Global Water Monitor & Forecast Watch List

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Introduction

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

ISciences also provides assessments of the impacts of water anomalies on people, agriculture, and electricity generation. Detailed data and reports are available for purchase. Additional information and pricing is 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 2018 and an ensemble of forecasts issued the last week of September 2018. 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.

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

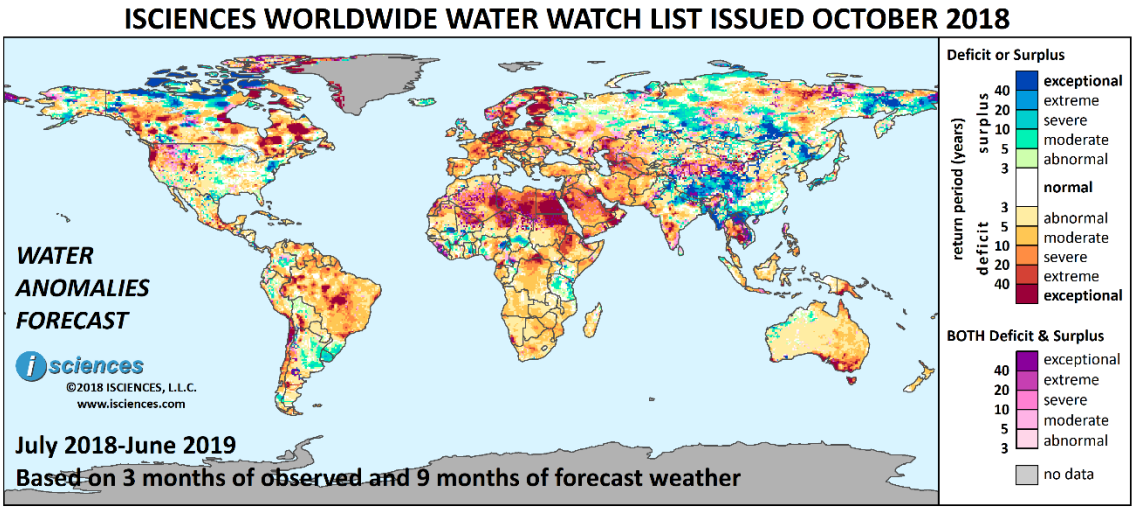
Deficits and surpluses are stated in terms of return period – a measure that characterizes the rarity of an anomaly. For example, a return period of 10 years indicates an anomaly that would occur, on average, once every ten years. Higher return periods indicate more extreme and, therefore, more disruptive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

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

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 2018 and running through June 2019 using 3 months of observed temperature and precipitation data and 9 months of forecast data.



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 many areas of water surplus including Iowa and surrounding states, the Ohio River Basin, eastern Pennsylvania, and Texas. Surpluses will be intense in Iowa and Pennsylvania. Deficits are expected in the Southeast, primarily moderate but more intense in Florida surrounding Lake Okeechobee. Intense deficits are also forecast along the Arkansas River, and in Colorado, and north-central Utah. Other areas of deficits include the Canadian River, the Rio Grande through New Mexico, and Maine.

Canada: Through December, exceptional water deficits in the east will shrink somewhat, and moderate to severe surpluses will emerge in much of northern Ontario with intense deficits in the northwest. Deficits will diminish considerably in the southern portions of the Prairie Provinces, though moderate deficits will linger in southern Manitoba and will emerge along the North Saskatchewan River. Elsewhere in the west the pattern of anomalies will remain much the same as in the prior three months.

Mexico, Central America, and the Caribbean: The forecast through December indicates pockets of intense water deficit in Mexican states along the southern Gulf of Mexico and across to the Pacific. Moderate deficits are forecast for Yucatan and Mexico's southern Pacific coast. Surpluses will persist in Coahuila, and will increase in northern Sinaloa, western Chihuahua, and from Zacatecas through Mexico

City. Surpluses are expected in eastern Guatemala and eastern Costa Rica. Deficits in Cuba will moderate.

South America: The extent of exceptional water deficit in the region will diminish considerably through December, though deficits will cover most of Brazil and will be intense across the north, in Mato Grosso, São Paulo, and Paraná. Intense deficits are also forecast in Bolivia from east of La Paz through Cochabamba to the south, and from southern Peru through the Atacama Desert in northern Chile past Santiago. Surpluses will persist in Uruguay, and in Entre Rios and Buenos Aires Provinces in Argentina, and will emerge in Rio Grande do Sul, Brazil.

Europe: Moderate deficits will dominate much of Europe from through December, downgrading from prior exceptional deficits in many areas. Severe to extreme deficits are, however, forecast for southern Sweden, central Finland, southern France, Switzerland, and southern Germany. Norway is expected to transition from exceptional deficit to moderate surplus or normal conditions. Moderate surpluses are also forecast in Scotland and extreme surpluses in west-central Sweden. Surpluses of varying intensity are forecast for European Russia and eastern Ukraine.

Africa: The forecast through December indicates that intense deficits will shrink considerably across northern Africa but emerge across the southern Sahara and into the Sahel. Intense deficits are forecast for the Nile River and western Ethiopia. Mild deficits are forecast for much of Africa's southern half. Areas of surplus include southern Mali, Sierra Leone, Liberia, Burkina Faso, Ghana, coastal and northeastern Nigeria, south-central Chad, Republic of the Congo, Tanzania, and southern Kenya.

Middle East: Water deficits are expected to shrink and downgrade significantly through December but intense deficits will persist in southern Iraq. Severe deficits are forecast for Georgia, Kuwait, most of Saudi Arabia, and into western United Arab Emirates. Deficits of varying severity are expected in Yemen, moderate to severe deficits in central and southern Iran, and mild deficits in the Levant.

Central Asia and Russia: The forecast through December indicates that prior exceptional water deficits in Turkmenistan, Uzbekistan, western Kazakhstan, and the North Caucasus region will downgrade considerably, leaving primarily mild conditions. In Russia, surpluses will increase between the Ob and Yenisei Rivers and will be extreme to exceptional. Moderate deficits are forecast in the southern Ural Mountains, with surpluses to the west. Surpluses will re-emerge in the Upper Don River watershed.

South Asia: The widespread exceptional water deficits that have dominated Afghanistan in recent months will moderate through December though deficits will remain more intense northeast of Kabul. Moderate deficits are forecast for southern Pakistan. In India, deficits will also moderate but will be intense along the Tungabhadra River in the southwest, and in Madhya Pradesh, Bihar, and Arunachal Pradesh. Areas of surplus include northernmost India, Uttar Pradesh, Nepal, Bangladesh, and Sri Lanka.

Southeast Asia and the Pacific: The forecast through December indicates that water surpluses will shrink but intense surpluses are forecast for western Myanmar, northern Laos, and northern Vietnam. Exceptional deficits will persist in western Cambodia. Deficits will increase in Thailand and will emerge in

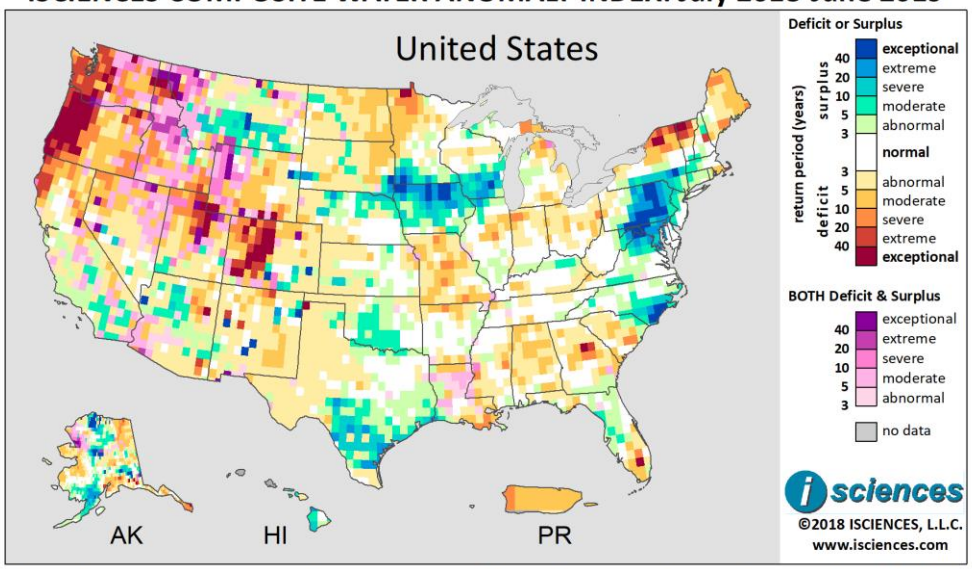
eastern and southern Sumatra and on smaller islands in the region. Philippines will transition from surplus to deficit. Deficits in Papua New Guinea, though downgrading, will remain severe.

East Asia: Widespread water surpluses will emerge south of the Yangtze River and in the Pearl River watershed over the next few months and may persist through March. Surpluses are also forecast for Sichuan, Qinghai, and Tibet and may persist even longer. Deficits will increase and intensify from western Inner Mongolia through Xinjiang, and moderate to severe deficits will emerge from the North China Plain to the Yangtze River. Extreme surpluses are forecast for southern Japan, and deficits for southern North Korea.

Australia & New Zealand: The forecast through December indicates that intense water deficits which have dominated much of Australia in prior months will retreat from most regions except the southeast. Deficits will be exceptional in Tasmania, and severe to exceptional along the southeast coast from Adelaide through Victoria and past Canberra. Moderate to severe deficits are forecast for New Zealand. Deficits in New Caledonia will moderate.

Watch List: Regional Details

United States



Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

NOTE: 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 NOAA National Hurricane Center.

The 12-month forecast ending June 2019 indicates significant water deficits in the Pacific Northwest, particularly western Oregon where deficits will be exceptional. Extreme to exceptional deficits are forecast for northern Utah and western Colorado, with deficits of generally lesser intensity in Northern California and in pockets throughout the Rocky Mountains. Elsewhere in the West, surpluses are forecast for southern Montana, some pockets of southern California, and north-central Arizona. Conditions of both deficit and surplus are forecast for parts of the Northern Rockies.

In the center of the nation, surpluses are expected to be widespread and intense in Iowa, reaching into southern Minnesota, southern Wisconsin, and northern Nebraska. Moderate surpluses are expected along the Missouri River, and a pocket of more intense surpluses is forecast for the Black Hills along the South Dakota/Wyoming border. Moderate to extreme surpluses are forecast for southern Texas and moderate surpluses in southern Oklahoma. Missouri will see some primarily moderate deficit conditions as will the Upper Midwest along the borders of Minnesota and the Dakotas, but deficits may be severe in Minnesota. Scattered mild to moderate deficits are expected in Michigan and its southern neighbors.

In the East, intense surpluses are forecast for eastern Pennsylvania and into nearby states, and in southeastern North Carolina. Parts of the Northeast are expected to experience deficits, reaching exceptional intensity in northern New York and northern Vermont but primarily moderate in Maine. Some deficits are also expected in pockets of the Deep South, and in southern Florida.

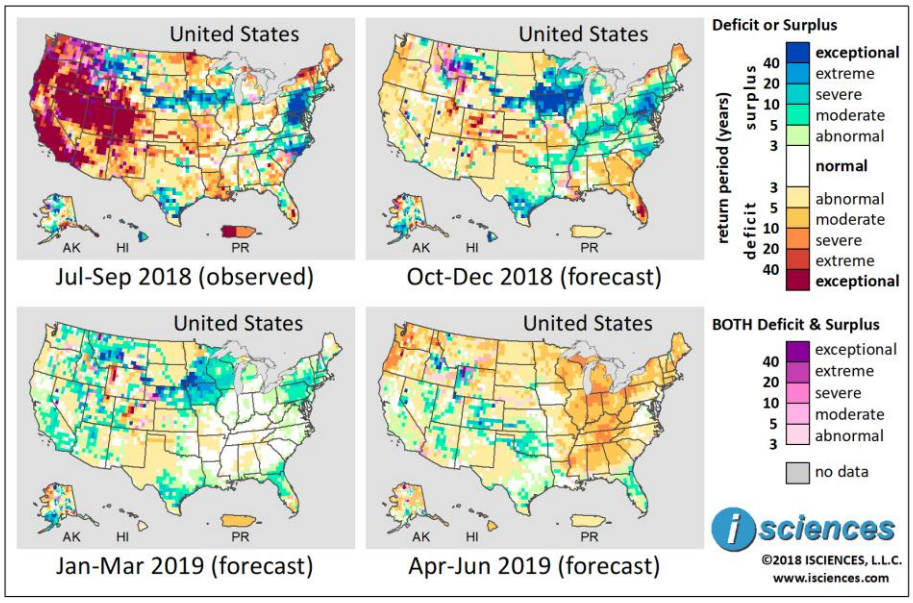
Outside the contiguous US, surpluses are forecast for Hawaii and deficits in Puerto Rico. A complex patchwork of conditions is forecast for Alaska including: surpluses in the southwest from Bristol Bay well into the interior, and in the upper reaches of the Copper and Susitna Rivers; and deficits around Anchorage, the Kenai Peninsula, and the Alexander Archipelago in the Alaska Panhandle.

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

The forecast map through December calls attention to significant surpluses. Surpluses are forecast for Iowa, southern and eastern Minnesota, Wisconsin, and Michigan's western Upper Peninsula and west-central Lower Peninsula. Surpluses will be exceptional throughout much of Iowa. Surpluses are also forecast for northern Nebraska, the Black Hills along the Wyoming/South Dakota border, and Montana. Moderate to extreme surpluses are forecast for the Ohio River Basin. Nearby in eastern Pennsylvania surpluses could be exceptional, surrounded by conditions of generally lesser intensity reaching north through southern New Hampshire and south through northeastern South Carolina. Surpluses of varying intensity are also forecast for southern Texas, southern Oklahoma, and Missouri.

Deficits are expected in the US Southeast, primarily moderate but more intense in Florida surrounding Lake Okeechobee. Moderate deficits are forecast for Missouri. Severe to exceptional deficits are expected along the Arkansas River through Kansas and Colorado, in western Colorado, and northeastern Utah. Deficits are forecast along the Canadian River through Oklahoma and the Texas Panhandle, and along the Rio Grande through New Mexico. In the Pacific Northwest, moderate deficits may linger in Oregon. On the opposite side of the country, some severe deficits are expected in Maine, northern Vermont, and northern New York.

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019



Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

From January through March, conditions in the Ohio River Valley will normalize but widespread surpluses will continue in aforementioned areas of Iowa, Minnesota, Wisconsin, and Michigan, though the extent of exceptional conditions will diminish. Surpluses will increase in Montana, and pockets of surplus, primarily moderate, will emerge in the Rockies, Pacific Northwest, along the Missouri River, California's southern half, and Arizona. Fairly intense deficits will persist in central Colorado and northwestern Wyoming, and moderate deficits along the Canadian River through the Texas Panhandle. In southern Texas, surpluses will downgrade somewhat. In the East, moderate surpluses remain in the forecast for Pennsylvania and neighboring states. Conditions in the Deep South and Southeast will transition from deficit to near-normal in most areas, but southeastern Georgia and much of Florida will transition to moderate surplus, while deficits around Lake Okeechobee diminish.

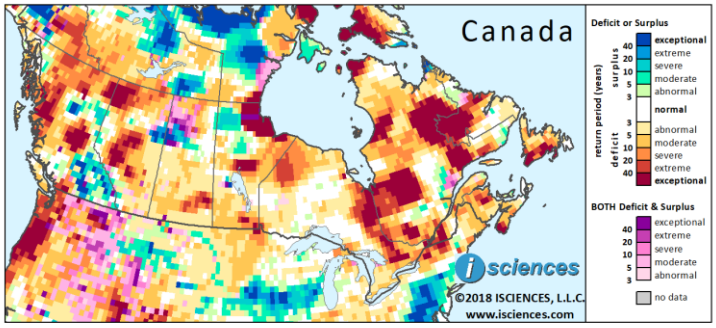
The forecast for the final months – April through June – indicates widespread deficits from the Great Lakes States through the Northeast, Ohio River Valley, and into the Deep South. Deficits are also forecast for the Pacific Northwest. Areas of surplus include: Florida, Oklahoma, the Arkansas River, Colorado, parts of the Northern Rockies, pockets in the Southwest, and along parts of the Rio Grande.

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

Canada

The 12-month outlook for Canada through June 2019 indicates vast, isolated pockets of intense water deficit in the country, particularly in the east.

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019



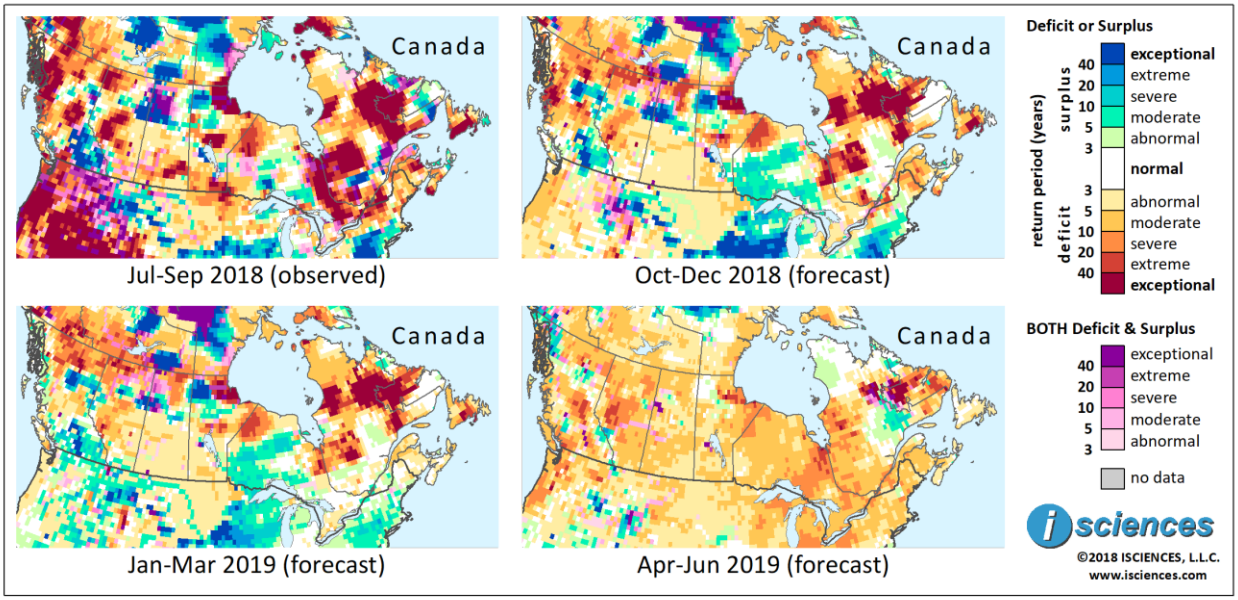
Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

Intense deficits are forecast to encompass large blocks in: eastern Quebec from the Caniapiscau Reservoir to the Gulf of St. Lawrence; around Lake Mistassini in central Quebec; Ontario's eastern border; northeastern Manitoba along Hudson Bay, in the center of the province north of Lake Winnipeg, and in the southeastern corner surrounding the city of Winnipeg; southern Saskatchewan including Regina; the Upper and Middle Athabasca River region and northwestern Alberta; surrounding Prince George, British Columbia and the Skeena River region in the northwest.

Areas of surplus include exceptional surpluses in northwestern Saskatchewan around Churchill Lake westward to Fort McMurray, Alberta, and surpluses of varying intensity in southeastern British Columbia.

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

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019



Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

The forecast through December indicates that the extent of exceptional deficits in the east will shrink somewhat. Areas of varying deficit include Newfoundland, much of northern Quebec (QC) into Newfoundland and Labrador, from Lake Mistassini in western QC past the border into Ontario (ON), north of Ottawa (in ON), west of Sherbrooke (in QC), and New Brunswick (NB). Moderate to severe surpluses will emerge in much of northern ON, but intense deficits will persist in the northwest.

Deficits will diminish considerably in the southern portions of the Prairie Provinces, with some moderate deficits lingering in southern Manitoba and emerging along the North Saskatchewan River. The pattern of anomalies across the northern portion of the Prairie Provinces will remain much the same as in the prior three months, though intense deficits will emerge in northern Saskatchewan. Deficits in the Upper and Middle Athabasca River watershed in Alberta will downgrade from exceptional to severe. In British Columbia (BC), surpluses will continue to emerge in the southeast and will increase in the north from Fort St. John west past Williston Lake.

From January through March, the overall pattern of anomalies is expected to be similar to the forecast for October through December. However, deficits will nearly disappear in NB and around Ottawa and Sherbrooke, will downgrade somewhat near Lake Mistassini (QC), and will shrink in the Skeena River region of western BC, transitioning to moderate surplus in the Lower Skeena watershed. Back east, moderate surpluses will emerge around Montreal.

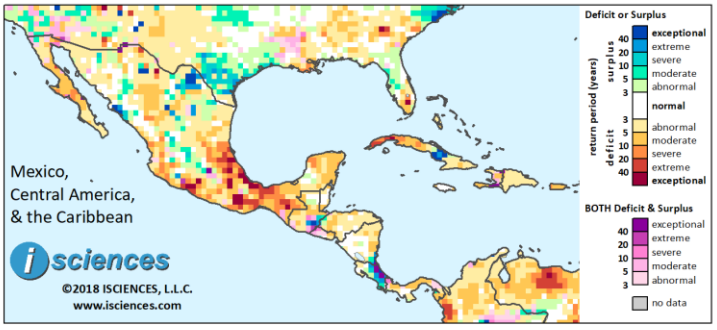
The forecast for the final three months – April through June – indicates widespread, primarily moderate, deficits throughout much of the country, and moderate surpluses in QC east of the Manicouagan Reservoir.

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

Mexico, Central America, and the Caribbean

The 12-month forecast ending June 2019 indicates pockets of severe to exceptional water deficit in Mexico's Gulf and southern states, and some primarily moderate deficits in central Baja, Durango, and Yucatan. Extreme to exceptional surpluses are expected in northern Coahuila and along Sinaloa's northern coast on the Gulf of California, with some pockets of lesser intensity in the center of the country.

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019



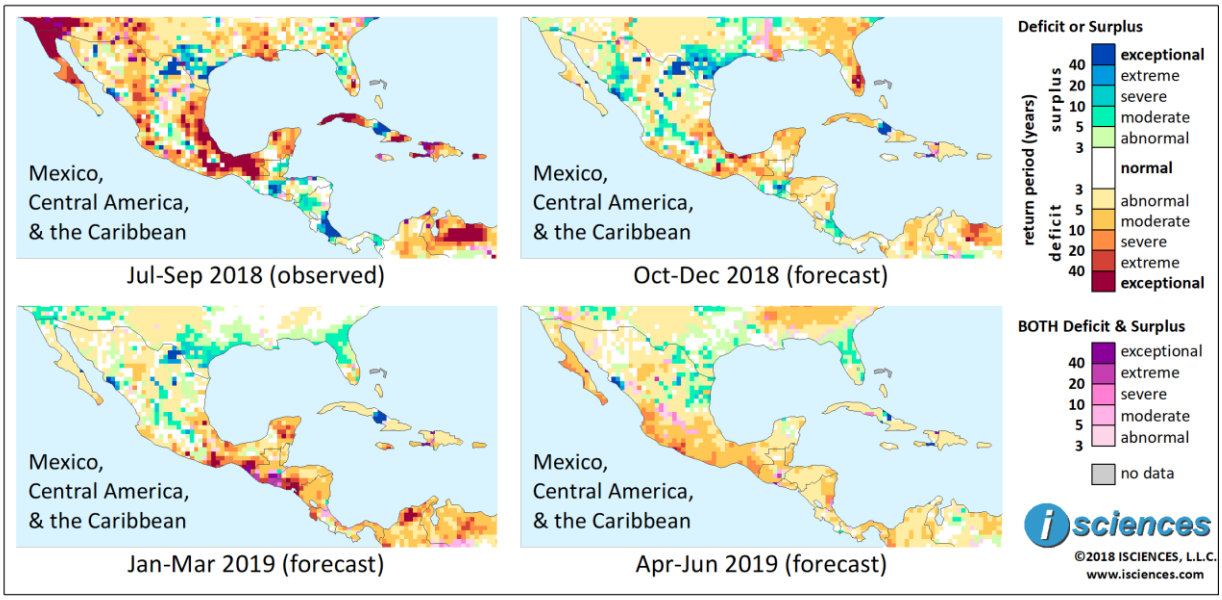
Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

In Central America, surpluses are forecast for Costa Rica and a pocket in southeastern Guatemala.

Moderate to extreme deficits are expected in western Cuba.

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

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019



Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

Intense deficits in the region are expected to diminish and downgrade over the next few months, and additional areas of surplus will emerge in Mexico. The forecast through December indicates primarily moderate deficits – with some pockets of more intense deficits – in Mexican states along the southern Gulf of Mexico and across to the Gulf of Tehuantepec in the Pacific. Moderate deficits are forecast for

Yucatan and Mexico's southern Pacific coast. Intense surpluses will persist in Coahuila in the north, and surpluses of varying intensity will increase in northern Sinaloa and nearby in western Chihuahua. Surpluses will also increase along a diagonal in the center of the country from Zacatecas through Mexico City.

In Central America moderate deficits are forecast for central Guatemala, southern Belize, western Honduras, and eastern Nicaragua. Surpluses are expected in eastern Guatemala and eastern Costa Rica and may be intense in Guatemala. Deficits in Cuba will moderate and deficits elsewhere in the Caribbean will become mild.

From January through March deficits will intensify in southern Mexico, particularly in Quintana Roo on the Yucatan Peninsula, and around the Gulf of Tehuantepec on the Pacific, reaching exceptional intensity in some pockets. Surpluses will persist in most of the aforementioned areas of Mexico, but will nearly disappear in Chihuahua. Deficits will increase in Central America, reaching most nations, and may be especially intense along the Pacific coast of Guatemala, El Salvador, and Honduras. Moderate to severe deficits will emerge in eastern Jamaica.

The forecast for the final three months – April through May – indicates moderate to severe deficits in Baja, southern Mexico, and parts of Central America. Surpluses are forecast to persist in northern Sinaloa, and to emerge in northeastern Mexico and along the Rio Grande.

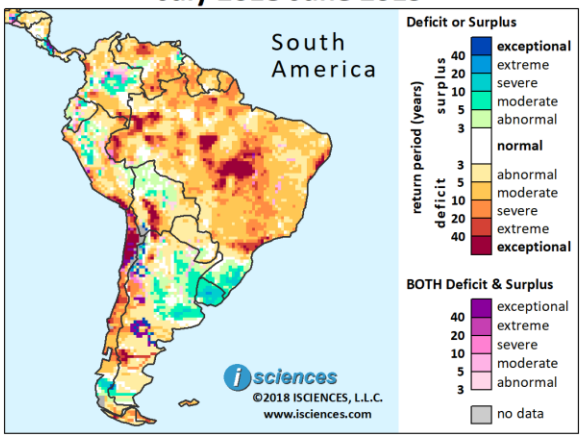
(It should be noted that forecast skill declines with longer lead times.)

South America

The 12-month forecast through June 2019 indicates significant water deficits in central Brazil and primarily moderate deficits throughout the rest of the country. Deficits may be exceptional in Pará, Tocantins, and Mato Grosso, as well as farther south in São Paulo. Deficits are also forecast for Brazil's northern neighbors.

Intense deficits are expected in southern coastal Peru; along a path in south-central Bolivia beginning near Cochabamba; much of Chile but particularly the north; and along the Ríos Chubut and Chico in Patagonia.

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019

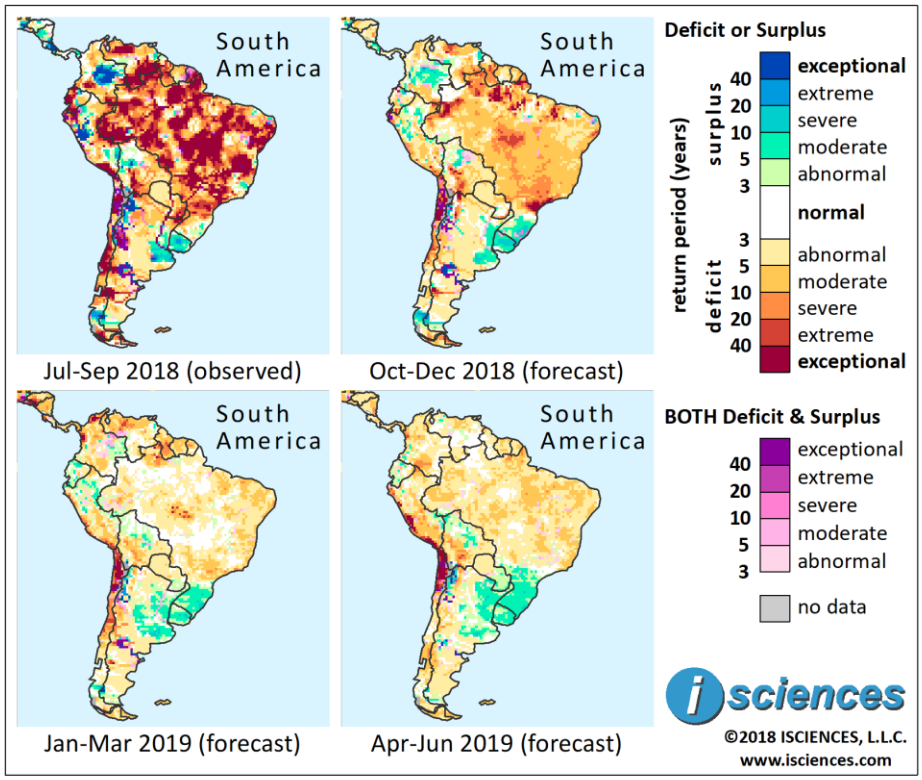


Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

Areas of surplus include: Rio Grande do Sul in southern Brazil; Uruguay; northeastern Argentina, and Buenos Aires, Cordoba, and central Neuquen Provinces in Argentina; and Patagonia surrounding O'Higgins/San Martín Lake and Río Santa Cruz.

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

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019



Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

The extent of exceptional deficits in the region will diminish considerably over the next several months. Through December, moderate deficits are forecast throughout most of Brazil but more intense patches are expected across the north, in the center of the country (Mato Grosso), and in the states of São Paulo and Paraná. Severe deficits are forecast for Guyana, and severe to extreme deficits in northern Venezuela. Intense deficits are also forecast in Bolivia from east of La Paz through Cochabamba to the south, and from southern Peru through the Atacama Desert in northern Chile past Santiago. Moderate to severe surpluses will persist in Uruguay and will emerge in nearby Rio Grande do Sul, Brazil. Surpluses of similar intensity are forecast for Entre Rios and Buenos Aires Provinces in Argentina, and in Patagonia around O'Higgins/San Martín Lake and Río Santa Cruz.

From January through March, deficit conditions in Brazil will continue to improve, with many regions returning to normal or mild to moderate deficit, though deficits may be more intense in Roraima and northern Mato Grosso. Deficits will persist in northern Venezuela, Guyana, Suriname, and French Guiana. Some pockets of deficit in northern Colombia will increase in intensity while the central part of the country transitions out of surplus to mild deficit. Deficits are forecast for coastal and southern Peru, and much of Chile, where conditions will be especially intense in the north. In Bolivia, deficits in the

south are expected to moderate. Surpluses will persist in southern Brazil and Uruguay and increase in northeastern Argentina.

In the final quarter – April through June – deficits will become more widespread in Brazil but will be merely mild to moderate; will decrease in its northern neighbors; will increase and intensify in Peru; and will remain intense in northern Chile. Surpluses are forecast for southern Brazil, Uruguay, and northeastern Argentina.

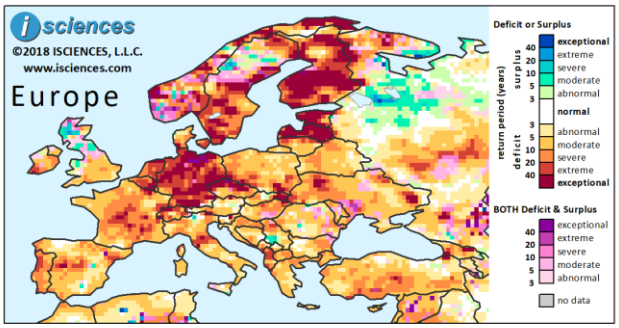
(It should be noted that forecast skill declines with longer lead times.)

Europe

The 12-month forecast through June 2019 indicates intense deficits in many parts of Central and Northern Europe. Areas with extreme to exceptional deficits include Finland, Sweden, Estonia, Latvia, Belgium, Netherlands, Germany, and Czechia (Czech Republic).

Deficits of varying intensity are forecast for nearly all remaining areas of Europe, with the exception of northern European Russia, southwestern Serbia, and northern United Kingdom, where moderate surpluses are forecast.

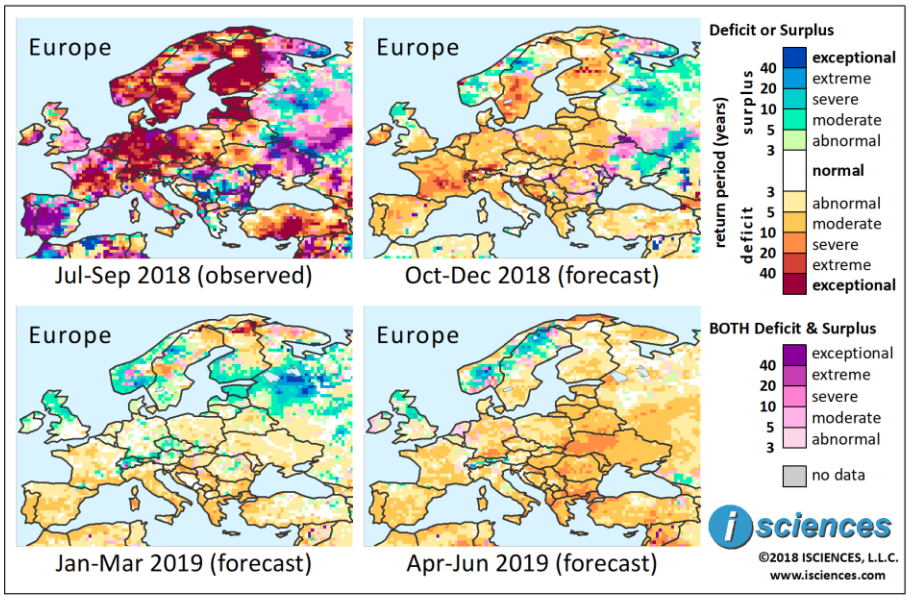
ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019



Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

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

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019



Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

Moderate deficits will dominate much of Europe from October through December, downgrading from prior exceptional deficits in many areas. Severe to extreme deficits are, however, forecast for southern Sweden, central Finland, southern France, Switzerland, and southern Germany. Norway is expected to transition from exceptional deficit to moderate surplus or normal conditions. Moderate surpluses are also forecast in Scotland and extreme surpluses in west-central Sweden. Surpluses of varying intensity are forecast for European Russia and eastern Ukraine.

From January through March, surpluses will increase in Northern Europe, deficits in Central and Eastern Europe will become merely mild or normalize, and moderate deficits are forecast for much of Mediterranean Europe including many Balkan regions. More specifically, surpluses will increase in northern United Kingdom, Norway, Sweden, and European Russia, and will emerge in Switzerland, Czechia, southern Finland, Estonia, and Latvia. Surpluses may be extreme to exceptional in Russia between Lake Onega and Rybinsk.

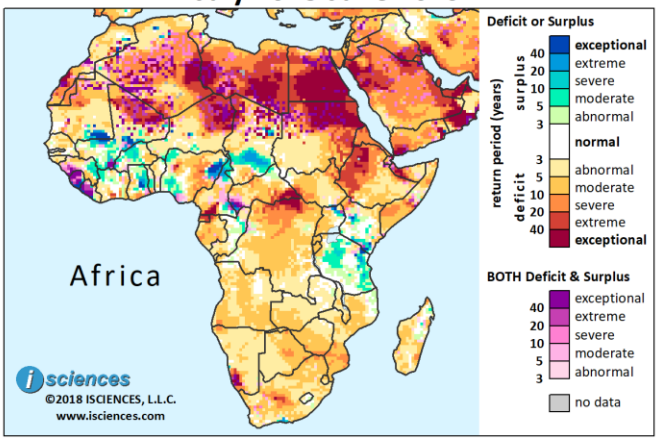
The forecast for the remaining months – April through June – indicates that surpluses will persist in parts of Northern Europe, but moderate deficits will increase throughout the region, with some severe deficits forecast in pockets of the Balkans and in western Ukraine.

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

Africa

The 12-month forecast through June 2019 indicates intense water deficits in a vast stretch across northern Africa from northern Mali to the Red Sea. Surpluses are forecast for pockets across the southern Sahel, around the northern Gulf of Guinea, and in patches of East Africa. Moderate deficits, punctuated by pockets of greater severity, are forecast for the remainder of the continent.

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019



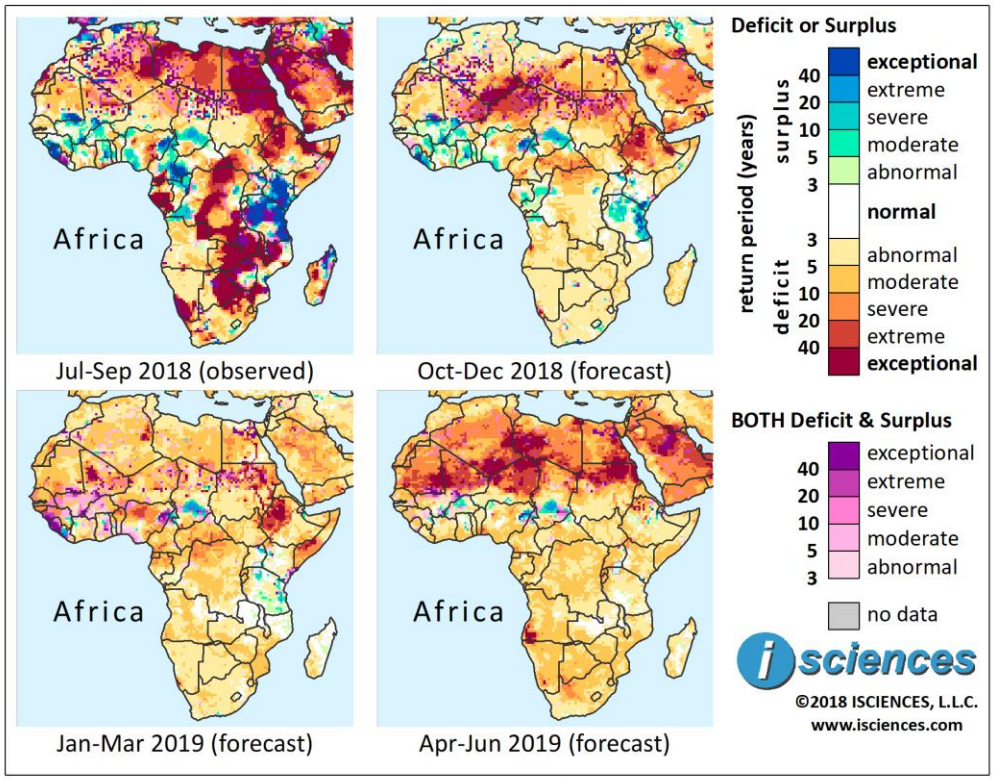
Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

Deficits are expected to be extreme to exceptional in western Ethiopia; the Blue Nile and the Atbara River; westernmost Somaliland; the intersection of Central African Republic and the Democratic Republic of the Congo; southwestern Cameroon and Equatorial Guinea; southwestern Namibia; and the Middle Orange River watershed in South Africa.

Regions with surpluses include: southeastern Mauritania, southern Mali, central Burkina Faso, Ghana, Togo, western and northeastern Nigeria, south-central Chad, and Tanzania, Kenya, and northern Uganda.

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

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019



Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

The forecast through December indicates that intense deficits will shrink considerably across northern Africa but emerge across the southern Sahara and into the Sahel. Extreme deficits are forecast along the Nile, Blue Nile, and Atabara Rivers, and in western Ethiopia and western Somaliland. Severe deficits are forecast for the White Nile through Sudan and for Central African Republic. Mild deficits are forecast for much of Africa's southern half. Areas of surplus include: southern Mali, Sierra Leone, Liberia, Burkina Faso, Ghana, coastal and northeastern Nigeria, south-central Chad, Republic of the Congo, Tanzania, southern Kenya, and northeastern Uganda.

From January through March, moderate deficits will dominate much of the continent, though more intense conditions are forecast for: Guinea-Bissau and Guinea; northwestern Mali; northern Nigeria; the Uele River through Central African Republic; the Nile, Atabara, Blue Nile, and White Nile Rivers; western Ethiopia; and southern Somalia. Surpluses will persist in south-central Chad, and some areas of surplus in West Africa will experience both deficit and surplus as transitions occur. Areas of surplus in Kenya, Uganda, and Tanzania will shrink or normalize.

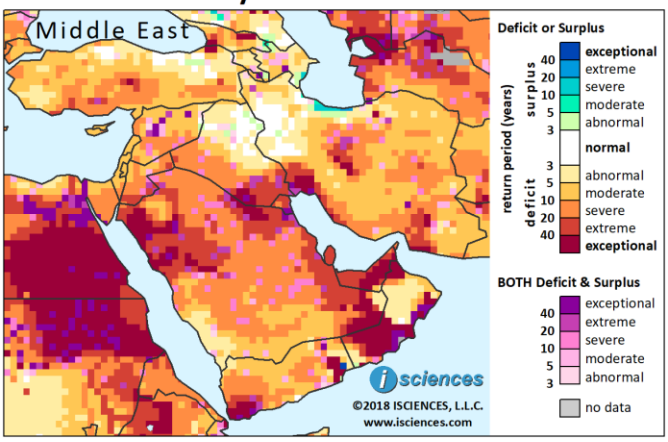
During the final quarter – April through June – deficits across northern Africa will become much more intense. Some pockets of surplus are forecast for Burkina Faso, northeastern Nigeria, and south-central Chad. Primarily moderate deficit conditions are forecast for the remainder of the continent.

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

Middle East

The forecast for the 12-month period ending June 2019 indicates deficits reaching exceptional intensity on the Arabian Peninsula and moderate to severe deficits in much of Turkey and the Levant. Areas of exceptional deficit include northwestern Saudi Arabia along the northern Red Sea, southwestern Yemen, western Oman, and eastern United Arab Emirates.

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019

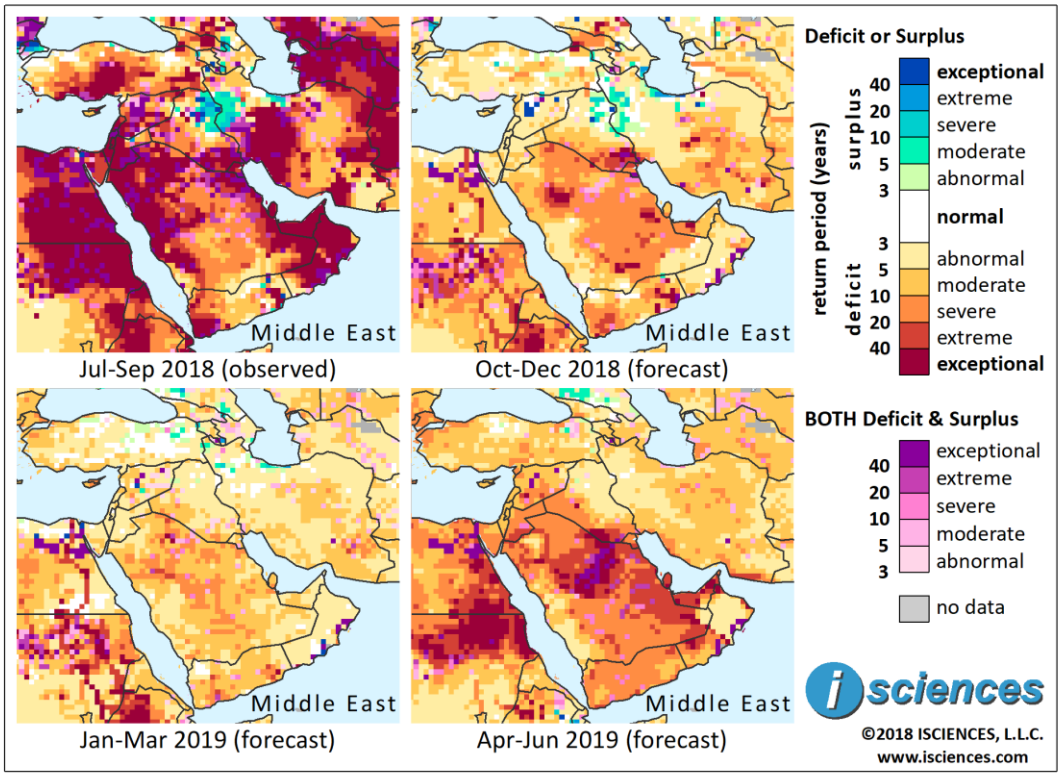


Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

In Iraq, conditions west of the Euphrates will be severe, but deficits will be even more intense in southern Iraq and into Iran along the northern Persian Gulf. Deficits of varying severity are forecast the bulk of Iran east of Tehran with intense deficits in the center of the country near Isfahan and south along the coast of the Gulf of Oman.

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

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019



Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

Deficits are expected to shrink and downgrade significantly in the region from October through December. Severe to exceptional deficits will persist, however, in southern Iraq around Basrah. Severe deficits are forecast for Georgia, Kuwait, most of Saudi Arabia, and into western United Arab Emirates. Deficits of varying severity are expected in Yemen and could reach exceptional intensity in some pockets in the east. Moderate to severe deficits are forecast for central and southern Iran. Deficits in the Levant will be mild, and mild to moderate deficits are forecast for Turkey. Some surpluses are expected in the northern Iran/Iraq border corridor, along Iran's Caspian Sea coast into Azerbaijan, and in northwestern Syria.

From January through March deficits will continue to downgrade, leaving moderate to severe deficits in Saudi Arabia and Yemen, primarily moderate deficits in western Iraq, central and southern Iran, western Turkey, and Georgia. Deficits elsewhere in the region will be generally mild, though conditions in Cyprus may be severe.

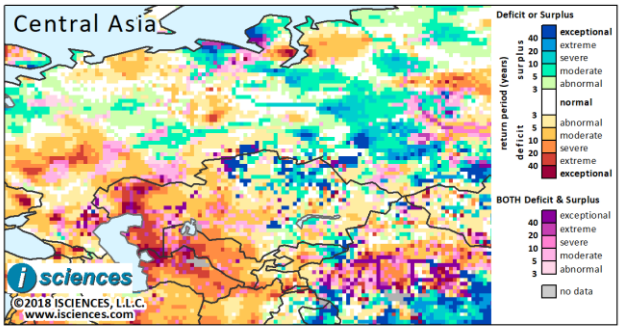
In the final quarter – April through June – deficits are expected to increase and intensify in the region with extreme to exceptional anomalies forecast for parts of the Arabian Peninsula and into southern Iraq.

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

Central Asia and Russia

The 12-month forecast through June 2019 indicates intense deficits in Turkmenistan, Uzbekistan and western Kazakhstan, particularly around the Caspian Sea. Deficits will also be intense in the Middle Volga River and Upper Don River regions of Russia.

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019



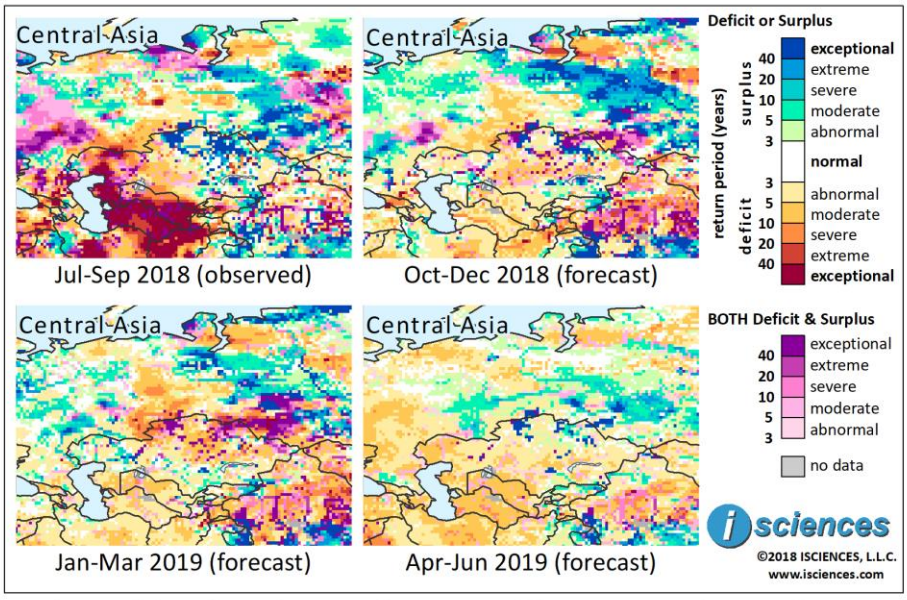
Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

Surpluses are forecast along the Ob River in Russia and will be widespread in the Middle and Upper Ob watershed and exceptional north of Novosibirsk. Surpluses are also forecast in the Vakh River region, an eastern tributary of the Ob. Intense surpluses are expected in the Tom River watershed and moderate surpluses along the Ishim River.

The forecast for northern Kazakhstan and eastern Kyrgyzstan also indicates surpluses. Deficits of varying intensity are expected in central Kyrgyzstan and Tajikistan.

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

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019



Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

The forecast through December indicates that prior exceptional deficits in Turkmenistan, Uzbekistan, western Kazakhstan, and the North Caucasus region will downgrade considerably. Deficits will be severe,

however, along the Harirud River in southern Turkmenistan as well as in eastern Tajikistan. Surpluses will persist in eastern Kyrgyzstan, south of Lake Balkhah in Kazakhstan, and scattered pockets in northern Kazakhstan, though conditions of both deficit and surplus are expected in the north as transition occur. Moderate surpluses are forecast to re-emerge in Kazakhstan west of the Aral Sea, but moderate deficits will increase in a band across the middle of the country.

In Russia, surpluses will increase between the Ob and Yenisei Rivers, encompassing the Taz River, and will be extreme to exceptional. Deficits are forecast in the Nizhnyaya Tunguska River region, an eastern tributary of the Yenisei. Moderate deficits are forecast in the southern Ural Mountains, with surpluses to the west. Surpluses will re-emerge in the Upper Don River watershed.

From January through March, deficits will increase across much of northern Kazakhstan and will intensify in the Urals in Russia, becoming severe. Surpluses between the Ob and Yenisei Rivers in Russia will diminish and downgrade somewhat but will remain exceptional in some areas including parts of the Yenisei. Surpluses will emerge on the Volga and may be intense in the Volga Uplands. Moderate deficits are forecast for western Uzbekistan, central Turkmenistan, and eastern Tajikistan. Surpluses will persist in eastern Kyrgyzstan and along the Ili River in southeastern Kazakhstan.

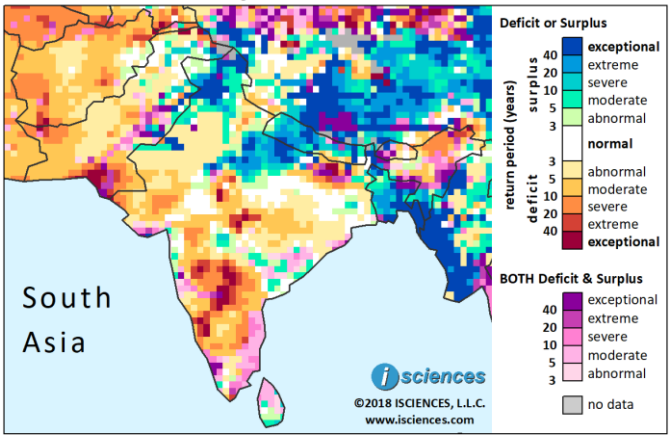
The forecast for the final months – April through June – indicates moderate deficits in Uzbekistan and Turkmenistan, western Kazazkstan, and the Central Russian Uplands; a transition from deficit to surplus in the southern Urals in Russia; and a decrease in surpluses in the Lower and Middle Ob and an increase in the Upper Ob region.

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

South Asia

The 12-month forecast through June 2019 indicates intense water deficits in Maharashtra, Telangana, Karnataka, and Madhya Pradesh, India, and around Karachi, Pakistan. Severe deficits are forecast for Arunachal Pradesh in India's Far Northeast, and moderate to severe deficits are expected in Afghanistan.

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019

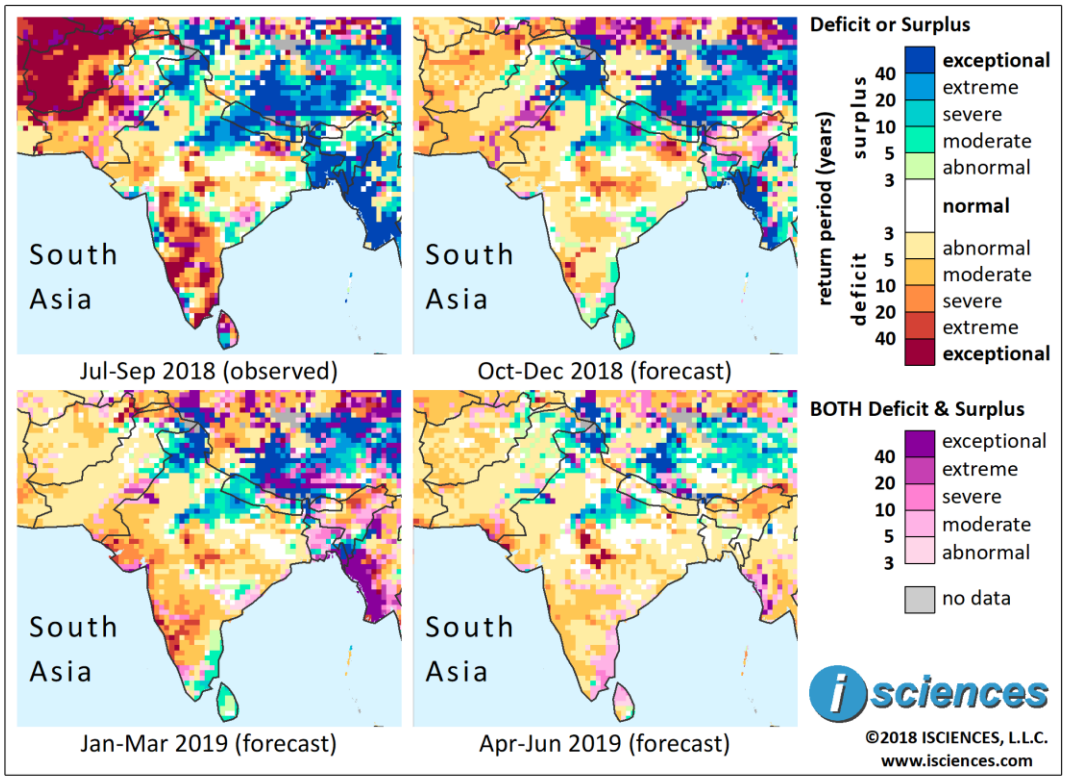


Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

Surpluses ranging from severe to exceptional are forecast for Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh, Manipur, Tripura, and Mizoram, India; Nepal; and Bangladesh. Surpluses are also expected along rivers in northern Pakistan, pockets of central India and a pocket in West Bengal.

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

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019



Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

Widespread exceptional deficits that have dominated Afghanistan in recent months will moderate overall through December, though deficits will remain more intense northeast of Kabul and along the Harirud River in the west. Moderate deficits are forecast for southern Pakistan, surpluses in the northeast, and conditions of both surplus and deficits along parts of the Sutlej River. In India, deficits will downgrade also but will be intense along the Tungabhadra River in the southwest, and in Madhya Pradesh, Bihar, and Arunachal Pradesh. Exceptional surpluses will increase in northernmost India and will downgrade somewhat in Uttar Pradesh but remain severe to extreme. Moderate surpluses are forecast for: India's southeastern coast; from southern Odisha to the Bay of Bengal; as well as Sri Lanka, Nepal, and Bangladesh.

From January through March the pattern of surplus anomalies in India will remain much the same as the forecast for the prior three months while deficits increase and intensify overall, particularly in Karnataka, coastal Maharashtra, Gujarat, and Madhya Pradesh. Deficits in Afghanistan and Pakistan will continue to downgrade, becoming mild with some more intense areas including northeast of Kabul, Afghanistan. Surpluses will persist in Nepal, primarily in the west. Both surpluses and deficits are forecast for Bangladesh as transitions occur.

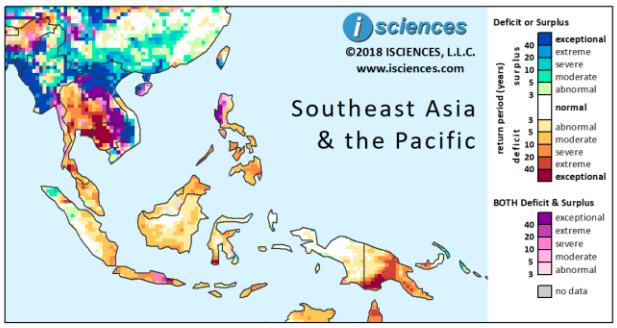
The forecast for the final month – April through June – indicates intense deficits in Madhya Pradesh, India, with moderate deficits to the south and west. Surpluses are forecast for Uttar Pradesh and India's far north. Some moderate deficits will emerge in Bhutan, relatively mild deficit conditions are forecast for Afghanistan and Pakistan, and nearly normal conditions in Nepal and Bangladesh.

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

Southeast Asia and the Pacific

The 12-month forecast through June 2019 indicates intense water surpluses in Myanmar, northern Laos, eastern Cambodia into Vietnam, and northern Vietnam. Significant deficits are forecast for western Cambodia and Thailand and are forecast to be exceptional in Cambodia.

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019

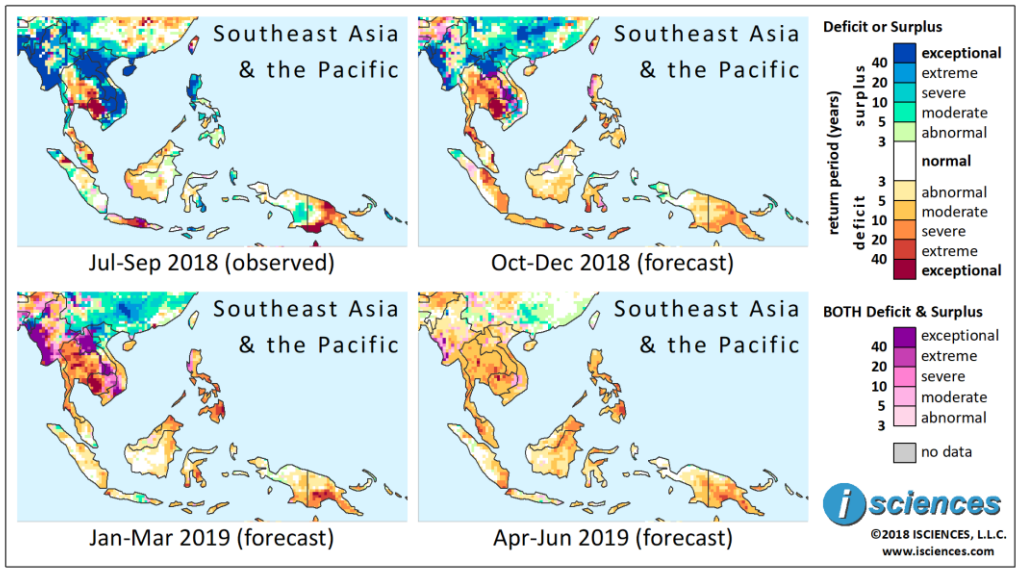


Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

Deficits of varying intensity are forecast for pockets of Malaysia, Philippines, Indonesia, and much of Papua New Guinea. Deficits are expected to be extreme to exceptional in Palawan (Philippines), and Papua New Guinea.

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

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019



Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

NOTE: 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 NOAA National Hurricane Center.

The near-term forecast through December indicates that surpluses in the region will shrink and downgrade, but exceptional conditions remain in the forecast for western Myanmar and northern Laos. Surpluses nearly as intense are expected in northern Vietnam. Moderate deficits will emerge in central

Vietnam, and exceptional deficits will persist in the bulk of western Cambodia. Moderate to extreme deficits will increase in Thailand and will emerge in eastern and southern Sumatra. Nearby Java will downgrade to primarily moderate deficits and neighboring islands to the east will transition from surplus to deficit, as will the Philippines. Deficits in Papua New Guinea are expected to moderate and conditions in eastern Papua, Indonesia will transition from surplus to mild deficit.

From January through March many regions of prior surplus will begin to transition, with both surpluses and deficits forecast (purple), including Myanmar, Laos, eastern Cambodia, the Mekong River, and Vietnam's Central Highlands. Exceptional deficits will shrink slightly in western Cambodia, deficits will increase in Thailand, and emerge in central and southern Vietnam and central and southern Myanmar. Deficits in the Philippines will intensify overall as will deficits in Papua New Guinea. Though deficits in Indonesia are forecast to shrink and downgrade, with some moderate surpluses emerging in central Java, severe deficits are forecast for southern Sulawesi.

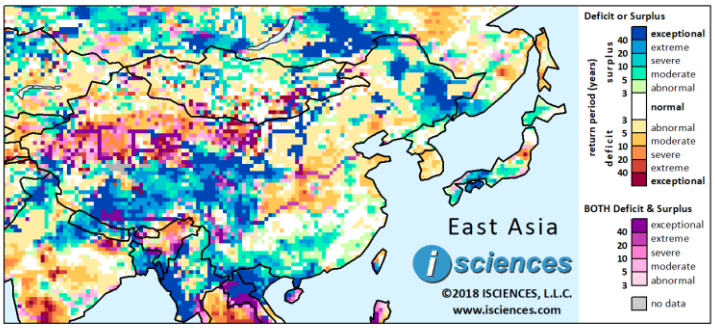
The forecast for the final months – April through June – indicates primarily moderate deficit conditions for many parts of the region

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

East Asia

The 12-month forecast for East Asia through June 2019 indicates widespread intense surpluses for Northeast China in Heilongjiang, Jilin, and northern Inner Mongolia; along the Ordos Loop and Upper Reaches of the Yellow River; in Qinghai and Sichuan; and in Tibet, including along the Yarlung River (Brahmaputra). Surpluses of somewhat lesser intensity are forecast for the Pearl River watershed in the south.

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019



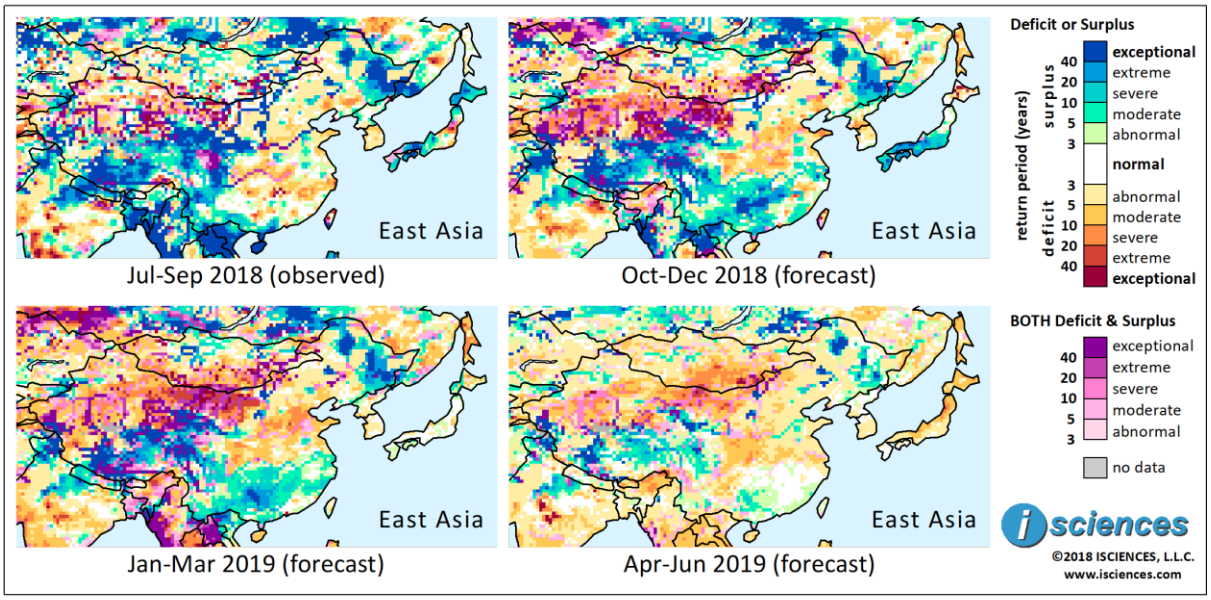
Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

Severe deficits are forecast for western Inner Mongolia and Xinjiang along with conditions of both deficit and surplus as transitions occur. Primarily moderate deficits are forecast for central provinces including Shanxi, Henan, and Hubei.

In Japan, surpluses are forecast for southern Honshu and Kyushu, and in western Hokkaido. Deficits are expected around Fukushima. Some moderate deficits are forecast for South Korea. A patchwork of anomalies is forecast for Mongolia with surpluses along rivers in the north and pockets of deficit scattered across the south.

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

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019



Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

Immediately apparent in the October through December forecast is the emergence of widespread surpluses south of the Yangtze River and through much of the Pearl River watershed. Surpluses may be exceptional at the intersection of Guizhou, Hunan, and Guangxi. Widespread surpluses will persist in Sichuan, Qinghai, and Tibet. Deficits are expected to increase and intensify from western Inner Mongolia through Xinjiang, with conditions of both deficit and surplus in areas of transition. Moderate to severe deficits will emerge from the North China Plain to the Yangtze River. Deficits are forecast for Taiwan.

Extreme surpluses are forecast for southern Japan, but some pockets of intense deficit are expected in Hokkaido. On the Korean Peninsula, moderate to severe deficits are forecast for southern North Korea reaching into South Korea. Deficits of varying intensity are expected spanning southern Mongolia and surpluses are forecast along rivers in the north.

From January through March widespread surpluses will persist from the Yantgze south; in Northeast China; and in Qinghai, Sichuan, and Tibet. Widespread deficits will persist from western Inner Mongolia through Xinjiang reaching extreme or exceptional intensity and will re-emerge in some areas where both surplus and deficit were forecast in prior months. Deficits will also persist from the North China Plain to the Yantgze, with intensity increasing to severe in the Plain. Conditions on the Korean Peninsula and in Japan will transition to near-normal, and anomalies in Mongolia will remain much the same as in the forecast for the prior three months with some increase in deficits.

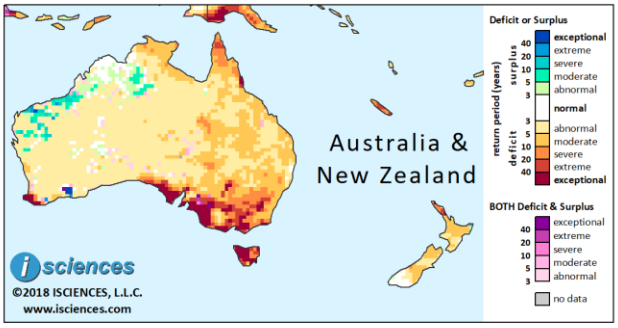
The forecast for the final three months – April through June – indicates that conditions south of the Yangtze will normalize overall, with some surpluses persisting in the western Pearl River region. Surpluses in Qinghai, Sichuan, and Tibet will downgrade somewhat but remain widespread, as will deficits in Inner Mongolia and Xinjiang. Some deficits are forecast for Japan but nearly normal conditions are expected in Korea.

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

Australia & New Zealand

The 12-month forecast through June 2019 shows intense deficits in southeastern Australia, moderate deficits in the eastern third of the country, and surpluses in northwestern Western Australia through the Hamersley Range to the Fitzroy River and in the Victoria River watershed of Northern Territory.

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019



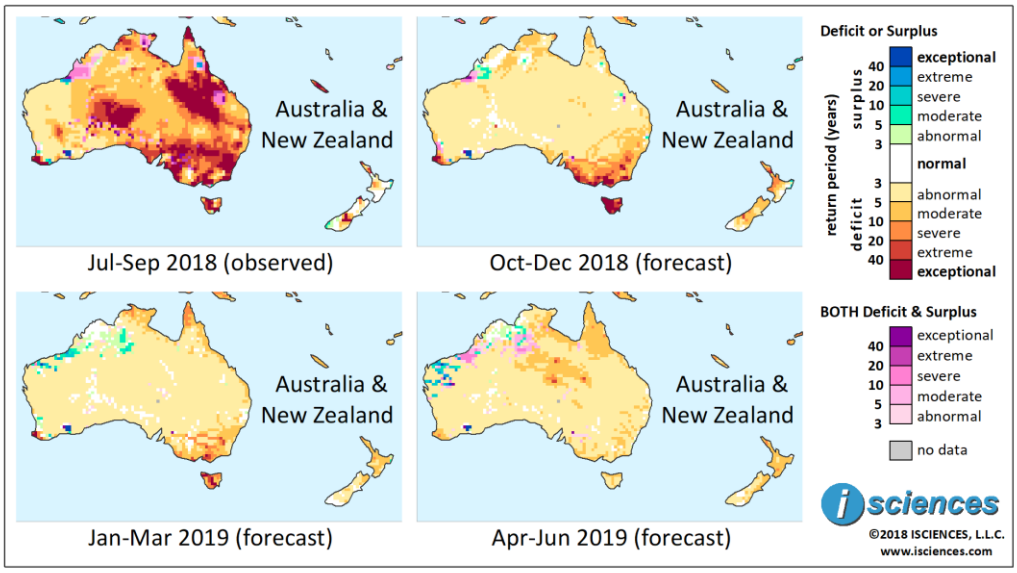
Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

Exceptional deficits are forecast for the Blackwood River region near Busselton in the tip of Western Australia, and moderate to extreme deficits are forecast for the Cape York Peninsula in northern Queensland.

Some moderate deficits are forecast for South Island New Zealand and severe deficits in western and northern North Island. Significant deficits are forecast for New Caledonia.

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

ISCIENCES COMPOSITE WATER ANOMALY INDEX: July 2018-June 2019



Based on observed data through September 2018 and forecasts issued September 24-30, 2018.

The forecast through December indicates that intense deficits which have dominated much of Australia in prior months will retreat from most regions except the southeast, where severe to exceptional deficits will persist. Deficits will be exceptional in Tasmania, and severe to exceptional along the southeast coast from Adelaide through Victoria and past Canberra. Moderate deficits are expected in the Murray-Darling Basin. Exceptional deficits will persist in the tip of Western Australia (WA), moderate

deficits are forecast scattered across northern Australia, and some moderate surpluses are expected south of the Fitzroy River in northern WA near the Dampier Peninsula. Moderate to severe deficits are forecast for New Zealand, and deficits in New Caledonia will moderate.

From January through March deficits will shrink and downgrade in southeastern Australia but will remain fairly intense in Tasmania. Moderate deficits are forecast for Victoria and eastern New South Wales (NSW) but deficits may be more intense east of Melbourne, along the Murray River, and in the Riverina region of NSW. Deficits in Cape York, Queensland will become severe, and intense deficits will persist in a small pocket in the tip of WA. Moderate to extreme surpluses will emerge in the Hamersley Range in northern WA, will re-emerge slightly north along the coast south of the Dampier Peninsula, and will also emerge in the Victoria River watershed of Northern Territory (NT). Moderate deficits are forecast for North Island, New Zealand and New Caledonia.

The forecast for the final months – April through June – indicates merely mild deficits in much of Australia, moderate deficits across the north and in the center of the country, and some lingering surpluses in northwestern WA and in northern NT.

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