IMERG-based evaluation of long-lead fire danger forecasts over New Guinea for 2015

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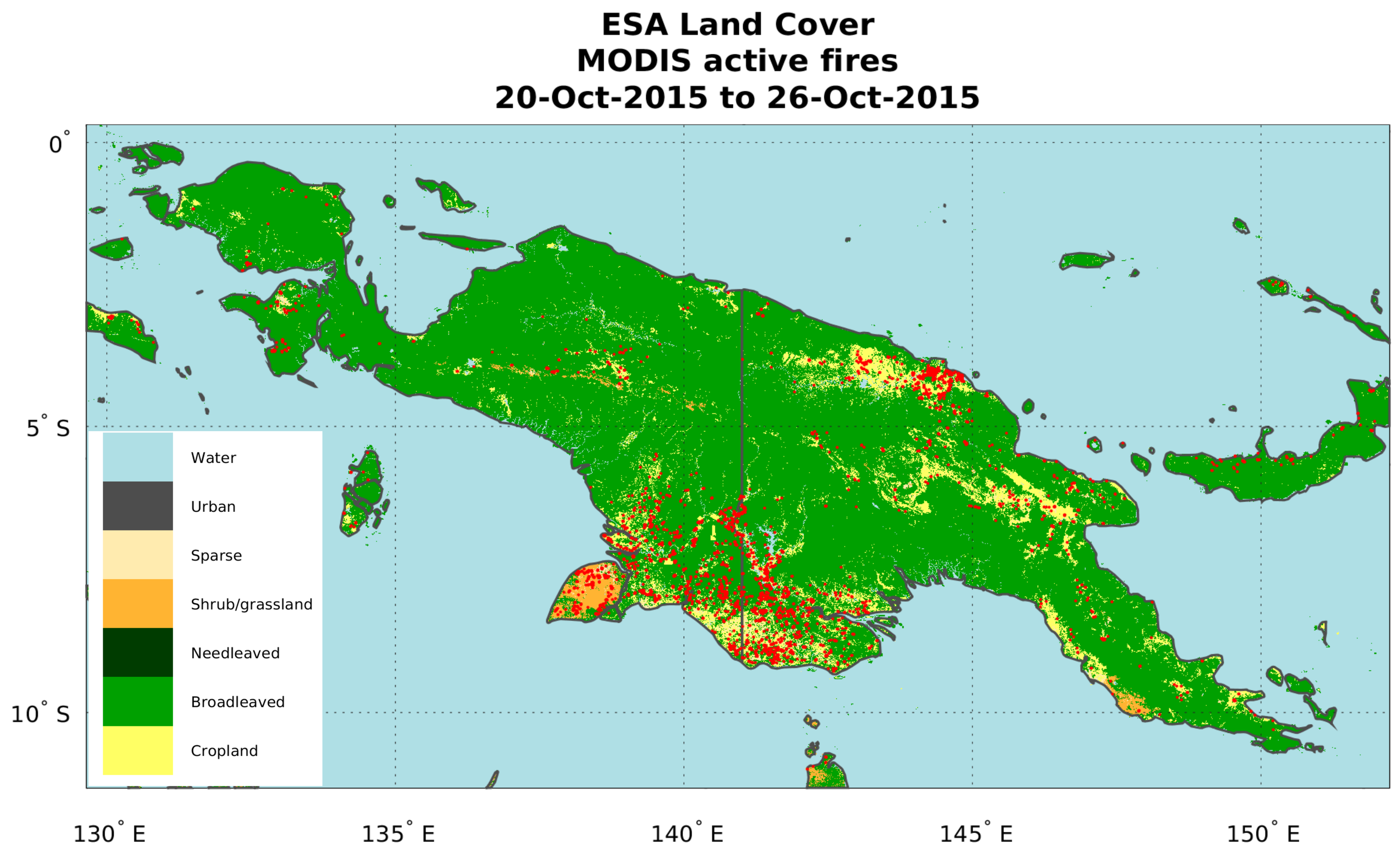
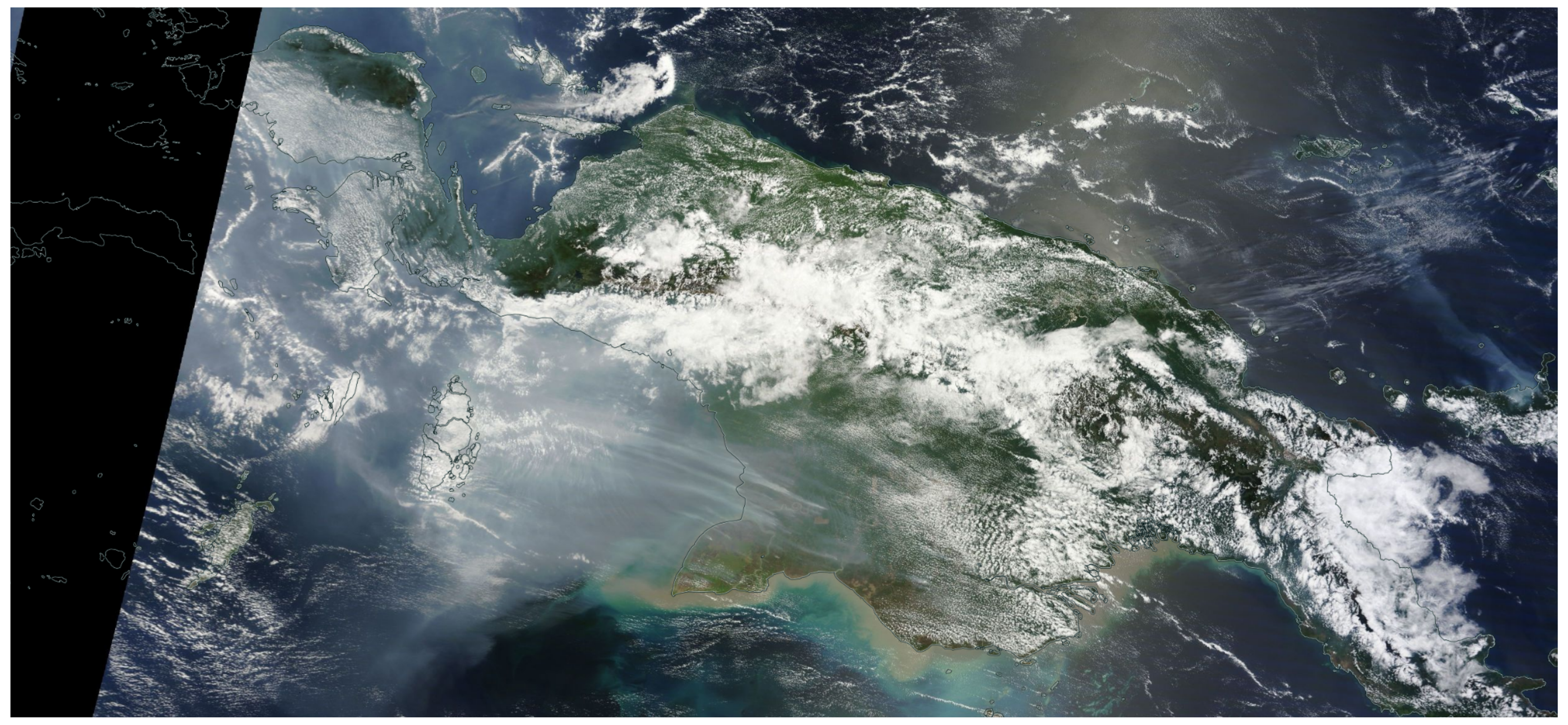
The 2015 fire season

Fire in Indonesia is used to clear and manage land for agriculture and plantation forestry *(1)*. Under sufficiently dry conditions – usually associated with El Niño – fires on the surface escape underground into degraded peat, where the fires have an inexhaustible supply of fuel and cannot be extinguished. The peat burns continuously until the return of the monsoon, creating severe air quality problems across the Maritime Continent.

During the severe burning of September and October 2015, CO_2-equivalent GHG emissions were 1.5 billion metric tons, between the annual mean fossil fuel emissions of Japan and India (*2,3*).

Over New Guinea (comprised of Indonesian province of Papua and Papua New Guinea), recent, rapid land conversion in the low lying peat-swamps have brought with it more fire.



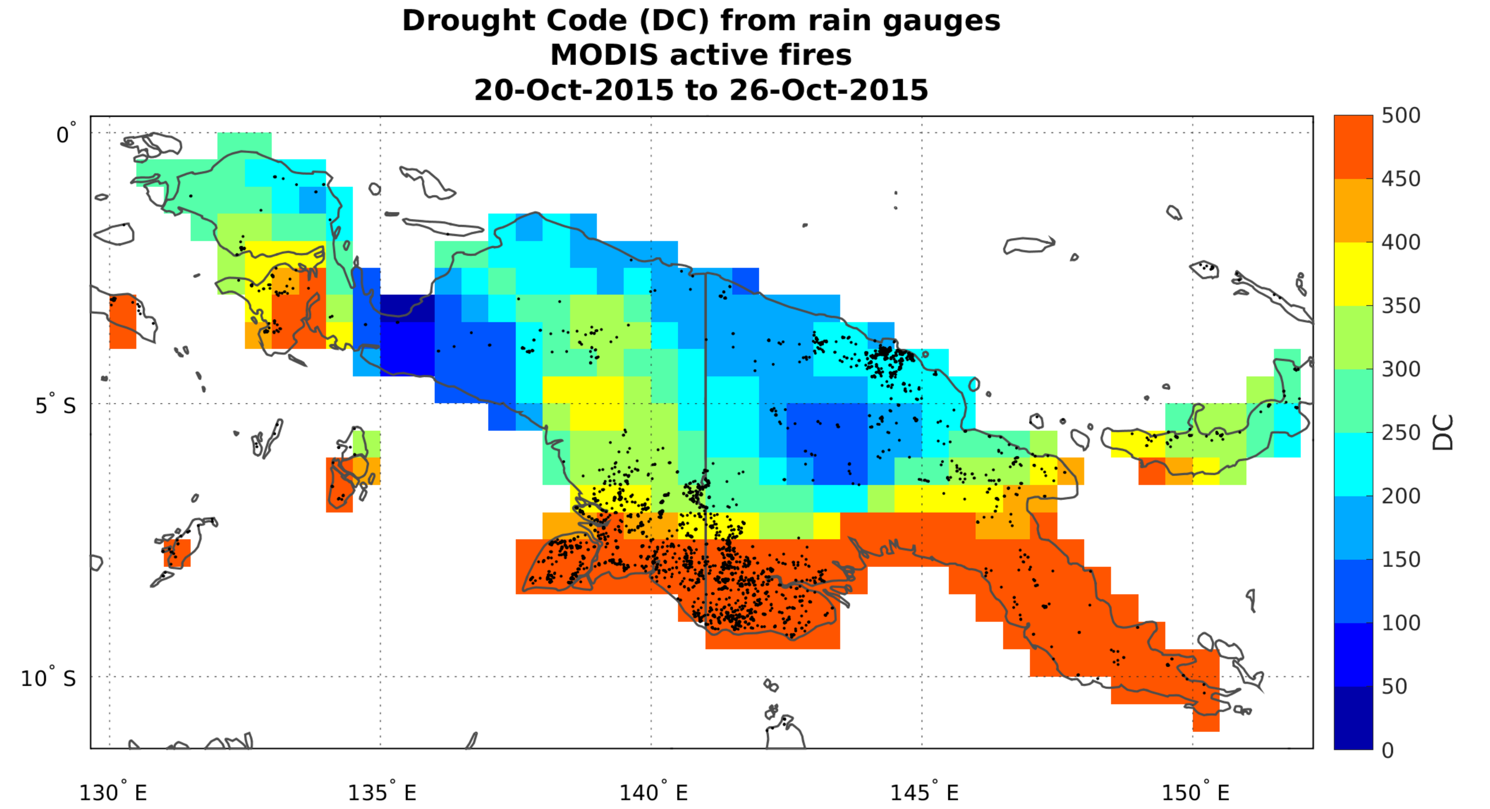


Land cover and MODIS active fires over New Guinea for October 20-26, 2015 (top), and Aqua MODIS true color image for October 20, 2015 at the peak of the fire season (bottom).

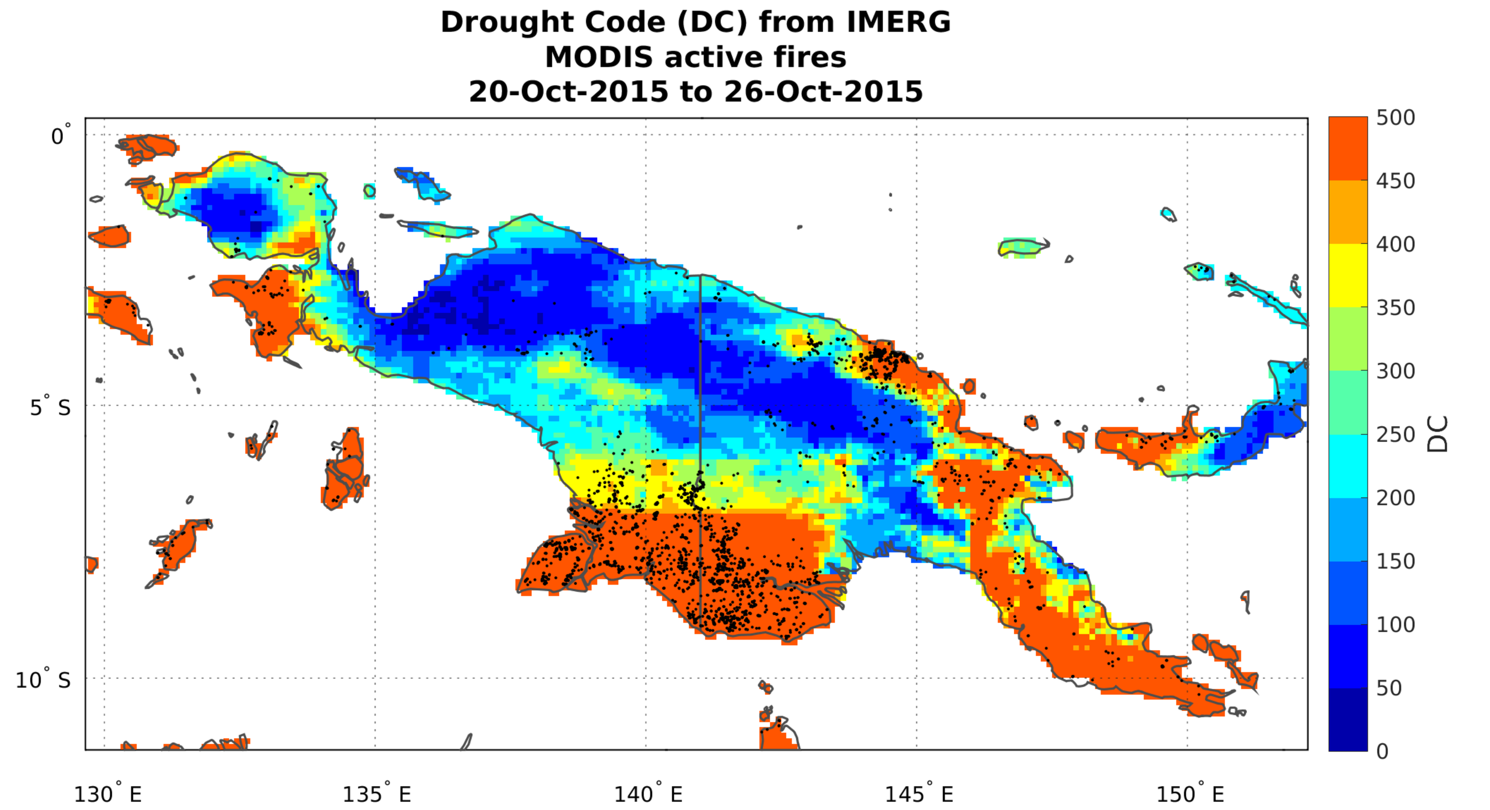
Monitoring fire weather with IMERG

As part of an evolving fire management program, the Indonesian Agency for Meteorology, Climatology and Geophysics (BMKG) operates the Fire Weather Index system, used to identify conditions under which fires can start and spread underground into peat (*4*).

The Drought Code (DC) component of the system is used to identify regions where it is sufficiently dry for peat to burn. The DC is a simple moisture balance model computed daily from 12:00 2m air temperature and 24-hour total precipitation. This is the main tool used by Indonesian authorities to distinguish between normal and dangerously dry conditions. Sustained peat fires are possible when the DC is greater than 350 *(4)*.



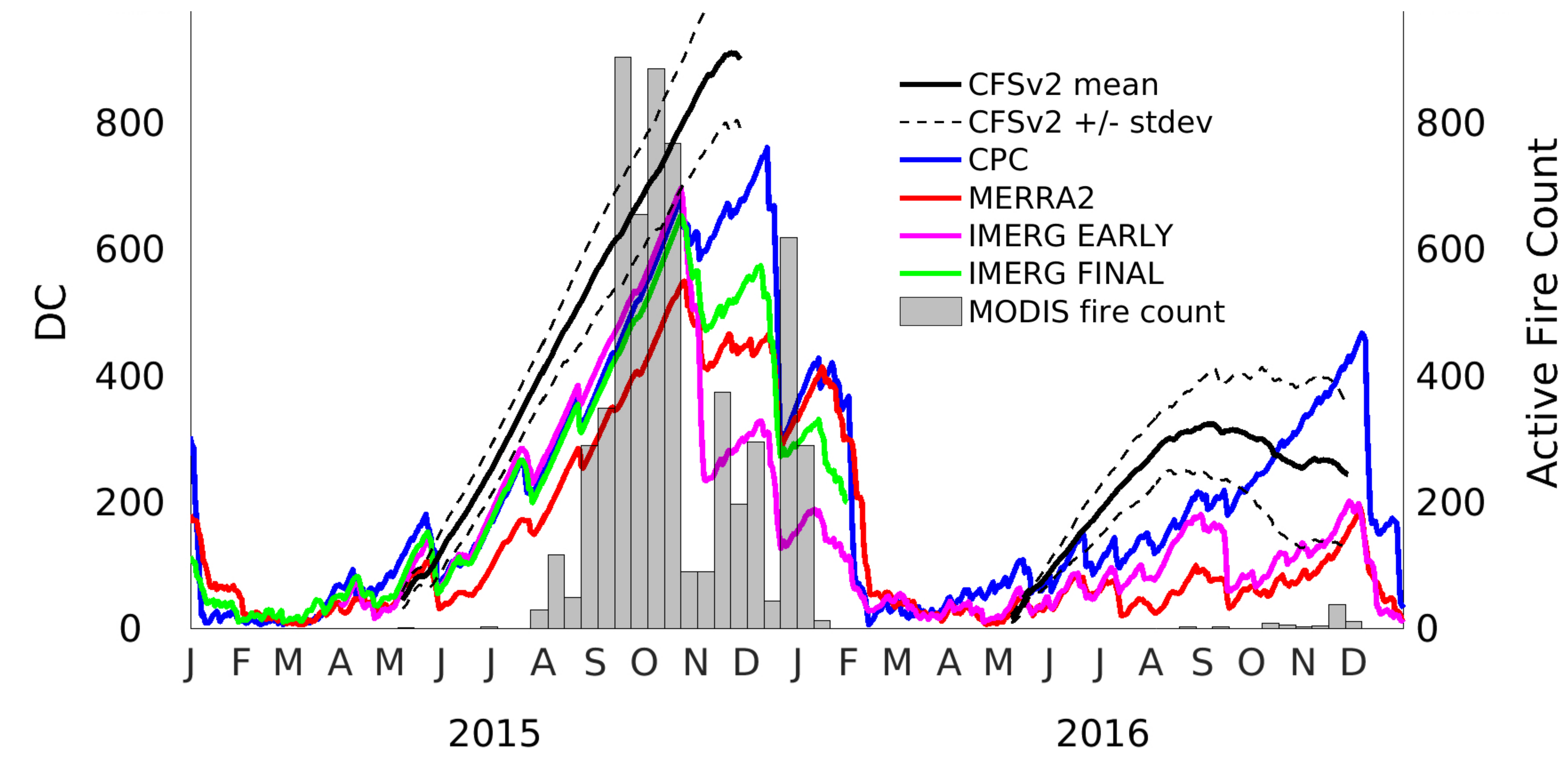
Over the southern, low-lying region of Papua, there are only two WMO-level surface stations, limiting the accuracy DC maps and making it difficult to verify DC forecasts at different lead times.



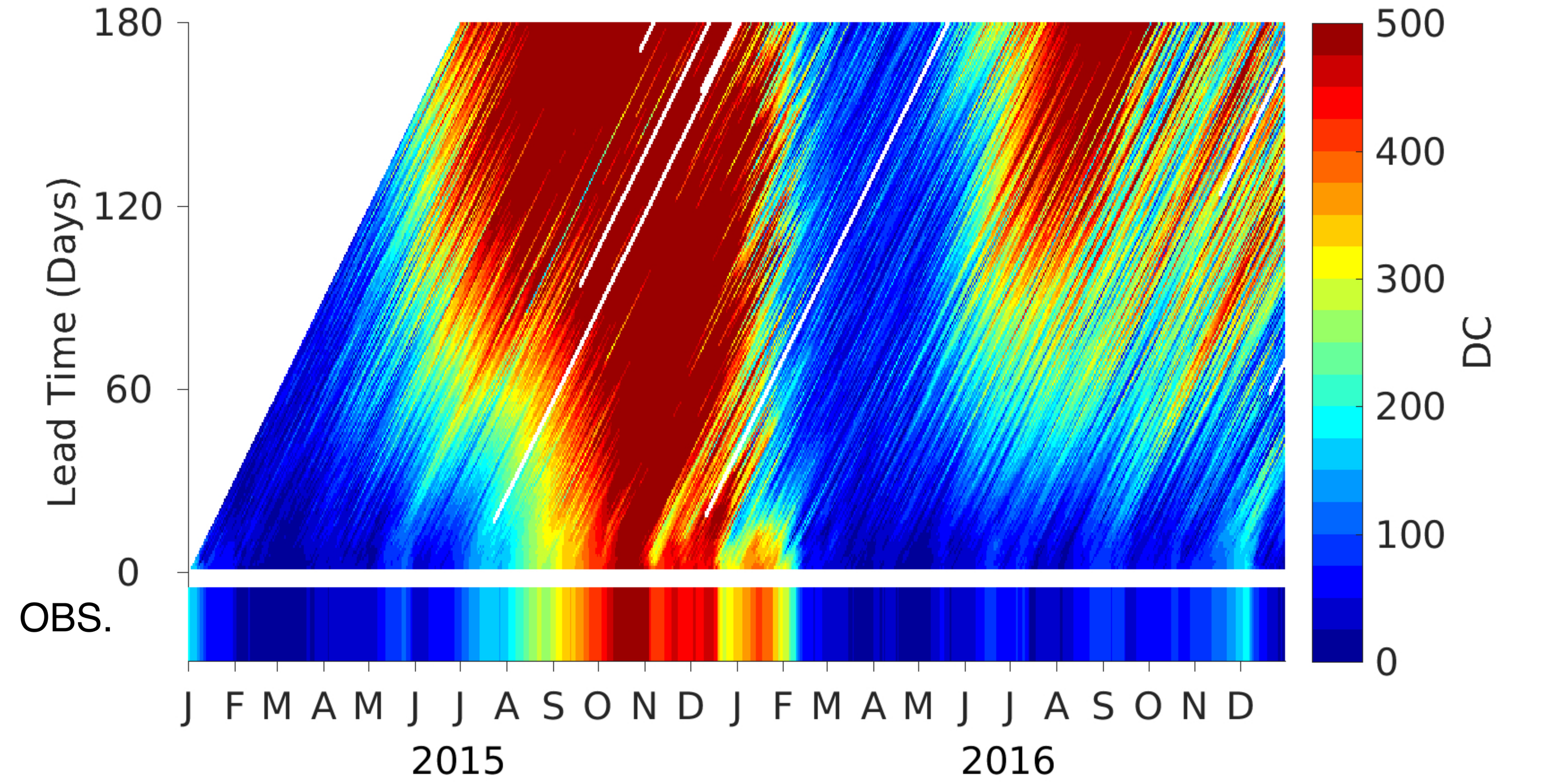
DC computed from IMERG v4 provides much greater detail, and better separation between severe and non-burning regions. Data are from the Global Fire Weather Database *(5)*.

Seasonal forecast evaluation with IMERG

As the starting point for a fire early warning system, we have computed 6-month ensemble forecasts of the DC using the NCEP Climate Forecast System version 2 (CFSv2) model *(6)*. The time series below shows the progression of observed DC, forecast DC from May initializations, and fire activity over Southern New Guinea during 2015 and, for comparison, 2016.



DC based on "EARLY" IMERG precipitation best captures the progression of fire activity, relative to MERRA2-based DC, CPC gauge-based DC and the "FINAL" IMERG DC. The latter two estimates are presumably being degraded because of the sparse surface station network. May forecasts captured the dry-season (Oct-Nov) differences in DC between 2015 and 2016, but predicted a too-early increase in DC to above threshold (350) levels in 2015.



Analysis of different lead times showed that 2015 forecasts improved at lead times shorter than 60 days, relative to IMERG-based DC. In 2016, the low DC was predicted only in June, after crossing the northern spring predictability barrier.

References

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