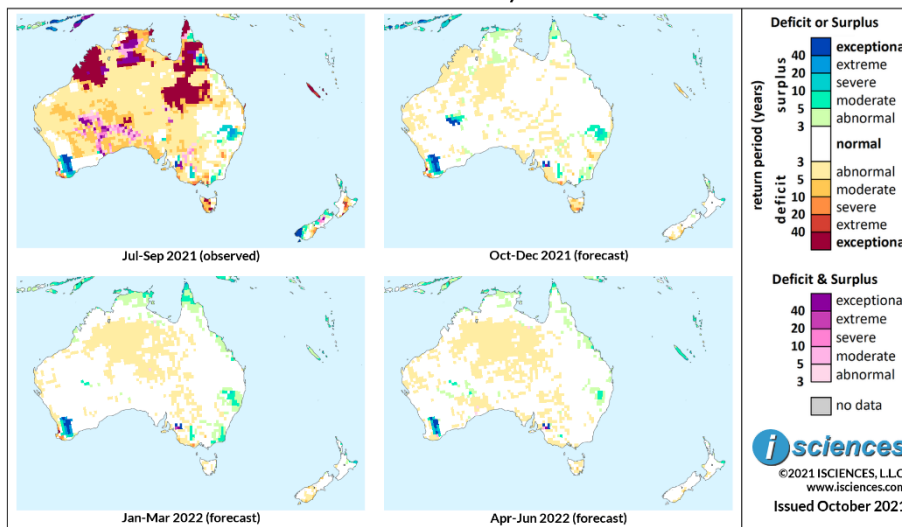
The 3-month maps (below) show the evolving conditions in greater detail.

ISciences Water Anomalies Forecast
Australia & New Zealand: July 2021 - June 2022



Based on observed data through September 2021 and forecasts through June 2022

ISciences Water Anomalies Forecast
Australia & New Zealand: July 2021 - June 2022



Based on observed data through September 2021 and forecasts through June 2022

The forecast through December indicates normal water conditions in much of the region. Moderate to severe surpluses are forecast in the Macintyre River area in northeastern New South Wales, moderate surpluses north of Grampians National Park in Victoria, and milder surpluses near the Australian Alps. Deficits will shrink and downgrade around Dubbo in New South Wales, west of Melbourne, and in Tasmania, though anomalies near Hobart will be severe. In Western Australia, intense surpluses will persist in the Avon River catchment east of Perth and extending south, but deficits of varying intensity are forecast along the coast from Perth well past Busselton. Surpluses are expected to re-emerge in Western Australia in the Lake Carnegie region southwest of the Gibson Desert. Some generally mild surpluses are forecast in the nation's far north.

A few pockets of moderate deficit will skirt New Zealand's southeastern coast and surpluses are expected on the points framing the Bay of Plenty on North Island. Moderate deficits are forecast in New Caledonia.

From January through March 2022, deficits will nearly disappear, persisting primarily in Australia's southwestern tip. Surpluses will persist in the Avon River catchment in the west but retreat from the Lake Carnegie region. Moderate surpluses will continue near the Grampians and in the Macintyre River region, and increase east of the Australia Alps and in the far north. Deficits will retreat from New Caledonia as mild surpluses emerge.

The forecast for the final months – April through June 2022 – indicates persistent, intense surpluses in the Avon River Watershed while coastal deficits nearby nearly disappear. Surpluses elsewhere in Australia will shrink, persisting primarily in the Macintyre River region. Moderate surpluses are forecast throughout New Caledonia.

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