Introducing GFWED: The Global Fire Weather Database

Robert Field

Field, R.D., A.C. Spessa, N.A. Aziz, A. Camia, A. Cantin, R. Carr, W.J. de Groot, A.J. Dowdy, M.D. Flannigan, K. Manomaiphiboon, F. Pappenberger, V. Tanpipat, X. Wang, Development of a Global Fire Weather Database, *Natural Hazards and Earth System Sciences*, 15, 1407-1423, doi:10.5194/nhess-15-1407-2015, 2015.

National Aeronautics and Space Administration
Goddard Institute for Space Studies
New York, N.Y.

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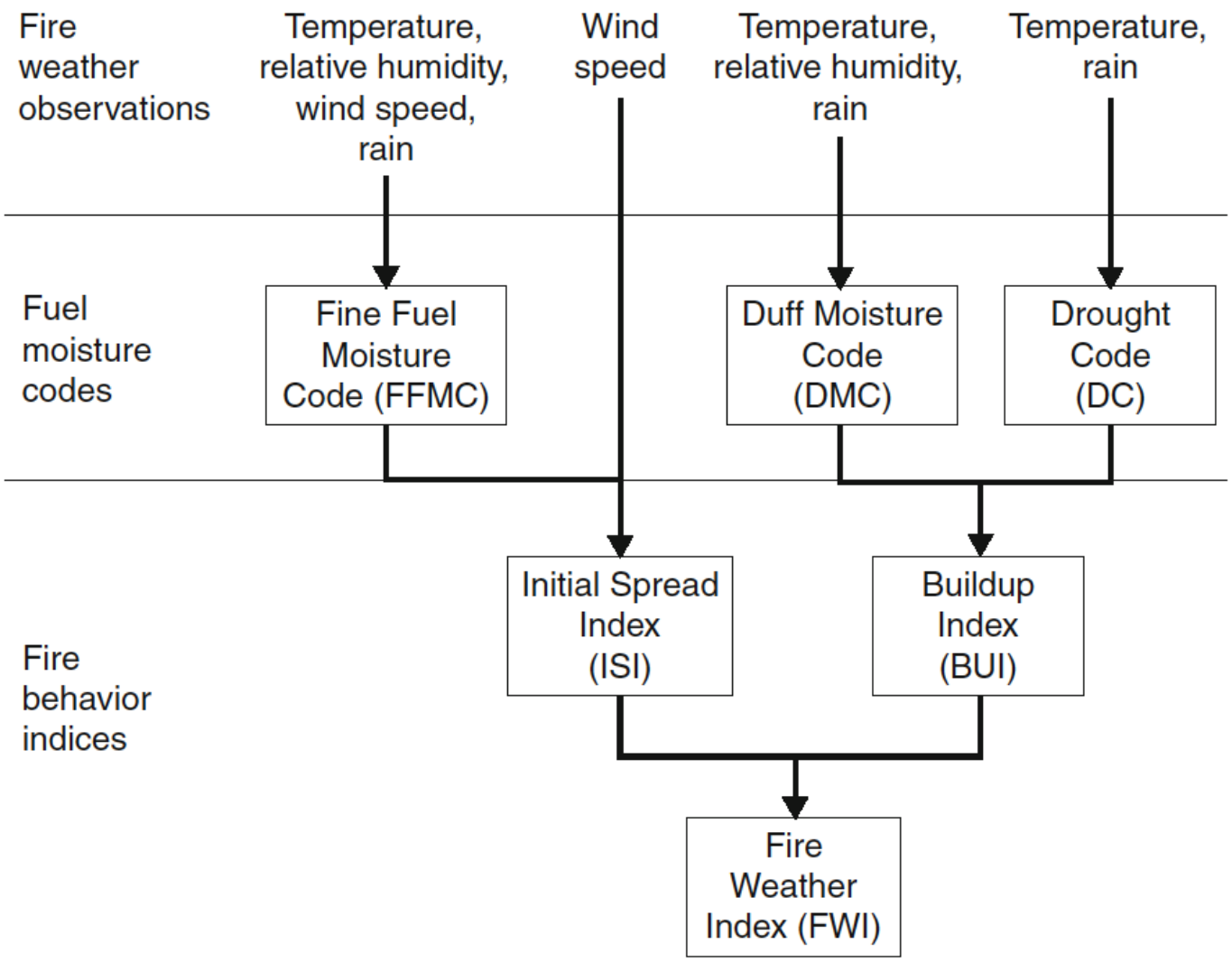
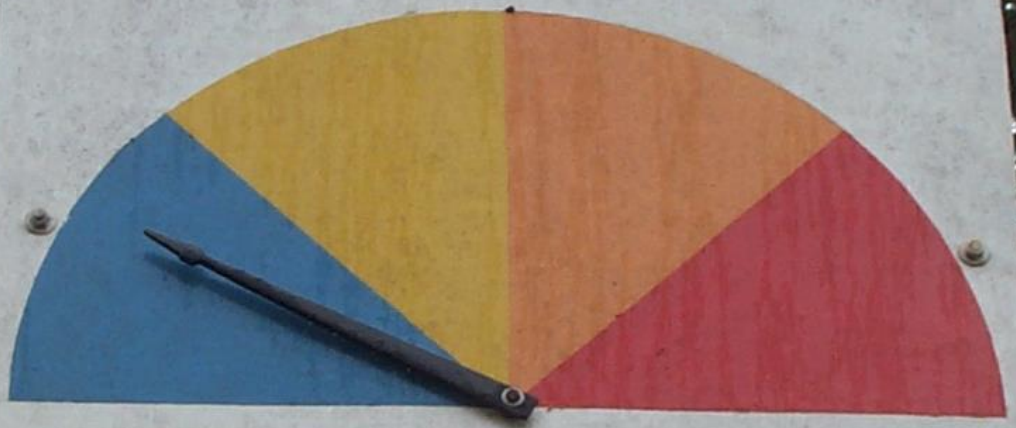


de Groot, W. J., and M. D. Flannigan (2014), Climate Change and Early Warning Systems for Wildland Fire, in Reducing Disaster: Early Warning Systems for Climate Change, edited by Z. Zommers and A. Singh, pp. 127-151, Springer, Dordrecht, doi:10.1007/978-94-017-8598-3.

PETUNJUK API
(Fire Indicator)



Risiko Rendah (Low Risk)

Risiko Sederhana (Medium Risk)

Risiko Tinggi (High Risk)

Risiko Berbahaya (Extreme Risk)

The Fire Weather Index System is most widely used fire danger rating system in the world.

Table 7.2 Summary of commonly referenced weather-based systems and indexes for national fire danger rating (documented systems only)

Index or system	Country or region of application[a]	Weather parameters	References
Canadian Forest Fire Weather Index System	Argentina, Canada, China, Chile, Fiji, Indonesia, Malaysia, Mexico, New Zealand, Portugal, South Africa, Spain, Sweden, Thailand, United Kingdom, USA (Alaska, some northern states), Venezuela; Europe and North Africa, Eurasia, global, Southeast Asia, Southern Africa	Temperature, rainfall amount, relative humidity, wind speed	Van Wagner (1987)

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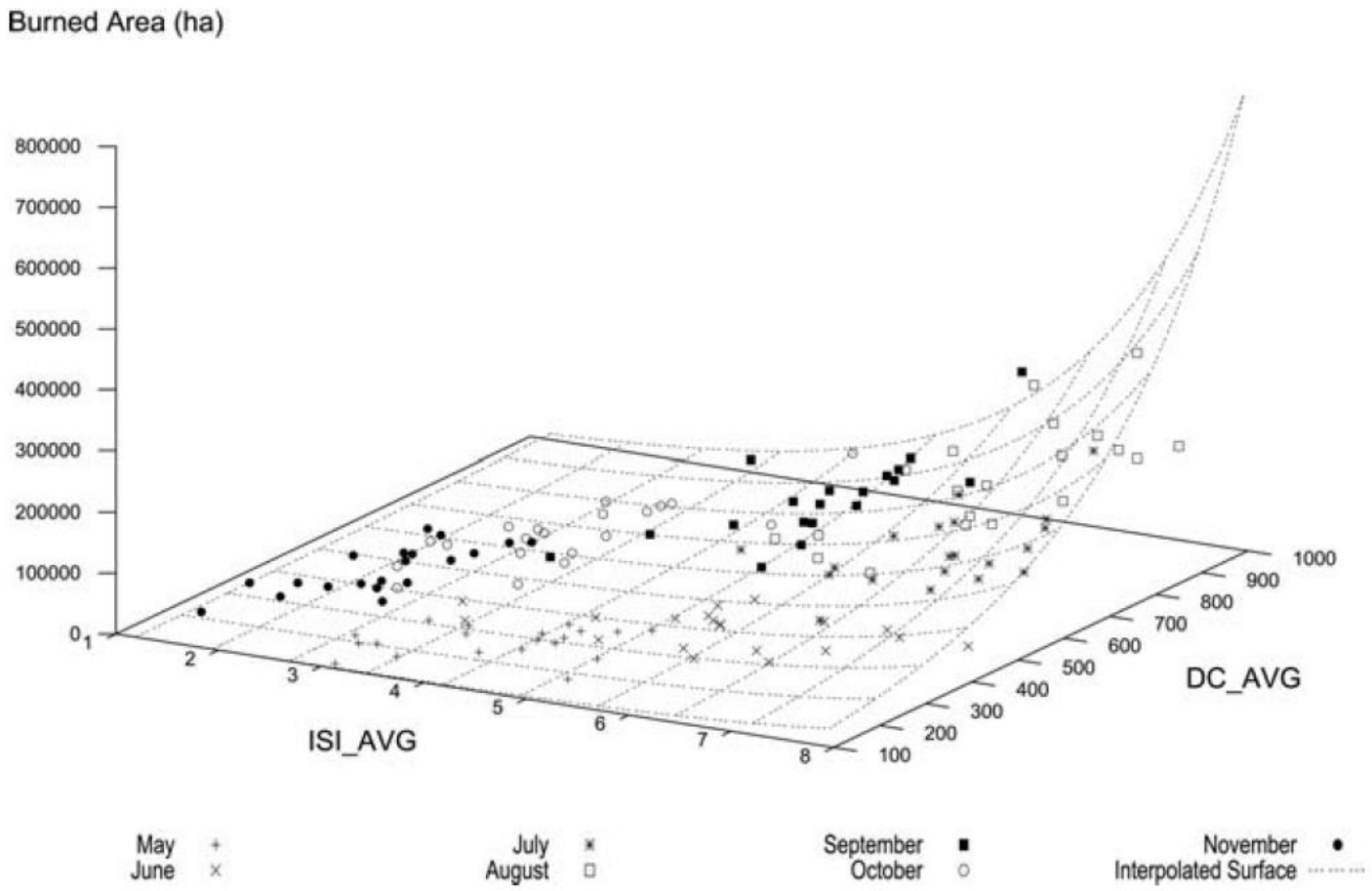
Mediterranean Europe



Camia, A., and G. Amatulli (2009), Weather Factors and Fire Danger in the Mediterranean, in *Earth Observation of Wildland Fires in Mediterranean Ecosystems*, edited by E. Chuvieco, pp. 71-82, Springer-Verlag, Berlin, doi:10.1007/978-3-642-01754-4_6.

GFWED

- Daily FWI database at 1/2^{o} x 2/3^{o} resolution beginning in 1980
- Weather inputs from MERRA & 2 global, gridded rain-gauge datasets
- Intended for:
  - A baseline for operational FWI use in new regions
  - Understanding drivers of fire activity anywhere in the world
  - Analysis of large-scale controls of fire weather

Data freely available
http://data.giss.nasa.gov/impacts/gfwed

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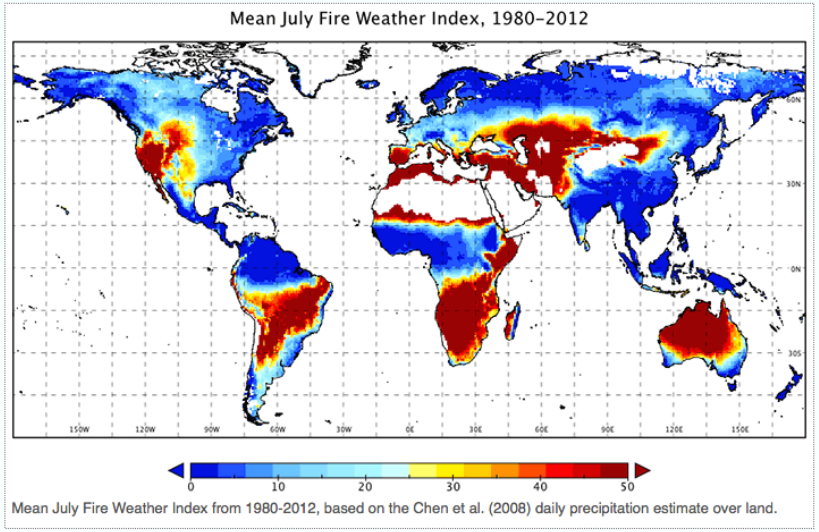
Global Fire WEather Database (GFWED)

The Global Fire WEather Database (GFWED) integrates different weather factors influencing the likelihood of a vegetation fire starting and spreading. It is based on the Canadian Fire Weather Index (FWI) System, the most widely used fire weather system in the world. Further information on applications of the FWI System can be found in Taylor and Alexander (2006). Technical descriptions are provided by van Wagner (1987) and Dowdy et al. (2009).

The FWI System is composed of three moisture codes and three fire behavior indices. The moisture codes capture the moisture content of three generalized fuel classes and the behavior indices reflect the spread rate, fuel consumption and intensity of a fire if it were to start.



Mean July Fire Weather Index from 1980-2012, based on the Chen et al. (2008) daily precipitation estimate over land.

FWI System calculations require measurements of 12:00 local time temperature at 2m, relative humidity at 2m, and wind speed at 10m, and precipitation totaled over the previous 24 hours. GFWED uses the NASA Modern Era Retrospective Analysis for Research and Applications (MERRA, Rienecker et al., 2011) for these inputs along with gauge-based precipitation estimates over land from Sheffield et al. (2006) and Chen et al. (2008). Details on the development and testing of the dataset can be found in Field et al. (2015).

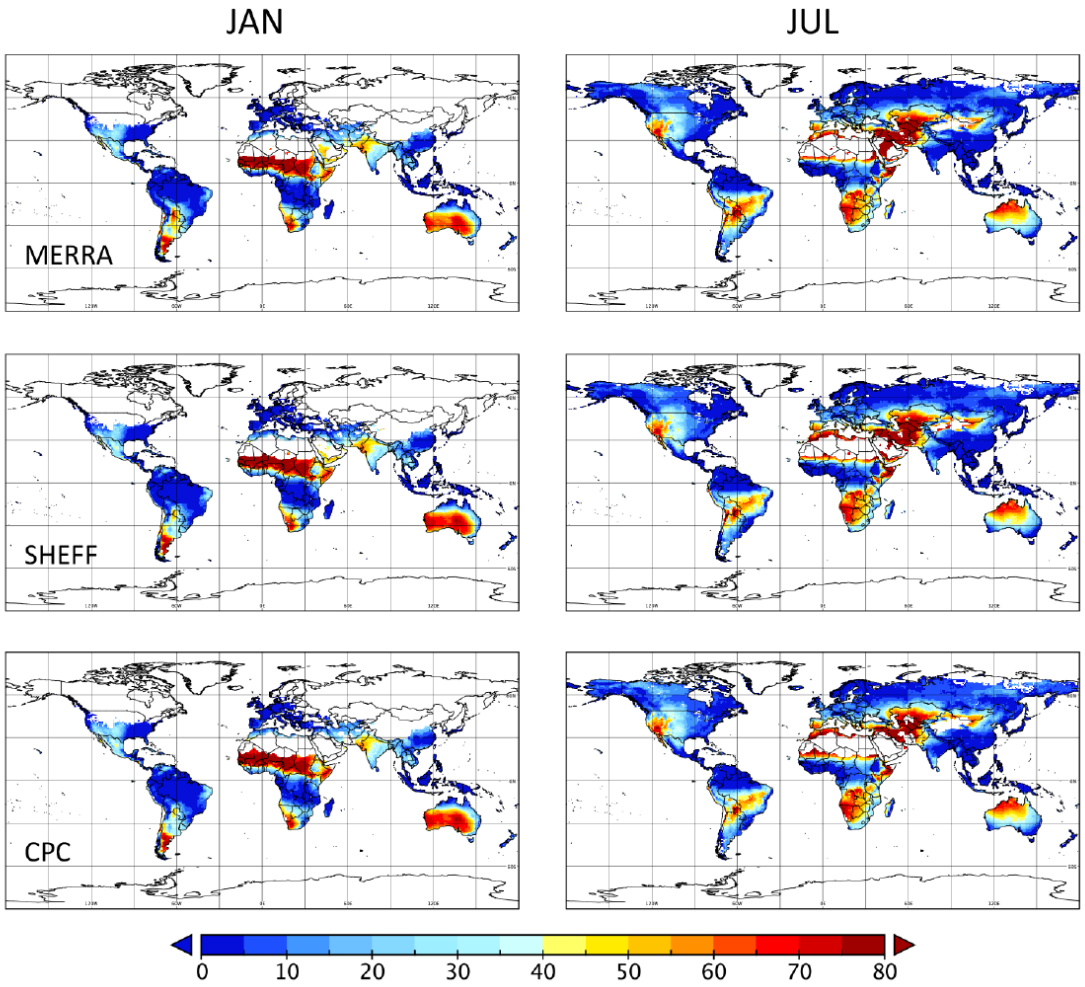
Data Access

GFWED data are distributed in NetCDF format from the NASA Center for Climate Simulation Dataportal. To download the data:

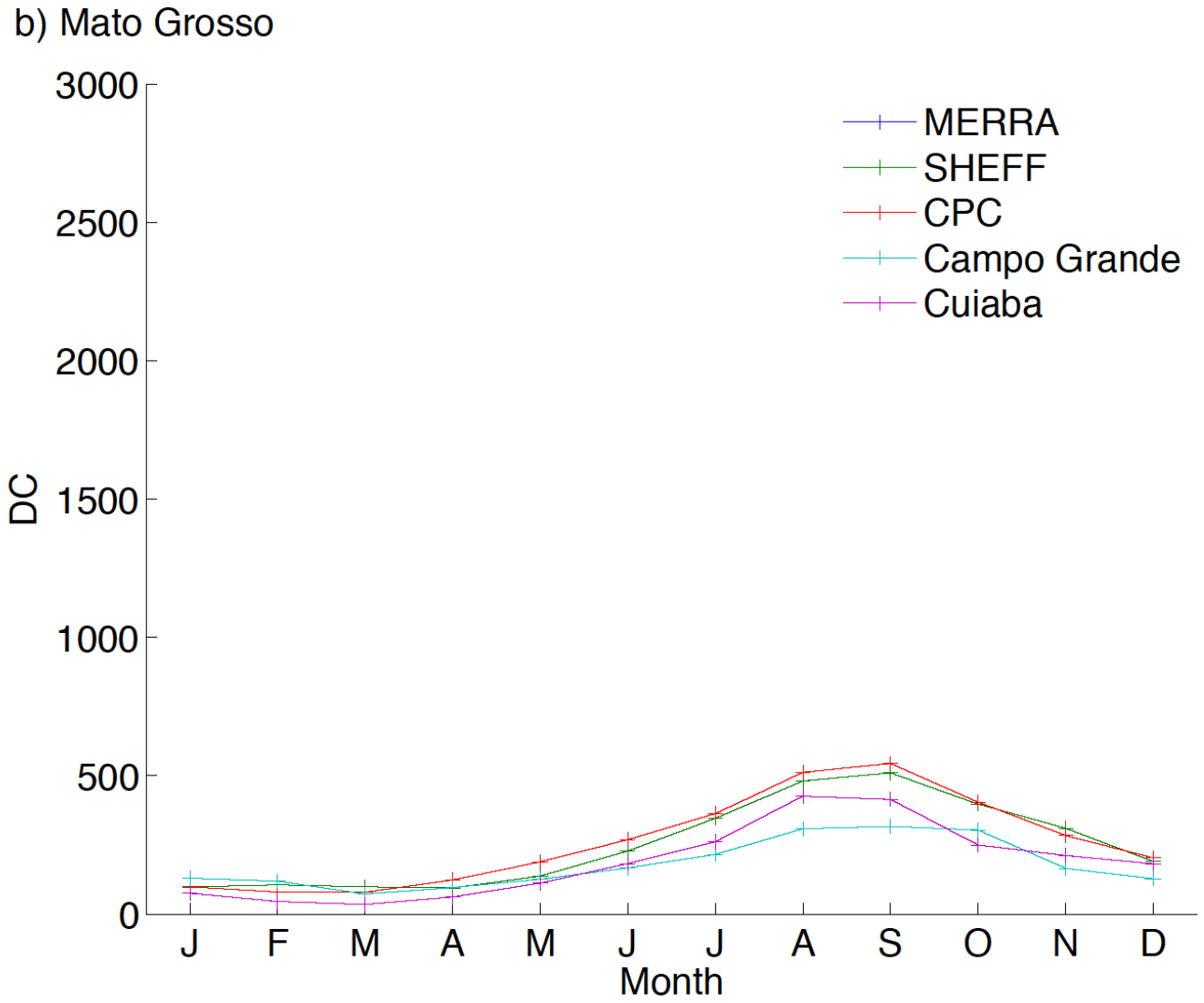
- ftp to dataportal.nccs.nasa.gov. Be sure your ftp client is in "passive mode".
- Login as user: GlobalFWI
- Press return when a password is requested. Do not enter your e-mail address as many anonymous ftp sites require.
- Be sure that your ftp client is in binary (bin) mode before downloading.

3 versions using different precipitation estimates

Mean FWI, 1981-2010

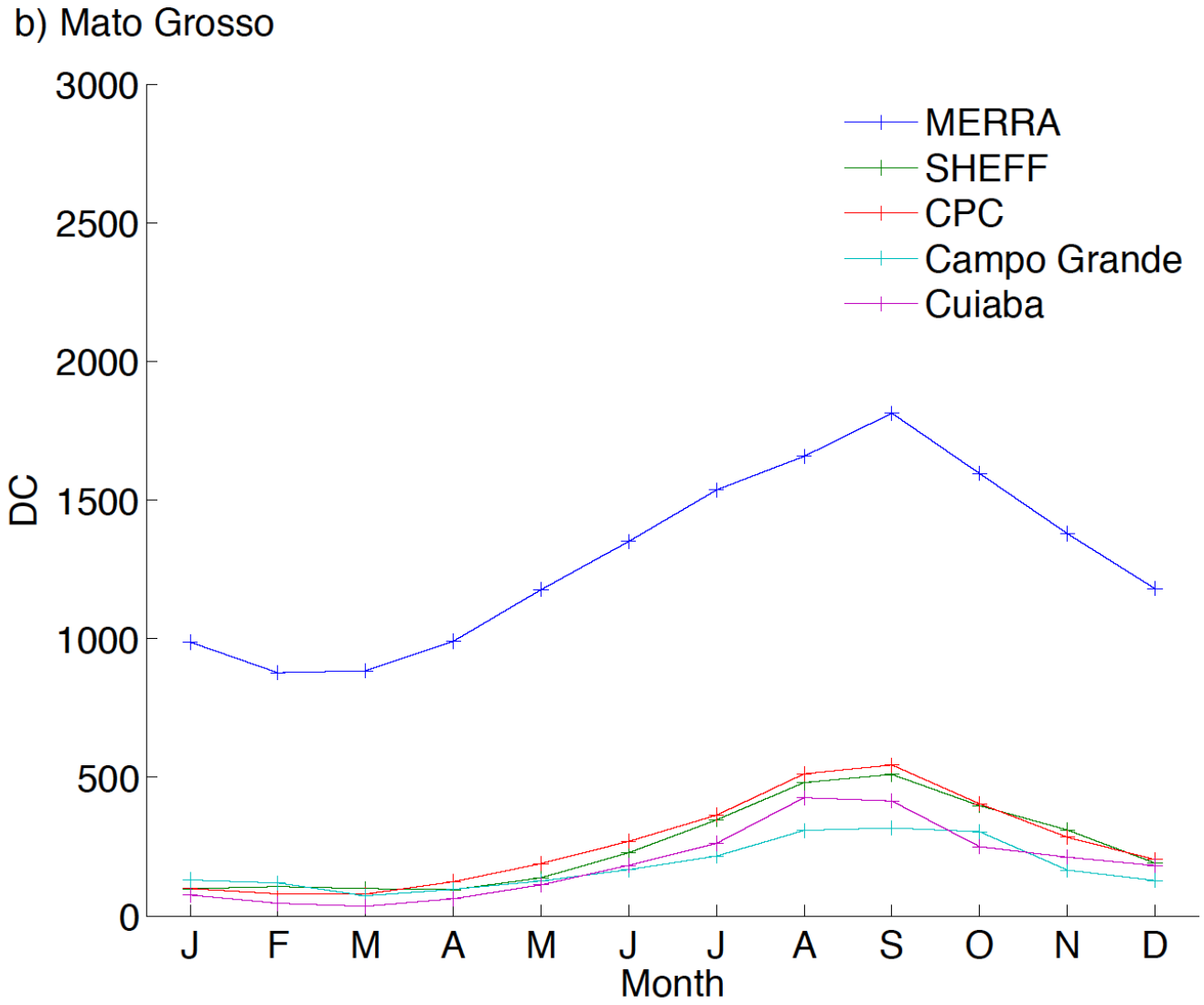


DC climatology over Mato Grosso, Brazil



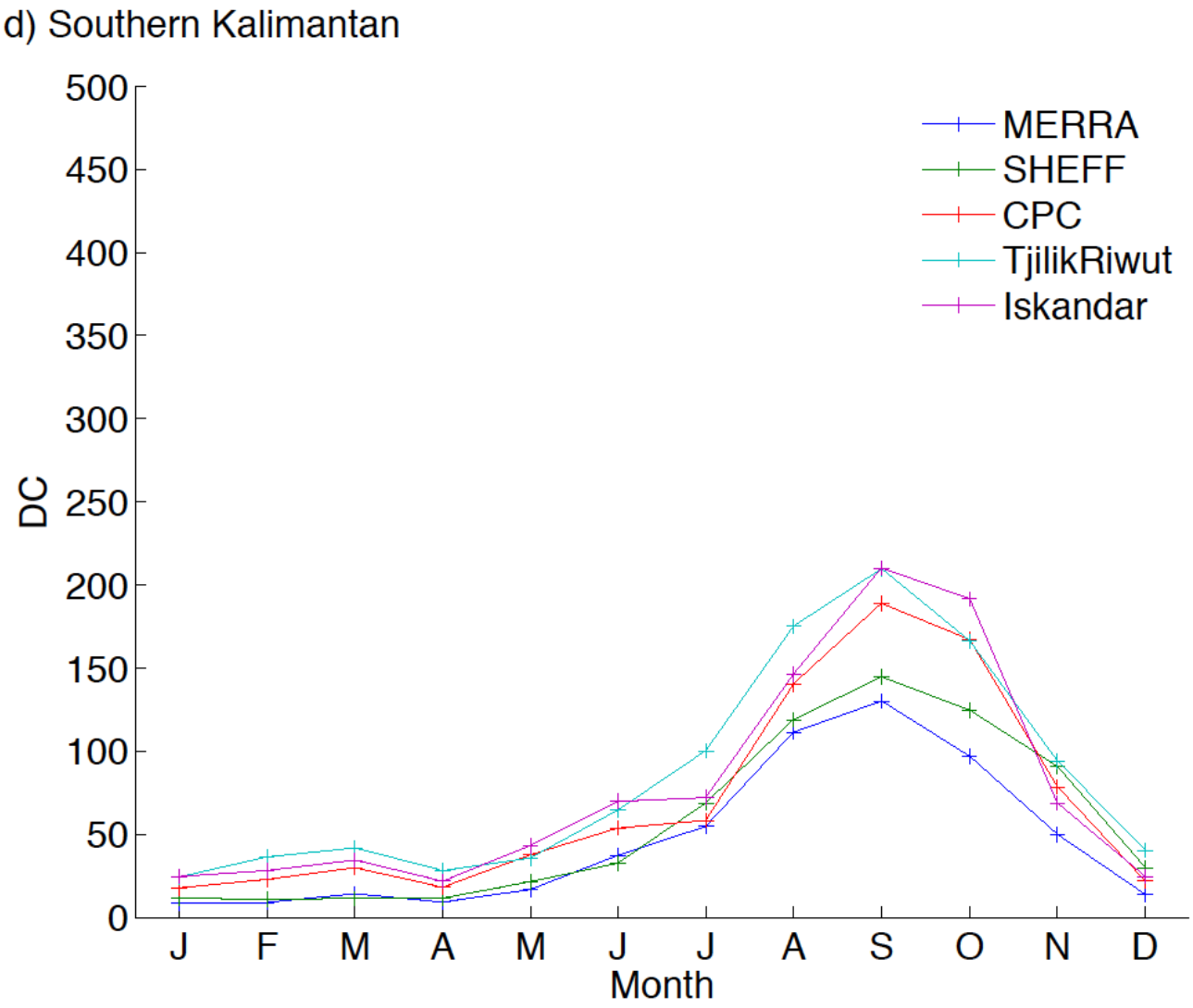
High MERRA DC bias due to low precipitation bias

DC climatology over Mato Grosso, Brazil



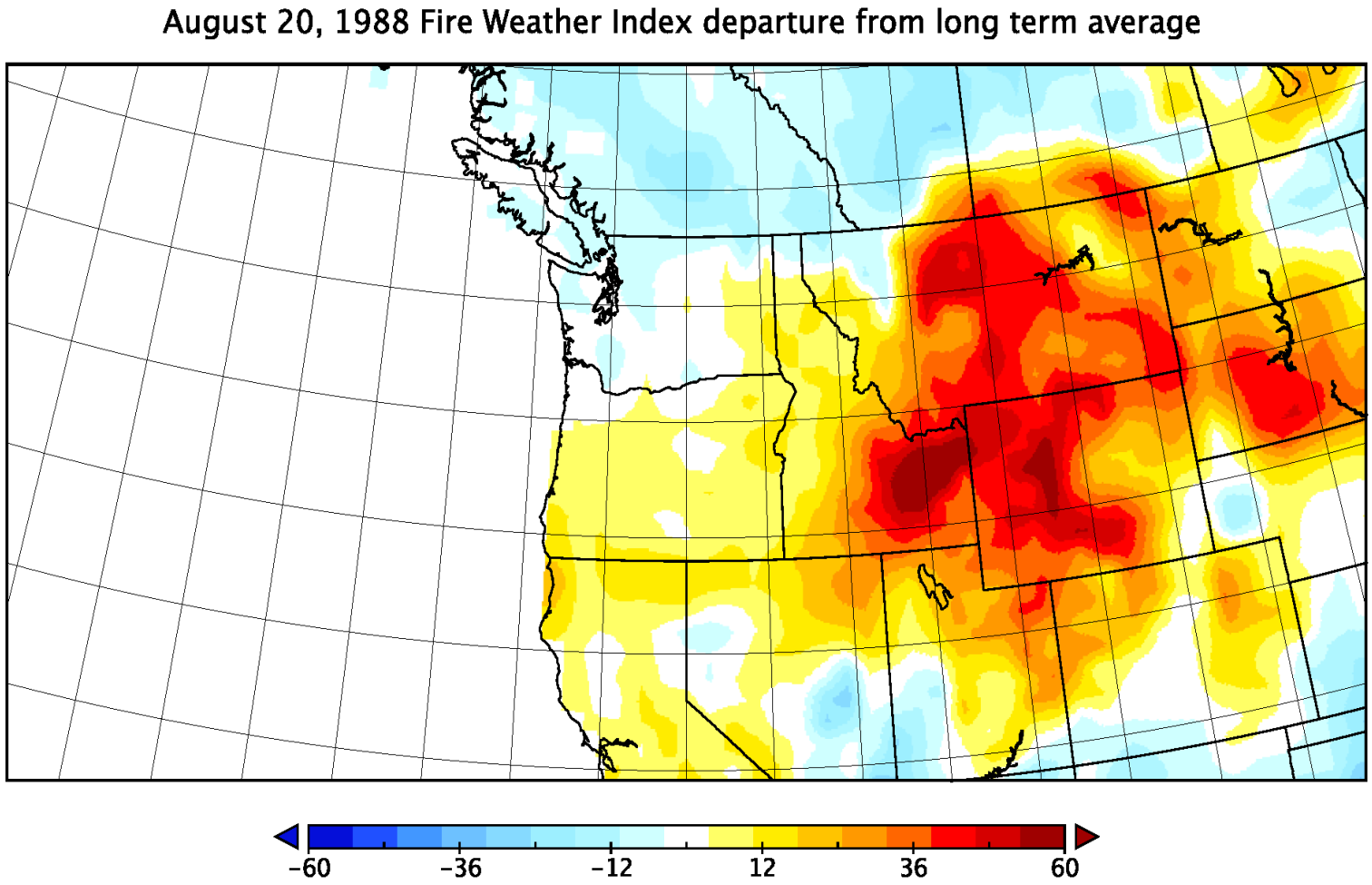
High MERRA DC bias due to low precipitation bias

DC climatology over Southern Kalimantan, Indonesia



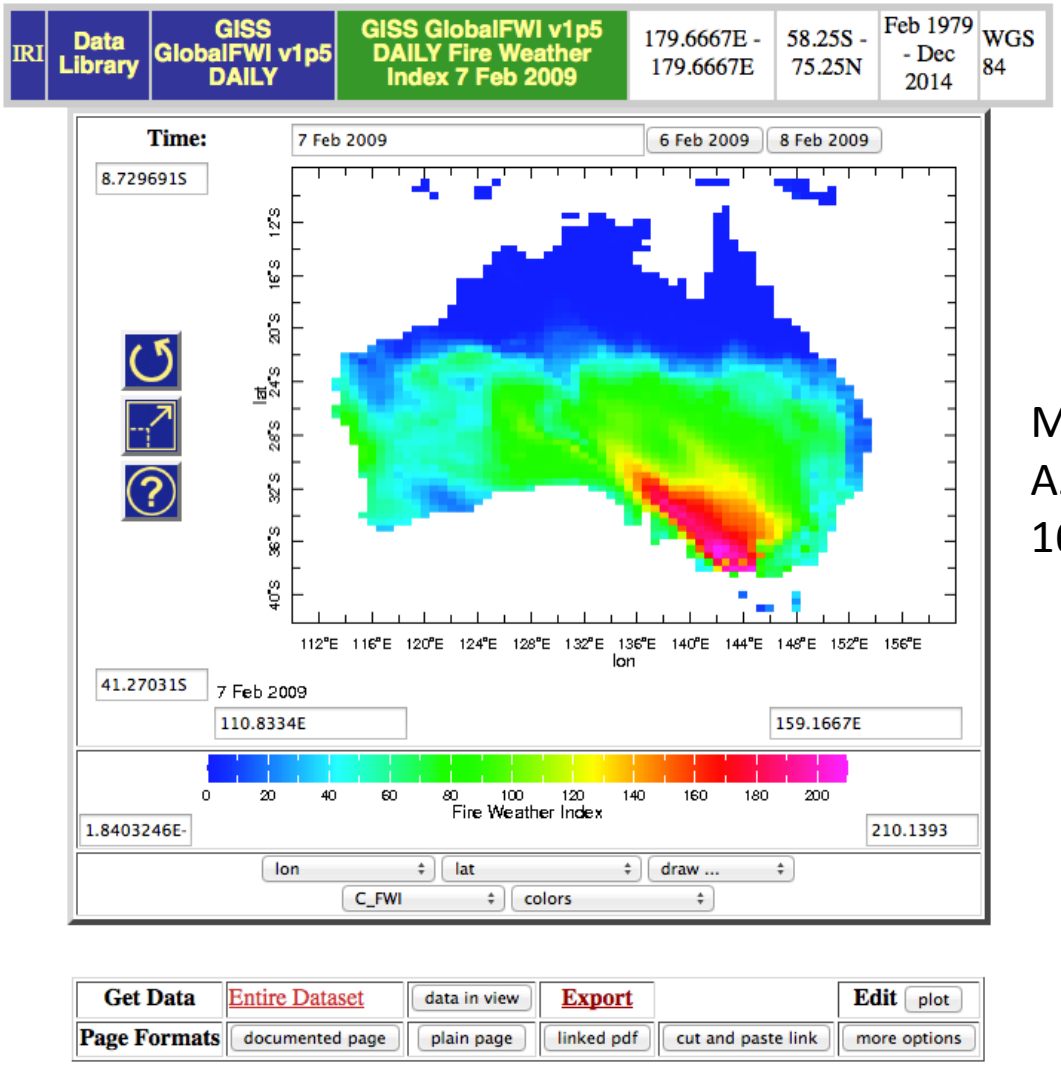
Low MERRA DC bias due to high precipitation bias

Peak of the 1988 Yellowstone fires
150 000 acres burned



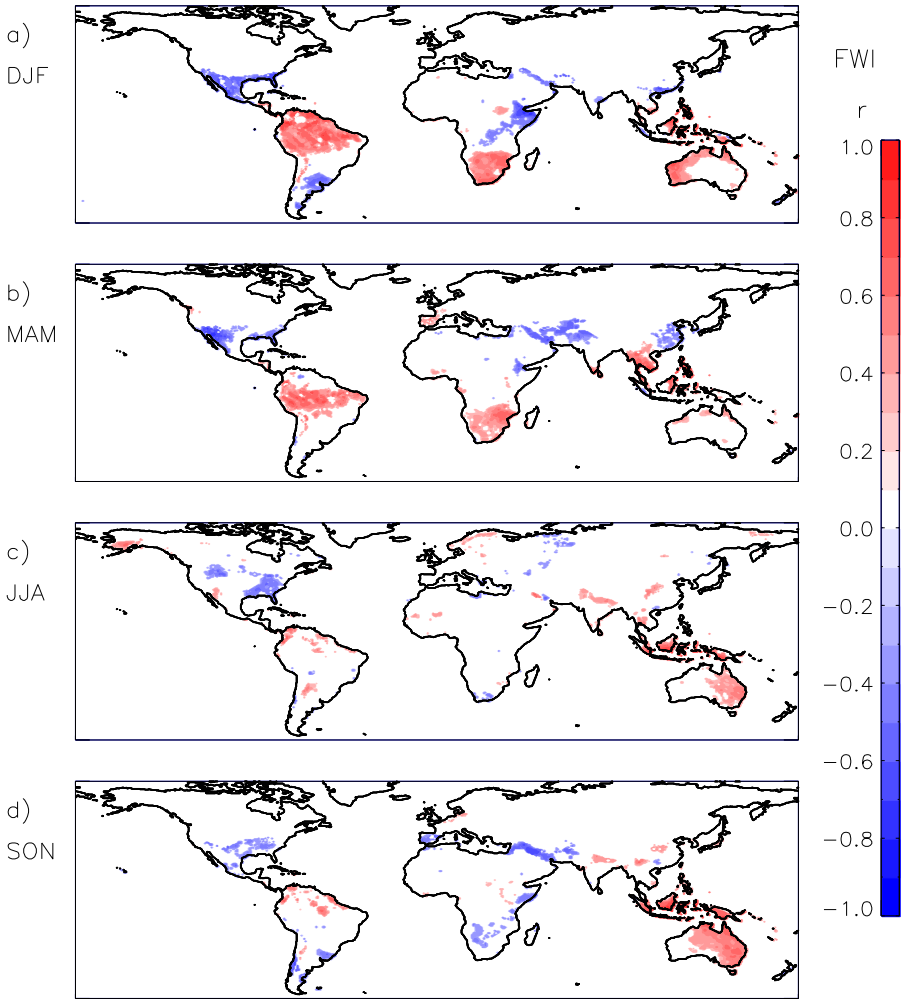
FWI on February 7 2009 in SE Australia, Black Saturday

Generated from Columbia IRI Data Library



More details on stratospheric plume:
A54E-01
16:00 - 16:15, 3002 Moscone West

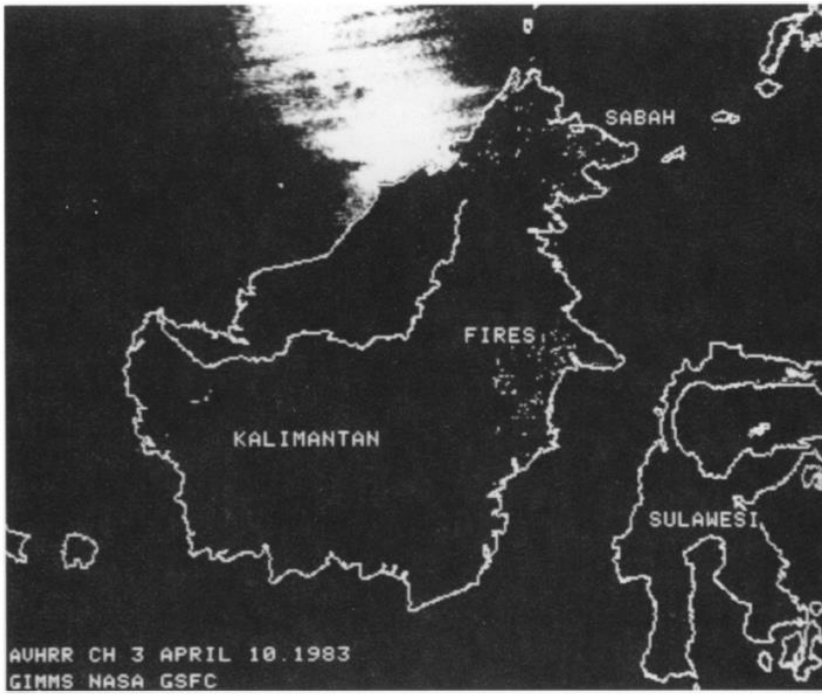
ENSO influences on fire weather



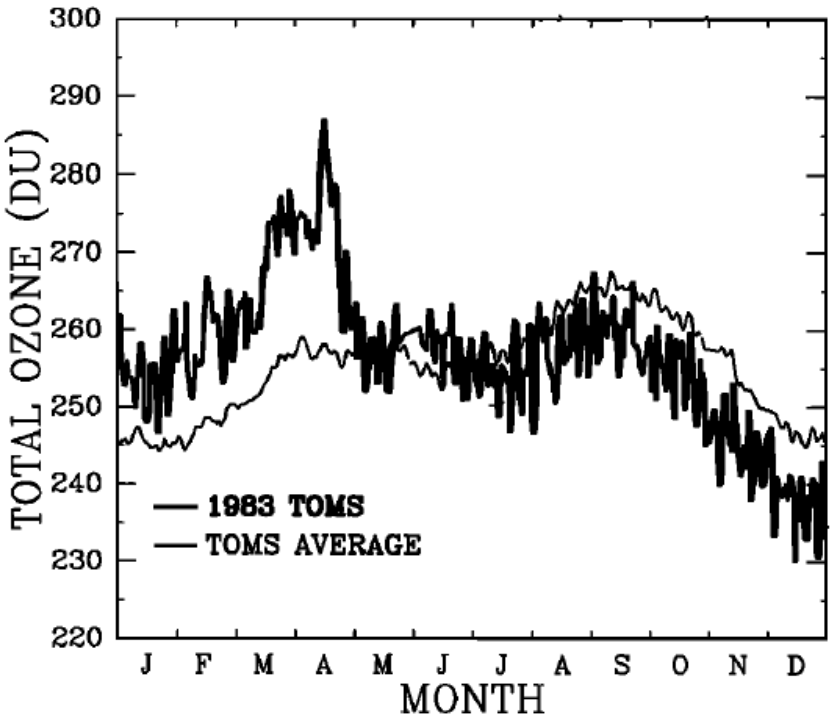
Global seasonal FWI correlation with Nino 3.4, 1980-2012
(Andrew Dowdy, Australian BoM)

Example: 1983 fires in Borneo

The first (?) large-scale fires in Indonesia and Malaysia to be described quantitatively in the literature.

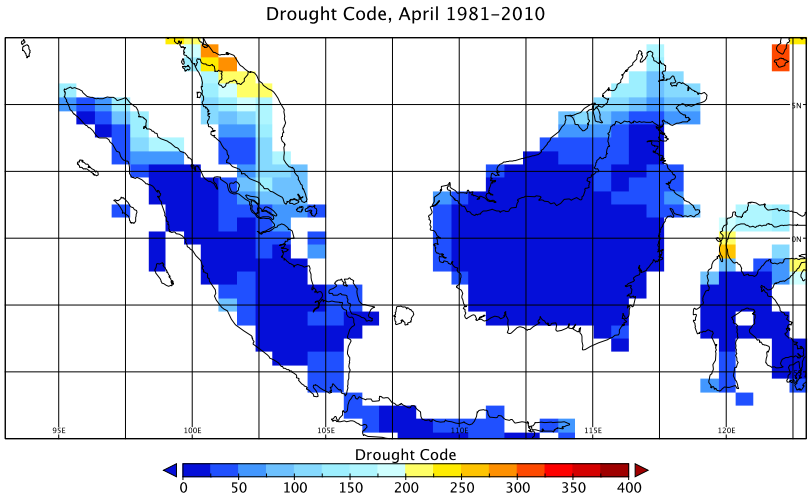


Malingreau et al. (1985, *Ambio*)

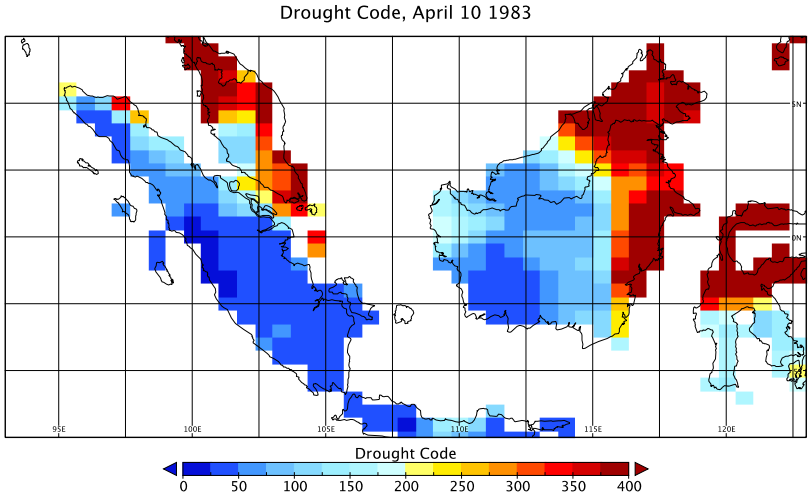


Fishman et al. (1990, *JGR*)

A prelude to later disasters.



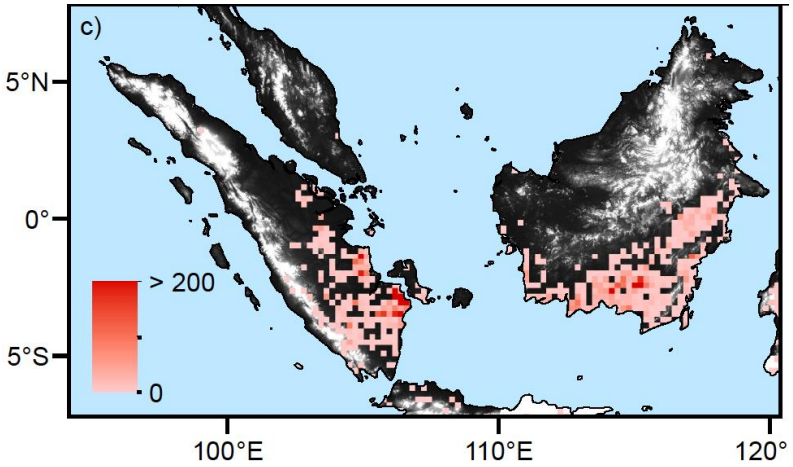
April is normally too wet for severe burning.



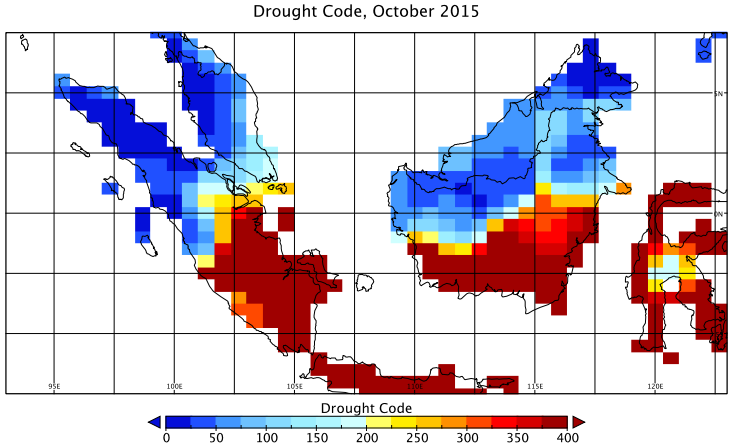
DC > 300 threshold based on 1994 and 1997 events (de Groot et al., 2007, MITI)

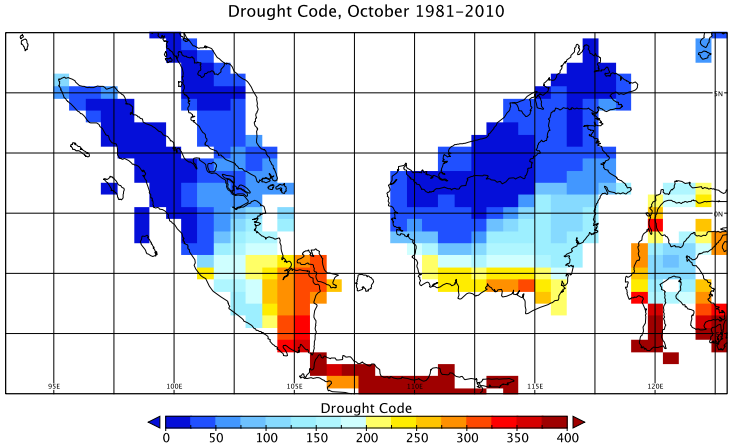
GFWED captures isolated 1983 drought in Sabah and East Kalimantan.

2015 fire in Indonesia the worst since 1997



October 2015 Terra MODIS active fires
(Thierry Fanin & Guido van der Werf)





Future development

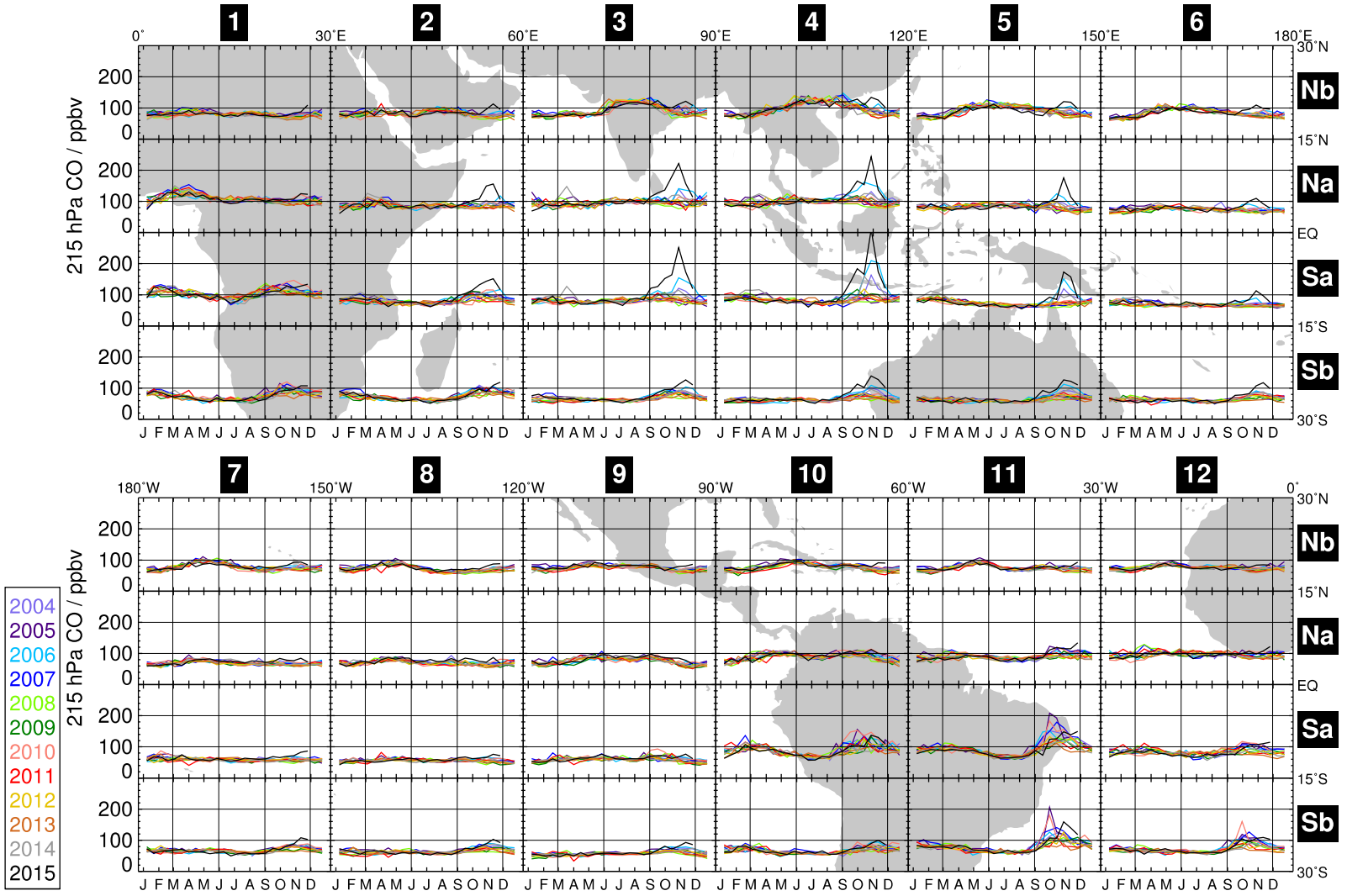
- In 2016, we will begin calculations using GPM, TRMM and GPCP precipitation data as part of the NASA PMM Science Team.

- We would like to add:
  - Other reanalyses
  - SMAP for DMC and DC calculations
  - Other simple indices: Nesterov, McArthur, NFDRS, Haines.

http://data.giss.nasa.gov/impacts/gfwed

2015 fire in Indonesia the worst since 1997

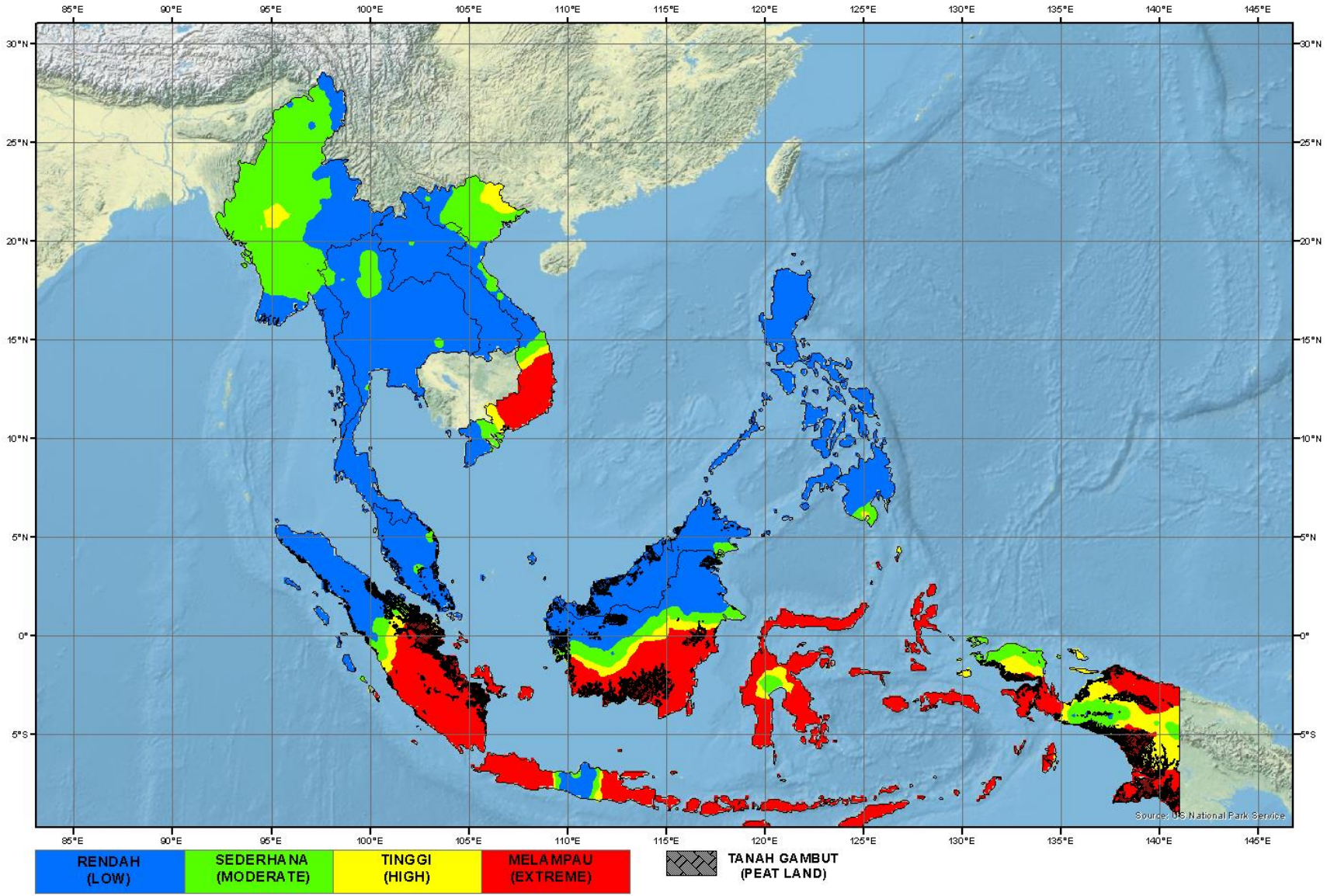
CO in the upper troposphere from Aura MLS (Nathaniel Livesey, JPL)



KOD KEMARAU

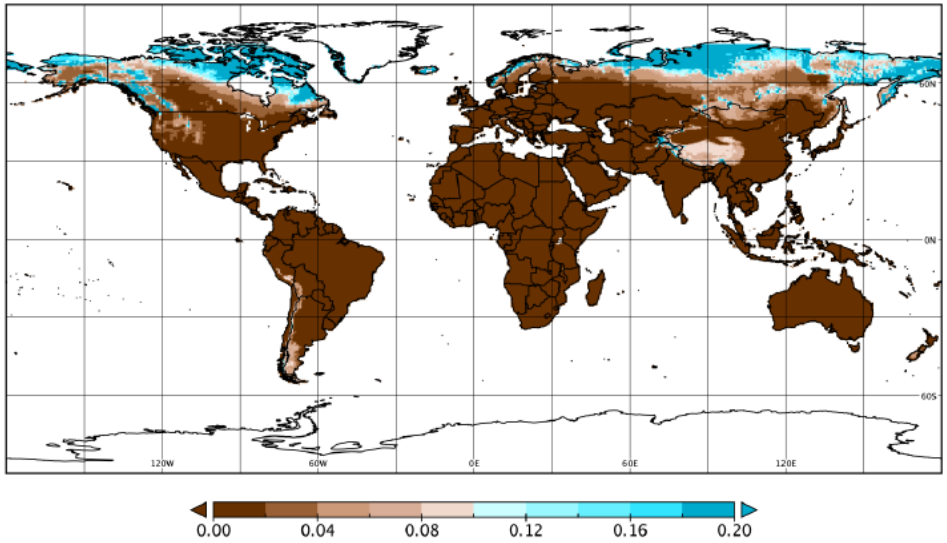
DROUGHT CODE (DC)

27-10-2015

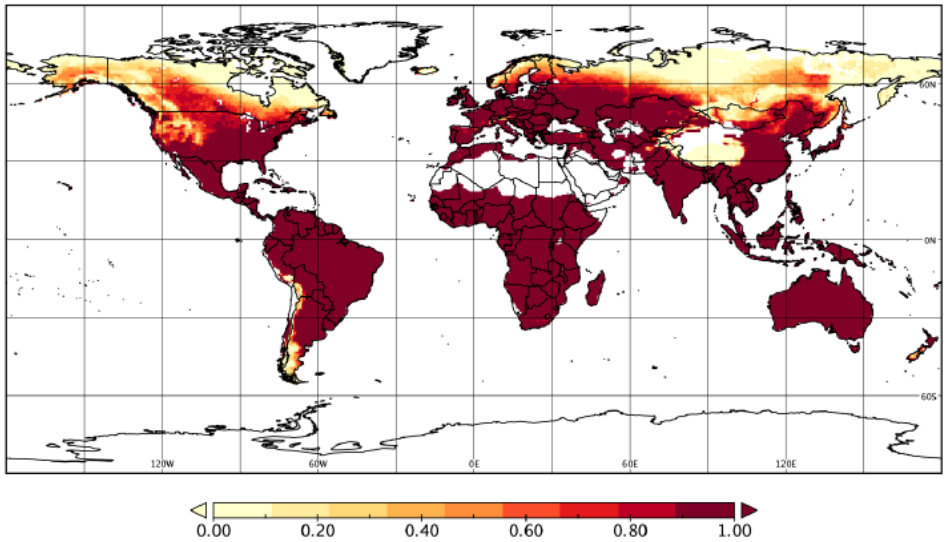


Fire season startup using snow cover and winter precipitation

May snow depth (m)



May fraction of days FWI is active



Global Wildfire Water Risk Index

(François-Nicolas Robinne, Univ. Alberta)