VIEWpoint 新观点

Daily satellite monitoring of crop drought conditions: developing a service

Maize growing Image: Pixabay

Explainer

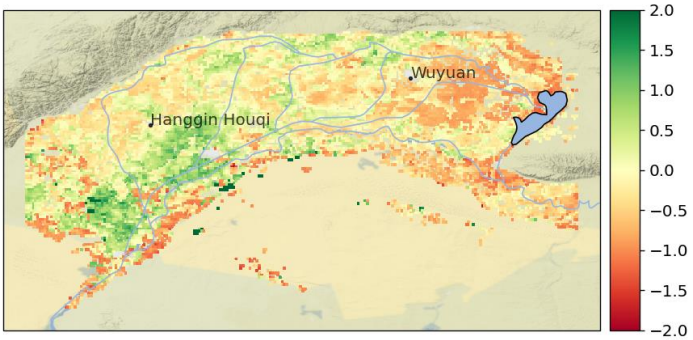
Accessible research from Climate Science for Service Partnership (CSSP) China, for decision-makers No.15

Focus

Satellite data offers daily automated monitoring of large agricultural areas to indicate emerging drought conditions and the system developed in CSSP China is a prototype near real-time remote monitoring service of crop condition at field-scale resolution.

Importance

From government agencies to insurance companies to small-scale farmers, a wide range of stakeholders have been identified as having an interest in current drought conditions likely to affect crop health and yields. Satellite monitoring offers near real-time diagnosis of the condition of crops, which can be streamlined into an automated service for early warning of emerging drought.



10-day mean crop condition example (negative values = dry/stress)

Approach

Building on existing research, seven areas of critical agricultural production have been chosen to develop the service, from the arid Plain of Inner Mongolia in the north (40°N, 108°E) to subtropical Guangxi in the south (23°N, 109°E). These areas have established irrigation systems, so the crop stress diagnosis is that of 'agricultural drought' – both lack of rainfall and limits on irrigation and where this water scarcity has consequences for crop growth.

The diagnosis of the crop condition has been carried out on 15 years of satellite measurements of land surface temperature and vegetation colour for each satellite image pixel. The current situation for each pixel is compared to this baseline of historic records to determine where the new observation sits in an index, where anomalously low (negative) values indicate dry conditions and high values indicate that water is not a limiting factor in crop growth (*above right*). A composite using 10 days' data avoids gaps due to cloud cover.

Next steps

This system is at the operational prototype stage to create maps of crop stress for users. The significant advantages of this system are that:

- crop condition can be detected at a relatively high resolution, about one kilometre
- the method is not sensor dependent, so other satellite data sources can be used
- the use of mapped anomaly data makes differences easier to spot
- a computationally efficient algorithm allows a near-real time operation, with the potential for results to be delivered within a few hours of the satellite pass.

These results, across some remote parts of China, could be easily accessed anywhere in the world. The analysis of the historic dataset from 2002 to 2017 has shown that some areas are becoming more drought prone, especially from 2014 onwards.

References

Tang et al., 2010 DOI:10.1016/j.rse.2009.10.012
Hu et al., 2019 DOI:10.1016/j.agrformet.2019.107707

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Produced by VIEWpoint, a CSSP China project from the Institute for Environmental Analytics, highlighting research and improving the uptake of climate services developed in the partnership, through accessible resources.