ISCIENCES, L.L.C.
61 Main Street, Suite 200
Burlington, VT 05401 USA

Global Water Monitor & Forecast Watch List

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For more information, contact:
Thomas M. Parris, Vice President, 802-864-2999, parris@isciences.com

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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.

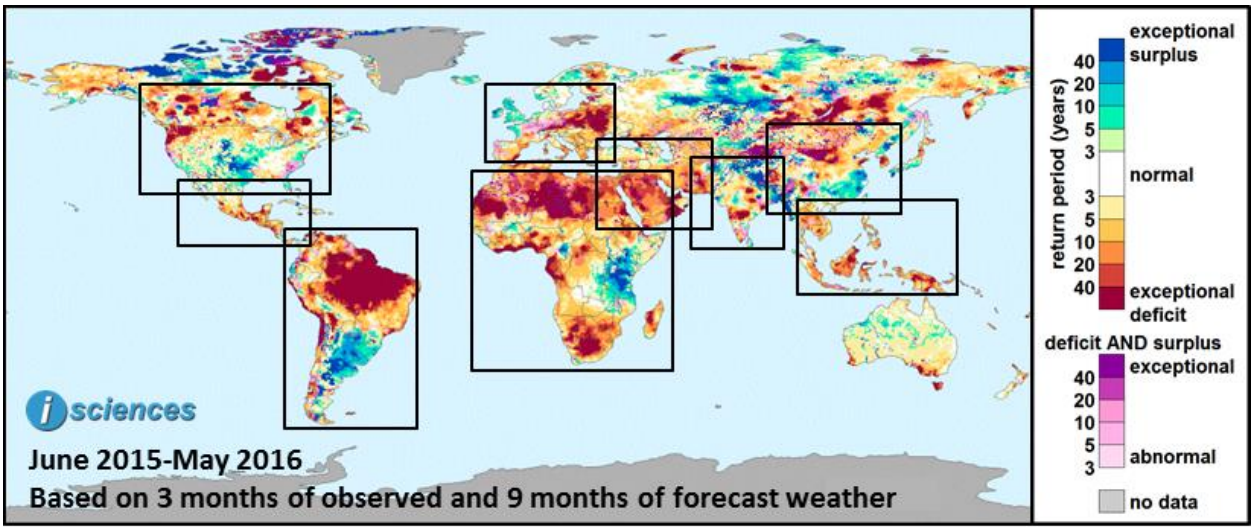
ISciences also provides assessments of the impacts of water anomalies on people, agriculture, and electricity generation. Detailed data and reports are available for purchase. Additional information and pricing is available upon request.

We have recently completed the latest Water Security Indicator Model (WSIM) analysis of global water anomalies using observed temperature and precipitation through August 2015 and an ensemble of forecasts issued the last week of August 2015. 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.

Worldwide Water Watch List



This map presents a selection of regions likely to encounter significant water anomalies during the one year period beginning in June 2015 and running through May 2016 using 3 months of observed temperature and precipitation data and 9 months of forecast data.

United States and Canada: Deficits may persist in the US Northwest. Deficits in the West may persist for a few months before beginning to transition to moderate surpluses. Surpluses are forecast in the Central and Southern Plains and parts of the eastern US. In contrast, widespread deficits are expected to emerge in the Mississippi Valley from the Gulf of Mexico northward to Minnesota; and, from Canada's Central Plains eastward through Ontario and into Quebec.

Mexico and Central America: Deficit conditions are forecast to persist in southern Mexico and much of Central America. Surpluses are expected in northwest Mexico.

South America: Deficits may continue across much of northern South America, particularly persistent in northern Brazil, and coastal Peru and Chile. Surpluses may emerge in coastal Ecuador and northern Peru. Surpluses are also forecast for central Paraguay, southern Brazil, Uruguay, and Argentina, and are expected to increase in extent and severity with widespread exceptional surpluses.

Middle East: Extreme to exceptional water deficits may dominate the region, including the Arabian Peninsula, Jordan, southern Iraq, and central Iran. Surplus conditions in Turkey are expected to transition to deficits, increasing in extent and severity.

Europe: Widespread deficits are expected in much of Continental Europe, while surpluses may dominate in the United Kingdom and Ireland. Deficits may transition to surpluses, first in Western Europe and later in Central Europe. However, Mediterranean Spain, Italy, Eastern Europe, and the Balkan Peninsula may experience persistent deficits.

Africa: Exceptional surpluses are expected in East Africa, centered in Tanzania. Exceptional deficits may dominate North Africa and are forecast to persist in coastal West Africa from southern Liberia to Angola. Deficits may strengthen in southern Africa and Madagascar.

South Asia: Extreme to exceptional deficits are forecast in several regions of India: Central Uttar Pradesh; East Madhya Pradesh/Northwest Chhattisgarh; Maharashtra/Northern Karnataka/Telangana.

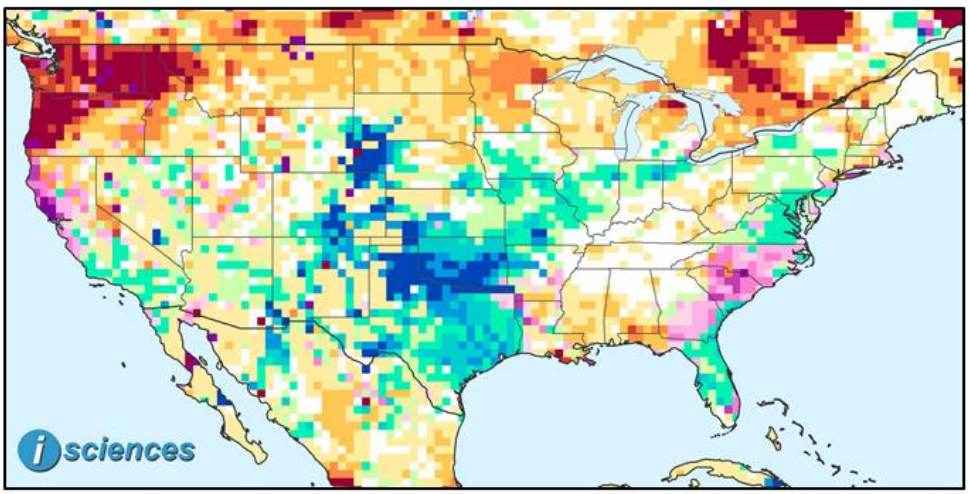
China, Mongolia, South Korea, Japan: Widespread deficits may continue in North China including the North China Plain and in Mongolia, though some areas may experience both deficits and surpluses. Widespread surpluses are forecast for Southeast China and southern Honshu, Japan. Exceptional deficits may persist in South Korea before beginning to diminish in severity.

Southeast Asia and the Pacific: Many parts of Southeast Asia and the Pacific may continue to experience moderate to exceptional water deficits in the coming months, particularly eastern Borneo and neighboring Sulawesi, the island of New Guinea, and the Philippines. Though periods of some respite are forecast, deficits are expected to return and spread in Thailand, Laos, Cambodia, and Vietnam.

Watch List: Regional Details

United States

The composite for the contiguous United States continues to indicate numerous regionally significant water anomalies.

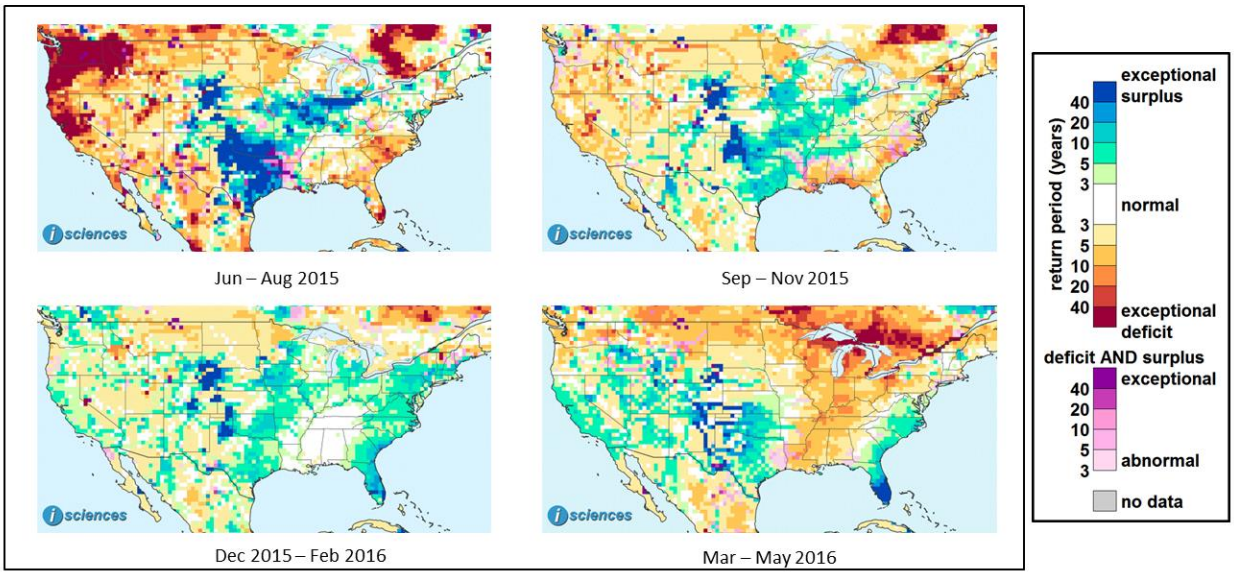


Based on observed data through August and forecasts issued the last week of August 2015

- Water deficits may dominate the northern US from the Pacific Northwest through the Great Lakes region.
- California may transition from deficits to moderate surpluses, with both surpluses and deficits possible in Northern California.
- Moderate deficits are forecast for Louisiana, Mississippi, and Alabama.
- Surpluses are expected in the Central and Southern Plains, in the Mid-Atlantic, and in Florida. Surpluses in the Southern Plains may be exceptional and widespread.
- The US Southeast may have characteristics of both water deficits and surpluses.

The 3-month composites (below) for the same 12-month period show the evolving conditions in more detail. Of particular interest is the possible emergence of extensive deficits forecast March through May from the central Gulf Coast region northward through the Great Lakes region. (It should be noted that forecast skill declines with longer lead times.)

WSIM Composite Water Anomaly Index Jun 2015-May 2016 (3-Month)



Based on observed data through August and forecasts issued the last week of August 2015

September to November:

- Deficits may persist in the western US, though the Pacific Northwest may experience both deficits and surpluses. Deficits may also persist in the Northern Plains and into Minnesota.
- Surpluses may persist in the Central and Southern Plains and along Mississippi River tributaries; and may emerge in northern Mississippi, northern Alabama, and eastern Tennessee.
- Deficits in the Southeast may transition to surpluses in November.
- Deficits may emerge in Upstate New York, Massachusetts, Connecticut, and Rhode Island, but may subside by November.

December through February:

- Surpluses may dominate many parts of the country, with the exception of the Northern Plains, where deficits may persist. Tributaries of the Mississippi River may continue to experience surpluses.

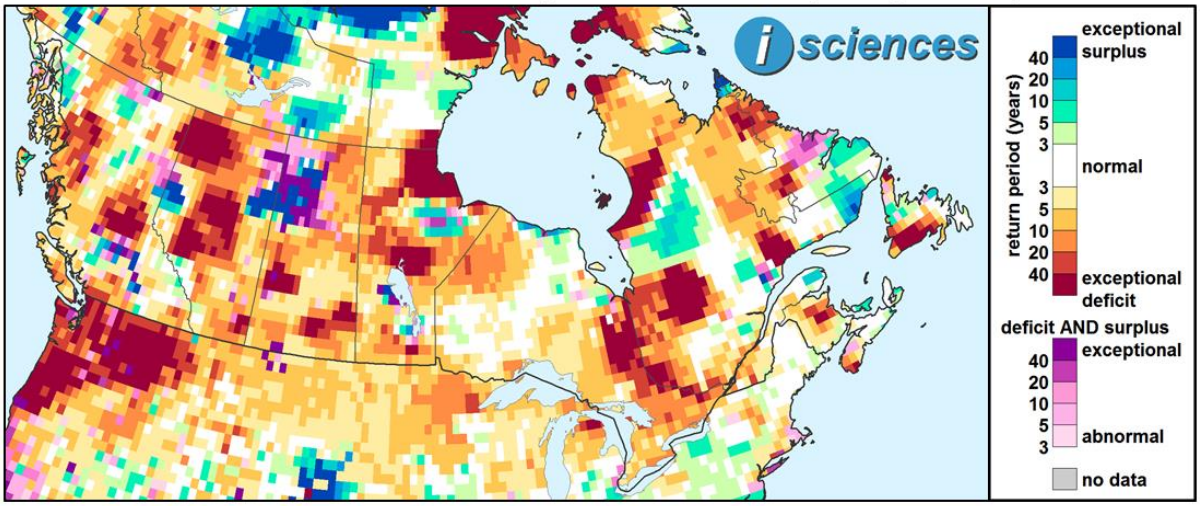
March through May:

- Widespread deficits are expected to emerge in the Mississippi Valley from the Gulf of Mexico northward into the Canada, and in the Midwest and Great Lakes.
- Surpluses may continue to emerge in the West, Southwest, and Texas.
- Surpluses may also persist in the South Atlantic states, with particular severity in southern Florida.

Canada

Widespread deficits with large pockets of exceptional deficits are expected in Canada's Central Plains, and eastern Ontario into Quebec.

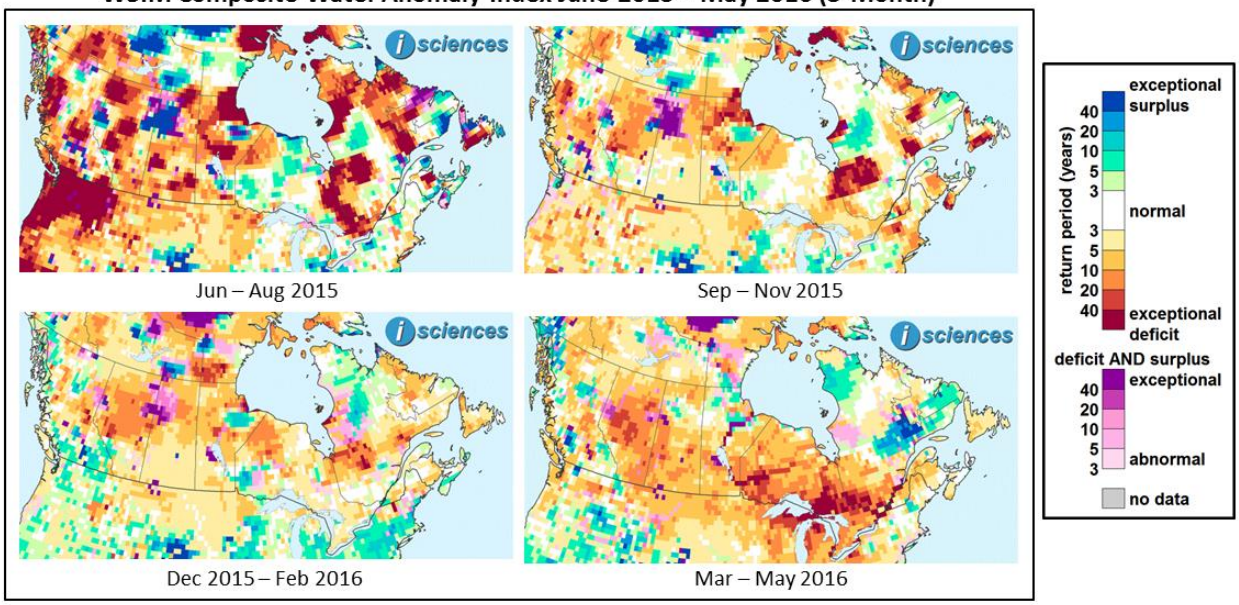
WSIM Composite Water Anomaly Index June 2015 – May 2016 (12-Month)



Based on observed data through August 2015 and forecasts issued last week of August 2015

As indicated in the 3-month maps (below) for the same 12-month period, deficits from British Columbia to Manitoba may persist for the duration of the forecast periods, and deficits in Ontario and Quebec may increase in extent and severity March through May. (It should be noted that forecast skill declines with longer lead times.)

WSIM Composite Water Anomaly Index June 2015 – May 2016 (3-Month)

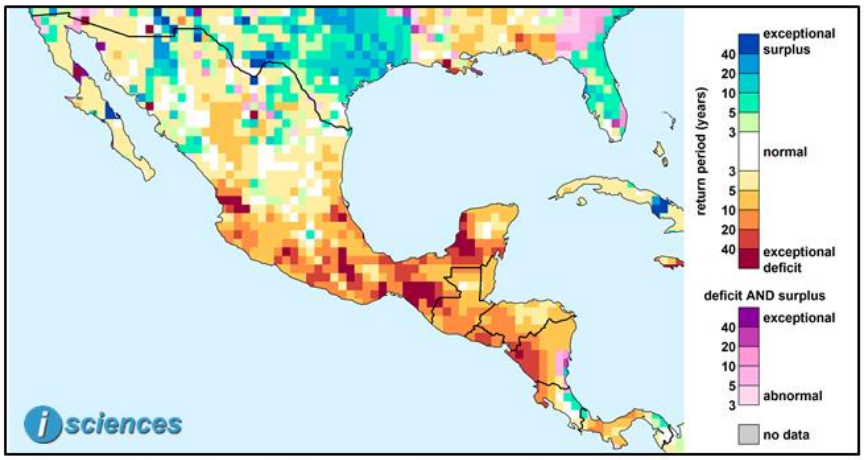


Based on observed data through August 2015, and forecasts issued last week of August 2015

Mexico and Central America

Widespread exceptional water deficits are forecast for southern Mexico, the Yucatan Peninsula, Belize, Guatemala, El Salvador, Honduras, Nicaragua, northwest Costa Rica, and western Panama. Surpluses may continue to emerge in Mexico's northwestern state of Chihuahua.

WSIM Composite Water Anomaly Index Jun 2015-May 2016

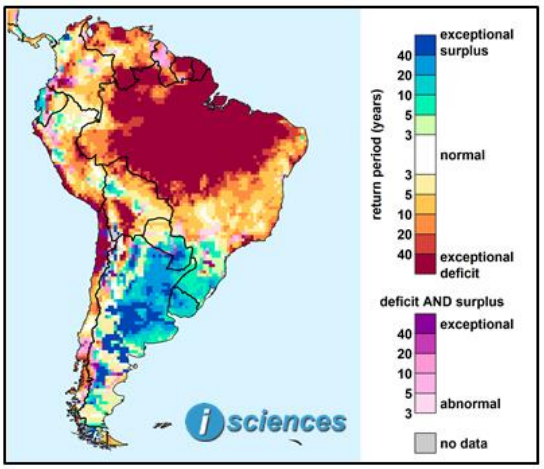


Based on observed data through August and forecasts issued the last week of August 2015

South America

Exceptional deficits may continue across much of northern Brazil and coastal Peru and Chile for the remainder of the forecast period. The extent, severity, and persistence of surpluses and deficits through May 2016 is evident in the 12-month map (right).

WSIM Composite Water Anomaly Index
Jun 2015-May 2016

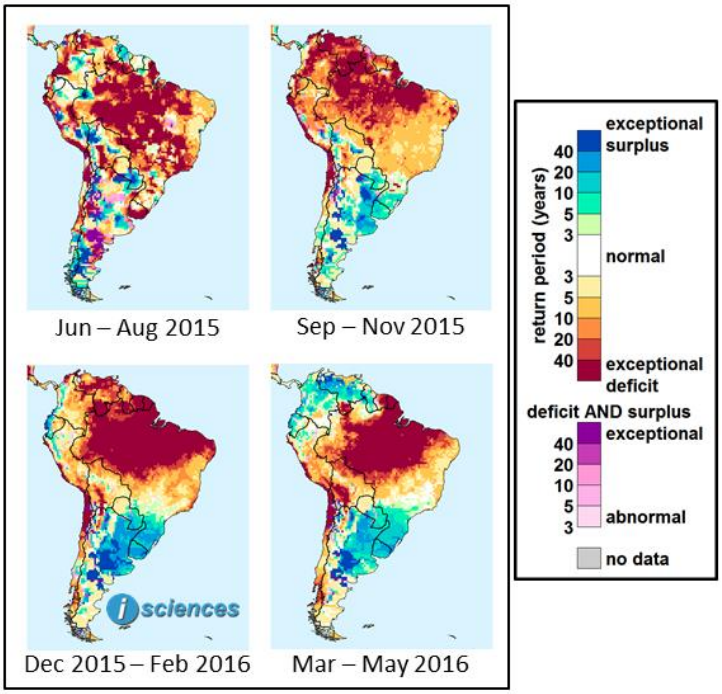


Based on observed data through August and forecasts issued the last week of August 2015

As seen in the 3-month maps (below) surpluses are forecast in September for central Paraguay, southern Brazil, Uruguay, and Argentina, and are expected to increase in extent and severity through May 2016 with widespread exceptional surpluses anticipated.

Also evident in the 3-month maps is the forecast of a shift from deficit to surpluses in northern South America March through May. Surpluses may begin to emerge in northern Peru, coastal Ecuador, and coastal Colombia December through February; and may continue to emerge in Colombia, Venezuela, and Guyana March through May. (It should be noted that forecast skill declines with longer lead times.)

WSIM Composite Water Anomaly Index Jun 2015-May 2016 (3-Month)



Based on observed data through August and forecasts issued the last week of August 2015

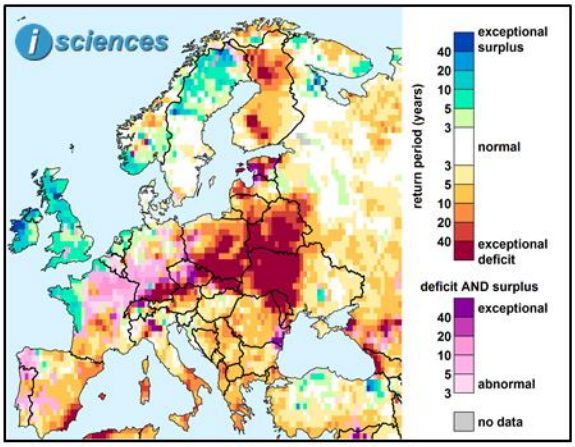
Europe

The 12-month composite map (at right) clearly shows the dominance of water deficits in much of Europe, with the exception of Ireland, the United Kingdom, and northern Sweden.

However, the forecast indicates a transition to surpluses in many areas as evident in the 3-month composites (below) for the same 12-month period.

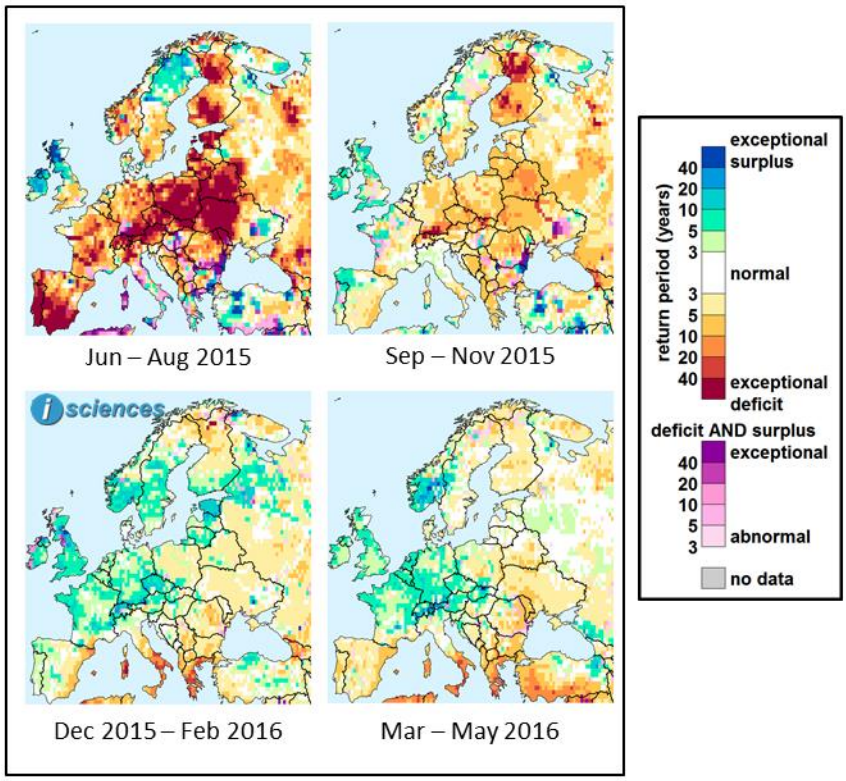
Though deficits are expected to persist in much of Europe through October, particularly along major rivers, they may diminish and transition to surpluses November 2015 through May 2016. Surpluses may emerge first in Western Europe and later in Central Europe. In contrast, water deficits are expected in the following areas November through May: Mediterranean Spain, Italy, and the Balkan Peninsula. (It should be noted that forecast skill declines with longer lead times.)

WSIM Composite Water Anomaly Index
Jun 2015-May 2016



Based on observed data through August and forecasts issued the last week of August 2015

WSIM Composite Water Anomaly Index
Jun 2015-May 2016 (3-Month)

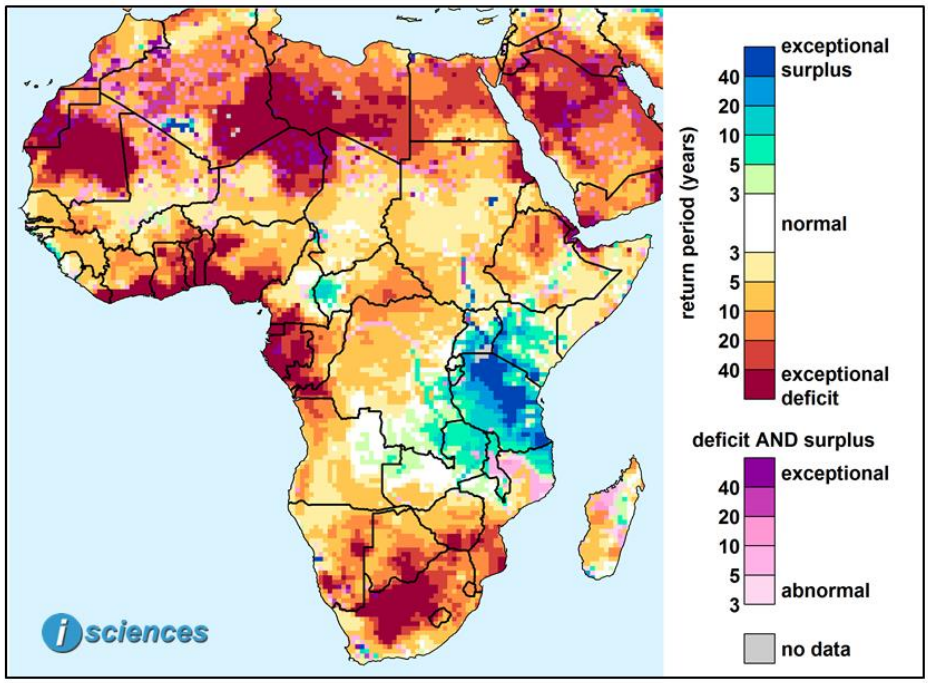


Based on observed data through August and forecasts issued the last week of August 2015

Africa

The dominant water security issues of interest in Africa continue to be drought in Coastal West Africa and Southern Africa, and water surpluses in Tanzania and surrounding regions, as apparent in the 12-month map below which shows 3 months of observed data and 9 months of forecast data.

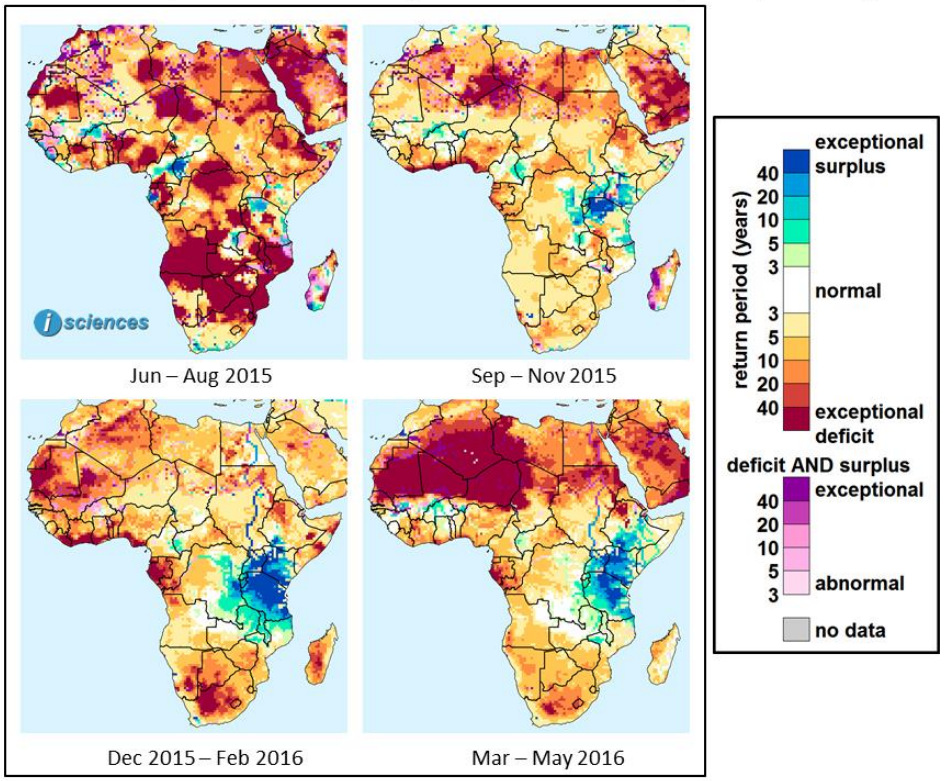
WSIM Composite Water Anomaly Index June 2015 – May 2016 (12-Month)



Based on observed data through August 2015 and forecasts issued last week of August 2015

The 3-month composites for the same 12-month period show the evolving conditions in more detail. Notable are the exceptional surpluses expected to dominate East Africa through May, and the widespread deficits across the northern third of the continent (particularly the northwest) in the March through May forecast.

WSIM Composite Water Anomaly Index June 2015 – May 2016 (3-Month)



Based on observed data through August 2015 and forecasts issued last week of August 2015

In addition, Coastal West Africa may continue to experience water deficits through May 2016, which may reach far inland to noncoastal areas as well. Exceptional deficits are expected to affect coastal regions of Liberia, Cote D'Ivoire, Ghana, Togo, Benin, Nigeria, Cameroon, Equatorial Guinea, and Gabon, and may extend farther south in the months to follow.

In Southern Africa conditions are forecast to moderate through November. However, severe (10-20 year) deficits may emerge in December and extreme (20-40 year) to exceptional (greater than 40 year) deficits are possible through May, affecting Namibia, South Africa, Lesotho, Botswana, Zimbabwe, and Mozambique.

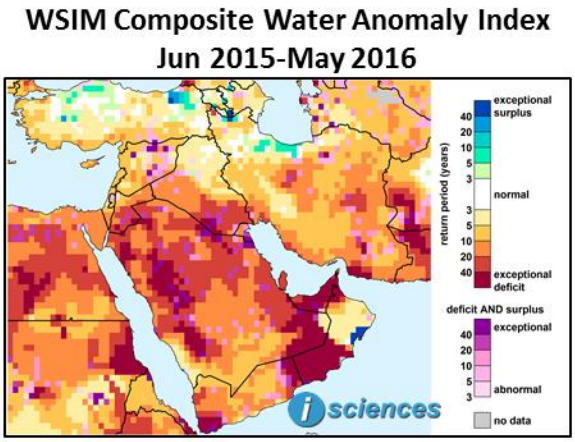
Water surpluses are expected in parts of East Africa in October which may become exceptional and widespread through May 2016 centering on Tanzania and also present in eastern Democratic Republic of the Congo, northern Zambia, northern Mozambique, Burundi, Rwanda, Uganda, Kenya, and southern Ethiopia.

Exceptional deficits are forecast for a large portion of northwest Africa from Mauritania through western Libya and Chad beginning in February and persisting through May. Severe to exceptional deficits are expected across the remainder of northern Africa.

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

Middle East

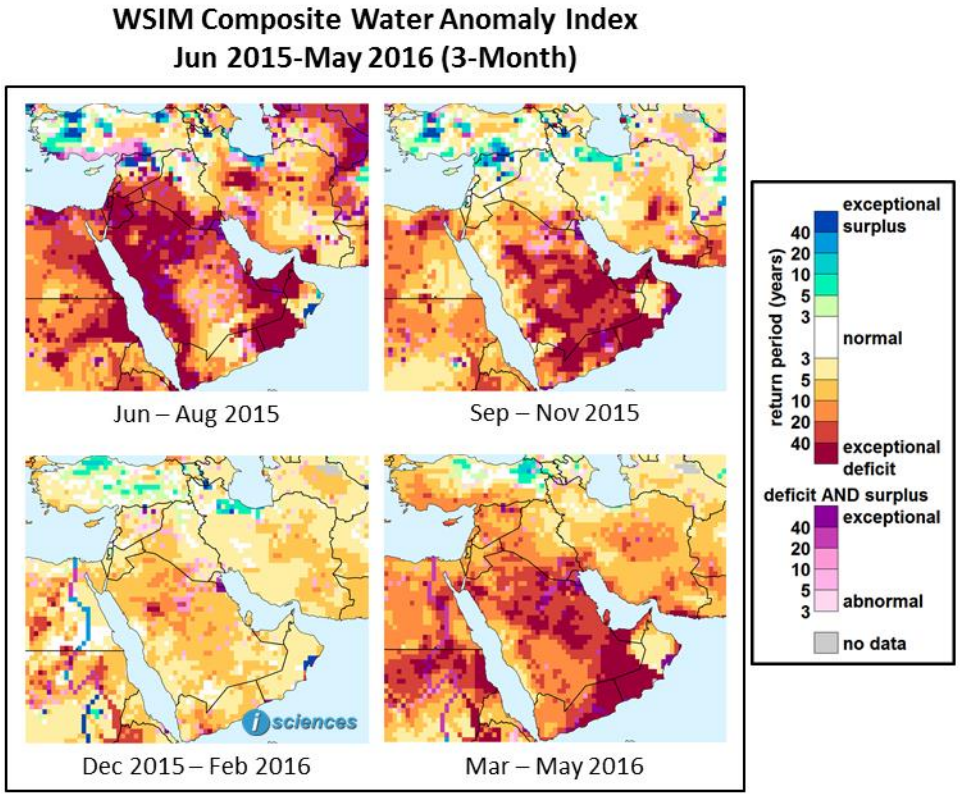
Extreme to exceptional water deficits may dominate the region, including the Arabian Peninsula, Jordan, southern Iraq, and central Iran, as seen in the 12-month map (right).



Based on observed data through August and forecasts issued the last week of August 2015

The 3-month composites (below) for the same 12-month period show the evolving conditions in more detail. While pockets of Turkey, Syria, and northern Iran are forecast to experience water surpluses September through November, exceptional deficits are expected on the Arabian Peninsula, southern Iraq, and central and southern Iran.

Moderate water surpluses may continue to emerge in Turkey December through February and may emerge in northern Iraq; deficits elsewhere may persist, though diminish in severity, before resuming previous exceptional deficit status March through May. Surplus conditions in Turkey are expected to transition to deficit beginning in February and increasing in extent and severity through May. (It should be noted that forecast skill declines with longer lead times.)

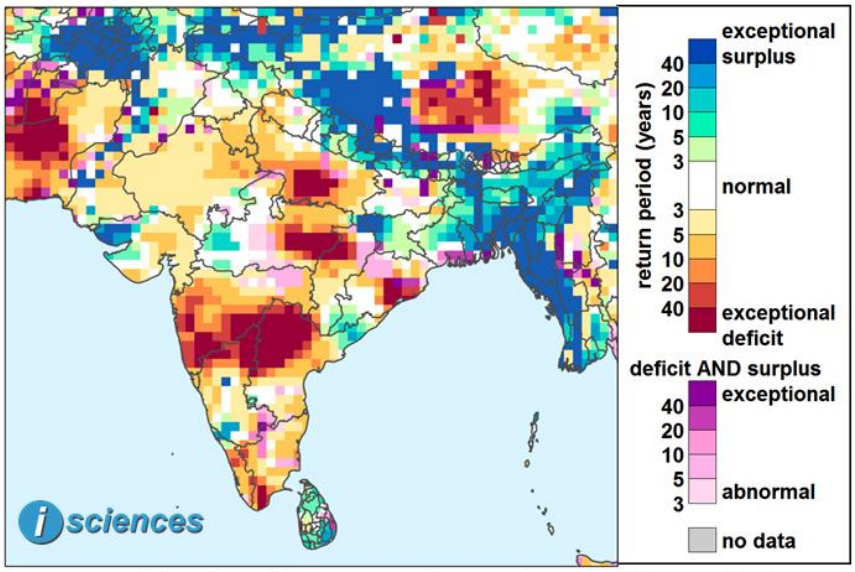


Based on observed data through August and forecasts issued the last week of August 2015

South Asia

We are now almost through the South Asian Monsoon season. The 6-month map below is based on observed temperature and precipitation for May, June, July, and August 2015; and, forecasts for September and October 2015 issued the last week of August 2015. Extreme to exceptional deficits are forecast in several regions of India: Central Uttar Pradesh; East Madhya Pradesh/Northwest Chhattisgarh; Maharashtra/Northern Karnataka/Telangana.

Composite Water Anomaly Index for the South Asian Monsoon
May 2015-October 2016 (6-Month)

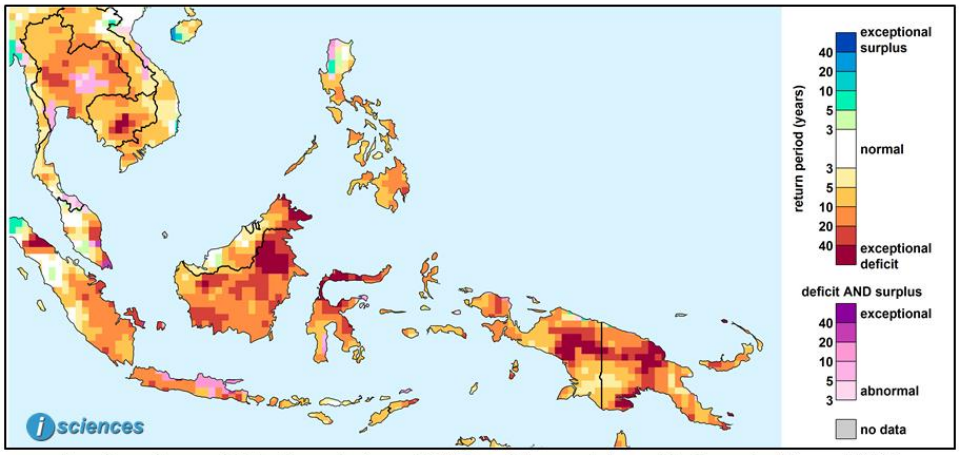


Based on observed data through August and forecasts issued the last week of August 2015

Southeast Asia and the Pacific

Many parts of Southeast Asia and the Pacific may continue to experience moderate to exceptional water deficits in the coming months, as evident in the 12-month map below.

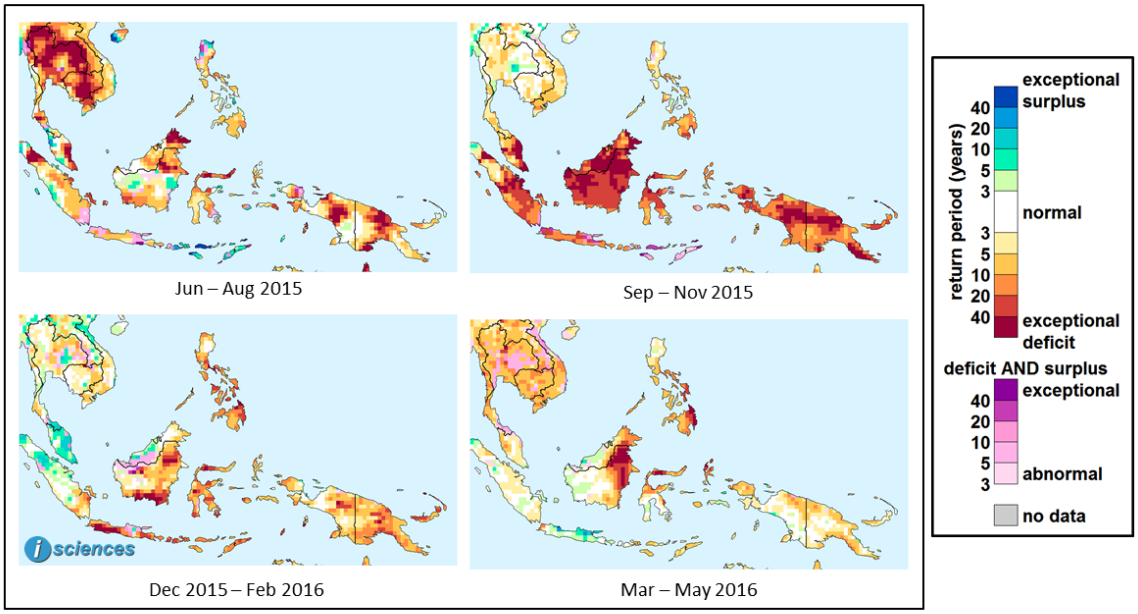
WSIM Composite Water Anomaly Index June 2015 – May 2016 (12-Month)



Based on observed data through August 2015, and forecasts issued last week of August 2015

As seen in the 3-month composites (below) for the same 12-month period, deficits may be of the greatest extent and severity September through November and may persist through May, particularly in eastern Borneo and neighboring Sulawesi, the island of New Guinea, and the Philippines. Deficits will persist and spread March through May in Thailand, Laos, Cambodia, and Vietnam. Thailand may experience both surpluses and deficits through February. (It should be noted that forecast skill declines with longer lead times.)

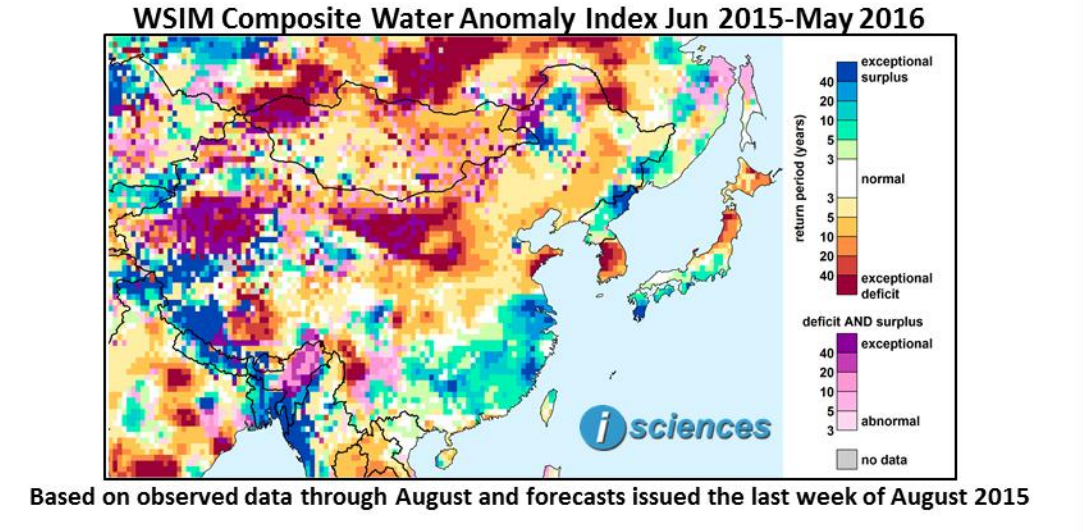
WSIM Composite Water Anomaly Index June 2015 – May 2016 (12-Month)



Based on observed data through August 2015, and forecasts issued last week of August 2015

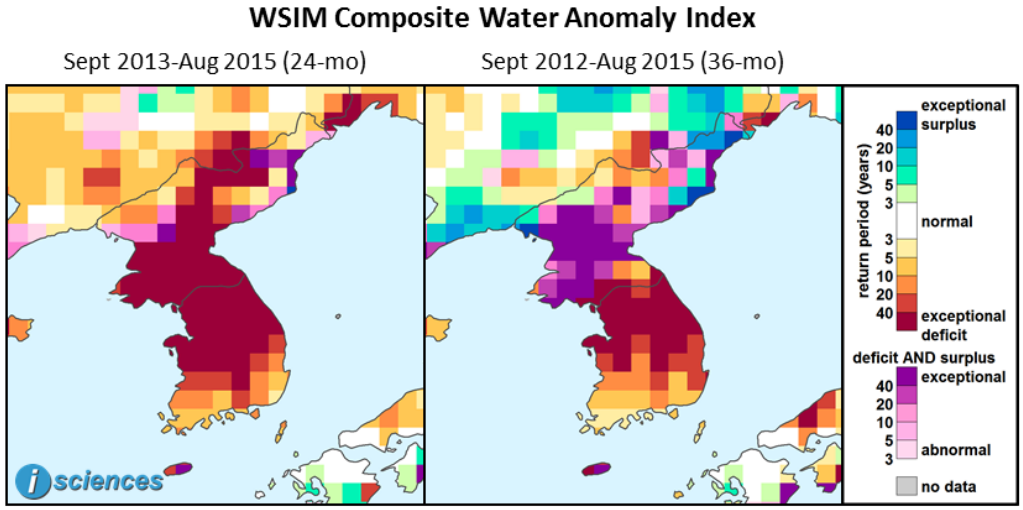
China, Mongolia, South Korea, Japan

Widespread deficits may continue in North China including the North China Plain and in Mongolia, though some areas may experience both deficits and surpluses. Widespread surpluses are forecast for Southeast China and southern Honshu, Japan. Deficits are forecast for northern Honshu and for Hokkaido, Japan. Exceptional deficits may persist in South Korea before diminishing somewhat in severity beginning in February 2016.



Based on observed data through August and forecasts issued the last week of August 2015

The drought in South Korea has been persistent, exceptional, and widespread, as seen in the 24- and 36-months maps below.



Based on observed data through August 2015