DROUGHT MONITORING AND ASSESSMENT (CHINA)

SUMMARY

Title
Drought Monitoring and Assessment (China)

Service
Monitoring of drought indicators (basic service), generation of additional products and analyses in case of drought (special service)

End users
Decisionmaking service of the China Meteorological Administration (CMA); provincial governments and agriculture services

Intermediate users
National Climate Centre; provincial meteorological bureaus

Application(s)
Operational climate monitoring

Models used
Thermal inertia soil model

Climate data records used
- Land surface temperature (2002 onwards)
- NDVI (2002 onwards)

Satellite observations used
- NOAA AVHRR, FY-2E (basic service)
- FY-3 MWRI (special service)

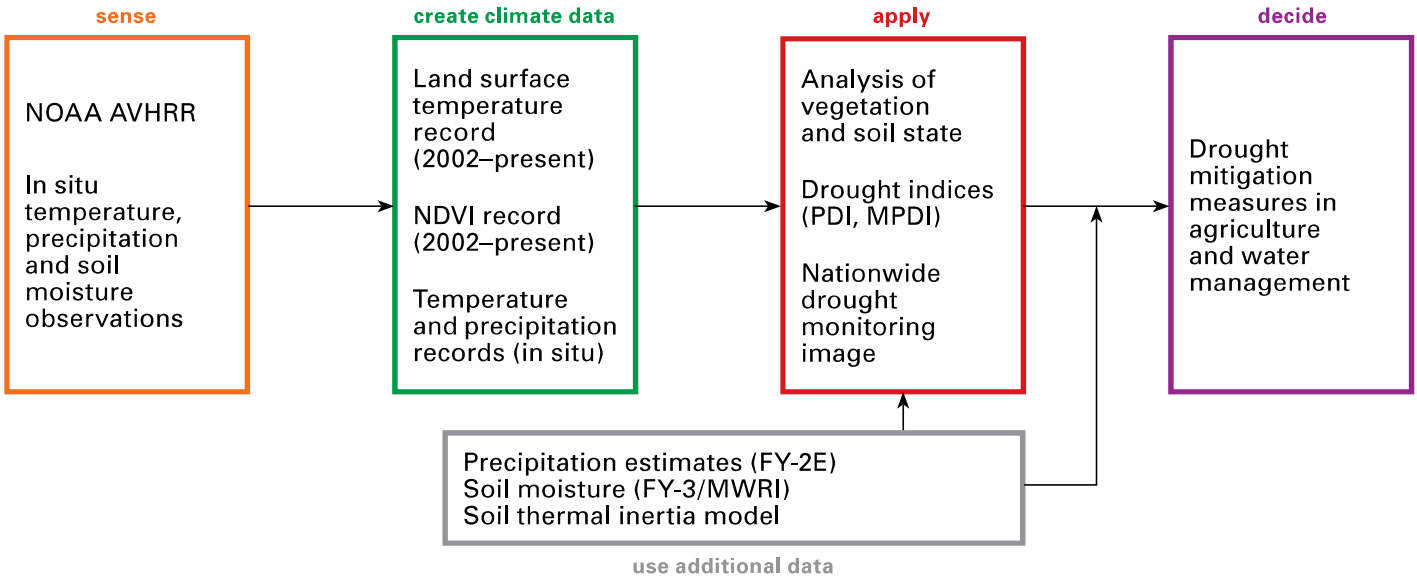
Agencies that produce records
National Satellite Meteorological Center, National Climate Center

Sustainability of service (demonstration or ongoing)
- Operational service
- Dissemination of information via reports and website
- Improvements concerning spatial, seasonal and physical geography
- Construction of long-term drought monitoring database

AUSAID, AUSTRALIAN GOVERNMENT

Blowing sand, China

INFORMATION FLOW



DESCRIPTION

Introduction

The National Satellite Meteorological Center (NSMC) of the China Meteorological Administration (CMA) began to devise a drought-monitoring operation involving satellite-based remote sensing in 2002. A complete drought-monitoring system is now operating, including research into and the application of several drought-monitoring methods, the development of software, optimization of data-process flow and the dissemination of drought-monitoring products and services.

Services provided

The goal of the NSMC/CMA drought-monitoring operation is to provide satellite remote sensing products and services to the public and to support national and local governments to plan prevention measures. End users of NSMC/CMA satellite drought-monitoring products include the CMA department of decisionmaking, the Ministry of Agriculture of China and the general public. Intermediate users of the products include the CMA National Climate Center and provincial meteorological bureaus. The application division of the Center uses surface observation data to monitor and assess the effect of severe climate events, including severe drought.

Two kinds of service are provided:

(1) Basic services

Under normal conditions, a nationwide drought-monitoring remote-sensing image using polar-orbit meteorological satellite data and a corresponding analytical report are generated and disseminated by the NSMC every ten days. The image and report are published on the website of the NSMC remote sensing application and released to several operational service systems. The products can therefore be explored and referred to by decisionmakers at the CMA, drought-monitoring and early warning specialists at the National Climate Center and staff at provincial meteorological bureaus.

(2) Special services

If a severe drought event occurs, the CMA pays special attention to the drought area and monitors and assesses the intensity and the development of the drought. CMA increases monitoring frequency in the drought area and deploys other satellite products, such as those that deal with precipitation estimation, land-surface temperature, evapotranspiration, vegetation, fire spot and water body area. This enables CMA to monitor the change of the severe drought and evaluate its effect. NSMC disseminates analytical reports to the CMA department of decision-making. Within two days, CMA provides a special report to the Ministry of Agriculture and the State Council of

China with recommended actions for drought mitigation. The provinces and local meteorological bureaus where the drought has occurred are then advised to take action. Monitoring information is therefore useful to help decisionmakers to understand the impact of the severe drought in order to propose effective prevention measures.

Example

The benefits of the service are illustrated using the example of a severe drought that occurred in south-west China from autumn 2009 until early summer 2010.

The extreme lack of precipitation during that period caused a severe and lasting drought in the provinces of Yunnan, Guizhou and Sichuan, in Chongqing City and the Guangxi Autonomous Region. Water supplies from reservoirs were insufficient and many rivers, brooks, wells, springs and lakes dried out. Residents and livestock suffered from the shortage of drinking water, and local agriculture sustained significant losses.

According to the accumulation of precipitation estimation using data derived from the FY-2E geostationary meteorological satellite (Figure 1), total rainfall from 1 November 2009 until 28 February 2010 in the south of Sichuan, most of Yunnan, the mid-west of Guizhou and Guangxi, was less than 100mm.

Images of ten-day land-surface temperature anomalies (Figure 2) demonstrated that temperatures between 1 September 2009 and the end of March 2010 had been higher than the average for the same period since 2002 in the south-west of China.

The drought began to develop from the beginning of November 2009. The meteorological satellite drought-monitoring images (Figure 3) showed that there had been a mild drought on a large scale in the north and middle part of Yunnan in the first ten days of January. Since then, the drought area in the south-west of China enlarged and the drought gradually intensified. The severe phase of the drought reached its peak during the middle ten days of March 2010. After light precipitation in the last ten days of March, the drought began to weaken. The severe phase weakened dramatically in early May and ended completely in the first ten days of July 2010. The anomalies in the vegetation index images (Figure 4) showed that vegetation growth was affected by the long-term phase of the drought. The drought also caused a significant increase fire risk. According to NSMC satellite monitoring results, from January until March 2010, fire spots in Yunnan and in Guizhou reached an eight-year high (Figure 5).

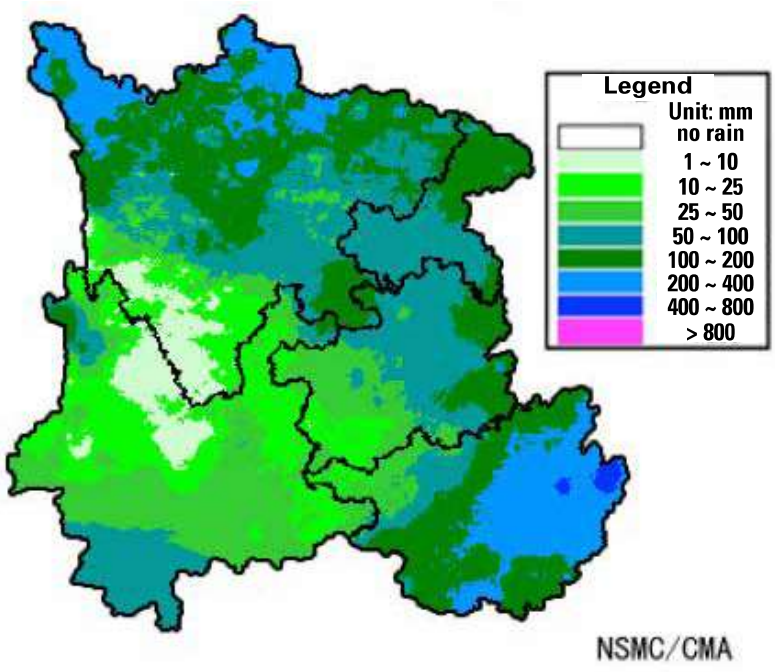


Figure 1. Accumulation of precipitation estimation in south-west China for the period 1 September 2009–28 February 2010, based on data from the geostationary satellite FY-2E

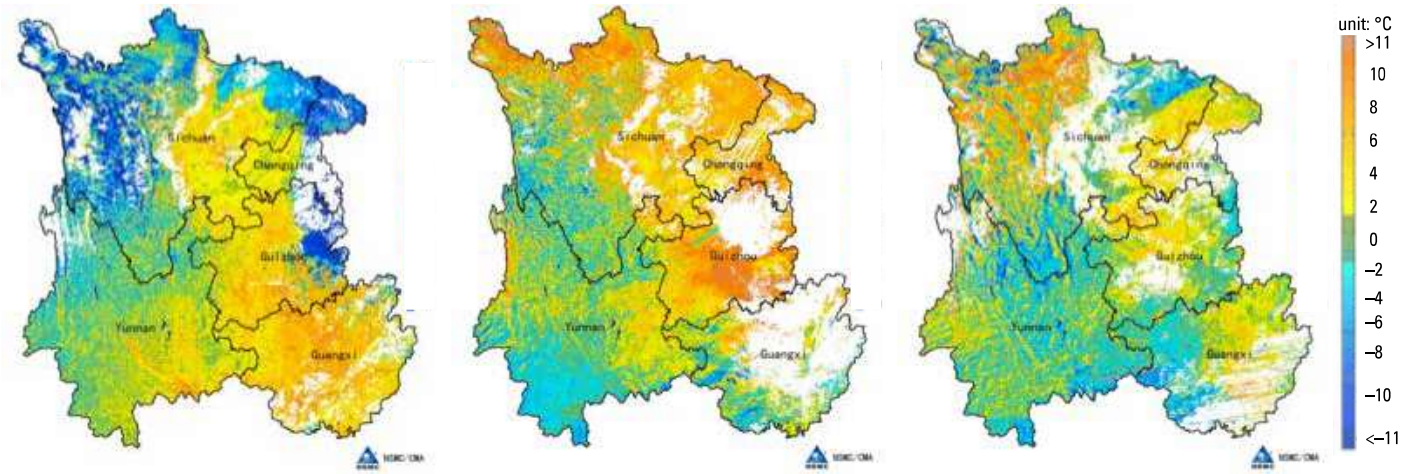


Figure 2. Anomaly of land surface temperature in south-west China for March 2010 (left: first ten days, center: middle ten days, right: last ten days)

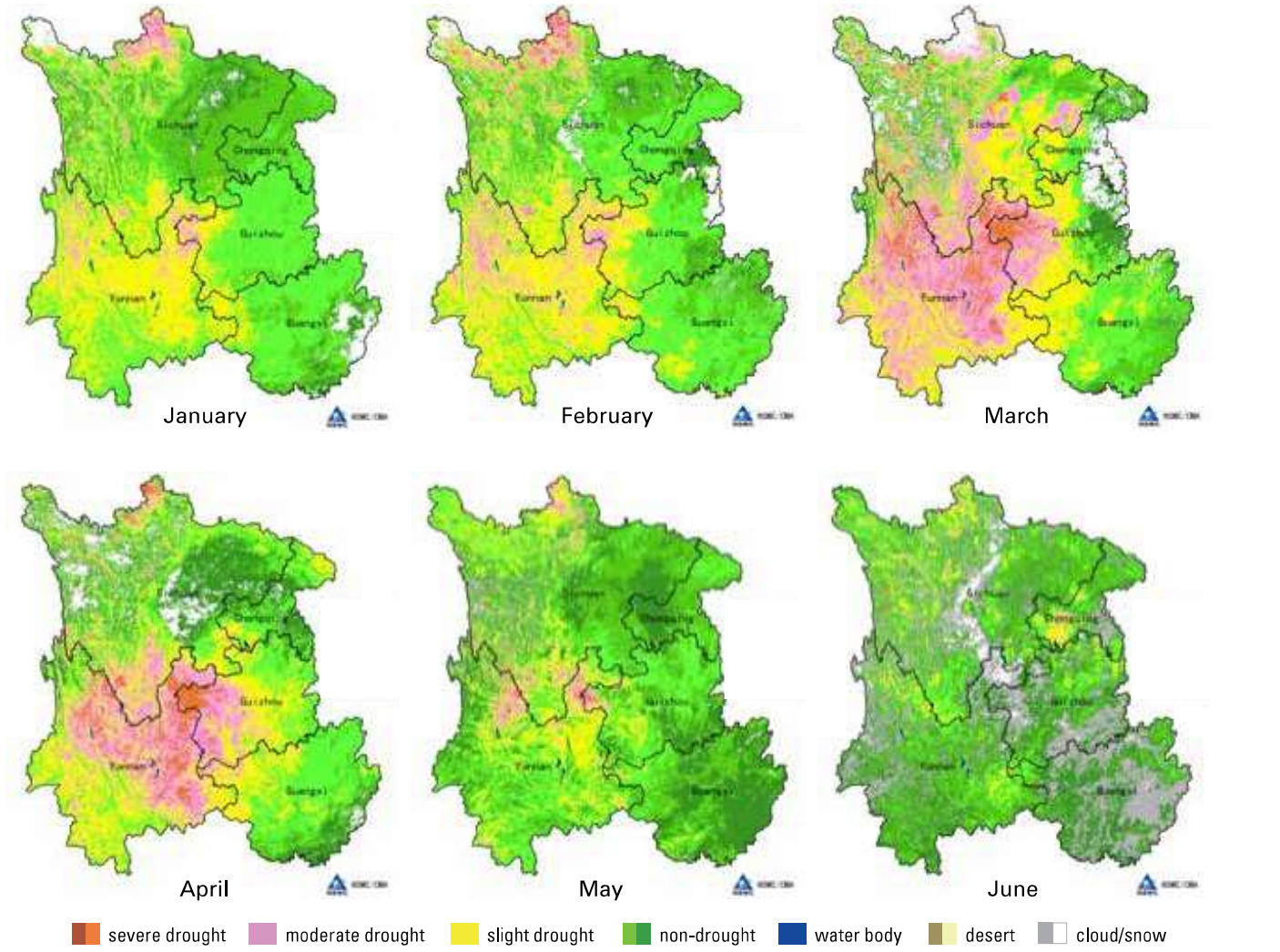


Figure 3. Drought monitoring image for south-west China using NOAA/AVHRR (first ten days of each month, 2010)

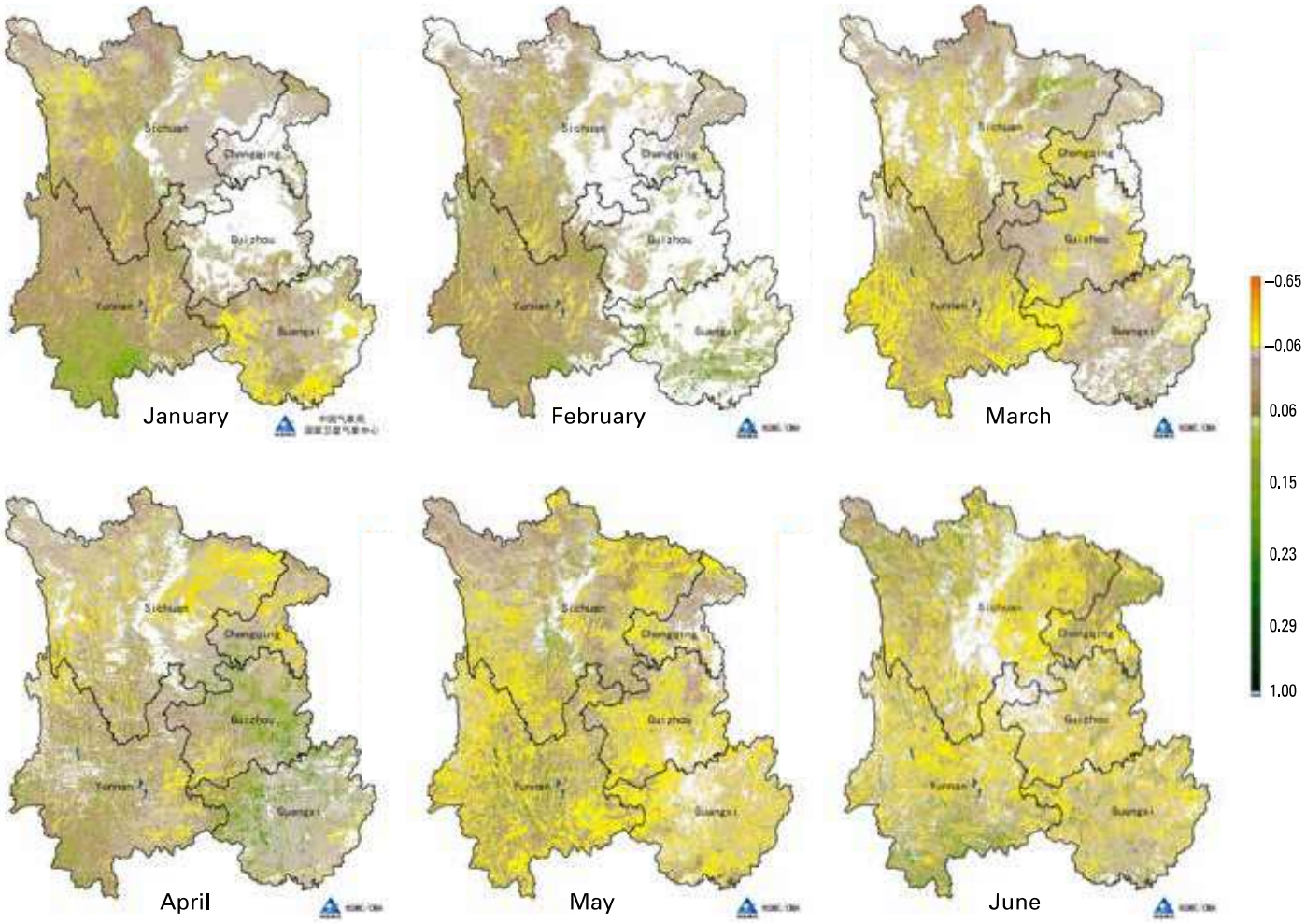


Figure 4. Vegetation monitoring image for south-west China using NOAA/AVHRR (first ten days of each month, 2010)

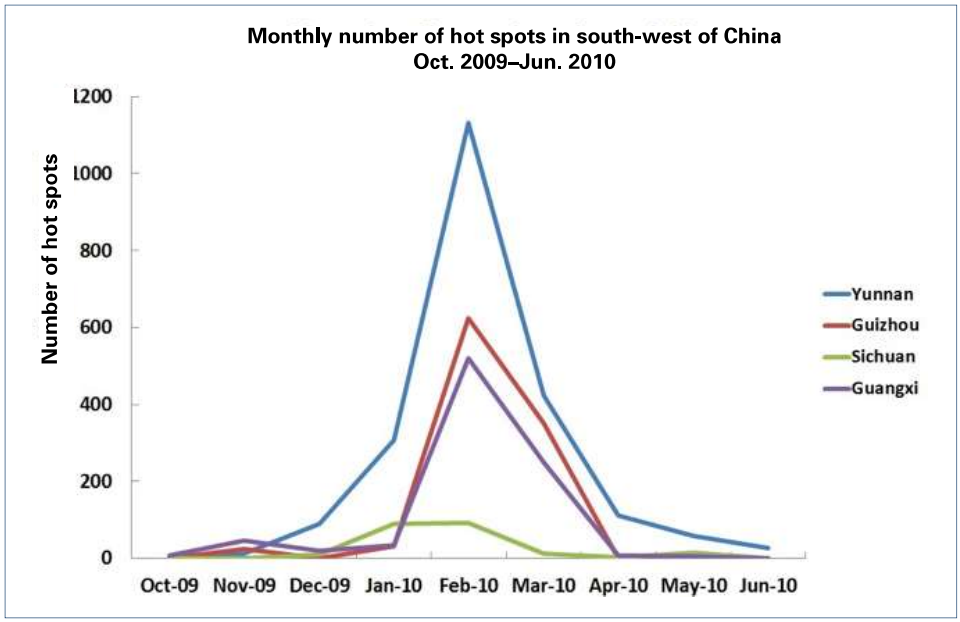


Figure 5. Fire hot-spot statistics using meteorological satellite (October 2009–June 2010)

Models and satellite data used

In drought-monitoring operations CMA applies a thermal inertia model (resistance of soil to thermal change). Soil moisture correlates positively with thermal inertia in the soil but negatively with diurnal temperature difference of the upper soil layers. Diurnal temperature difference of the upper soil layers can be obtained from meteorological satellite data. CMA uses the regression method to construct a model that integrates agrometeorological sample observing data and remote satellite data.

CMA also tries to adopt the Perpendicular Drought Index and the Modified Perpendicular Drought Index by using reflectances in the Red and near-infrared spectral bands to monitor severe drought events. Soil moisture data from FY-3/MWRI has been used to monitor severe drought events since 2012.

Land-surface temperature (2002 until the present, NOAA/AVHRR, NSMC, 1.1 km) and NDVI (2002 until the present, NOAA/AVHRR, NSMC, 1.1 km) are used to compile satellite-derived climate data records. If a severe drought occurs, FY-3/MWRI is used.

Further developments

(1) Improvements in remote sensing drought-monitoring methods and its accuracy. The construction of specific models that take into consideration spatial, seasonal and physical geographical differences.

(2) Construction of a long-term drought database using remote sensing products, such as NDVI, LST and evapotranspiration.