SOURCES OF SOIL DRYNESS MEASURES AND FORECASTS

bushfire&natural HAZARDSCRC

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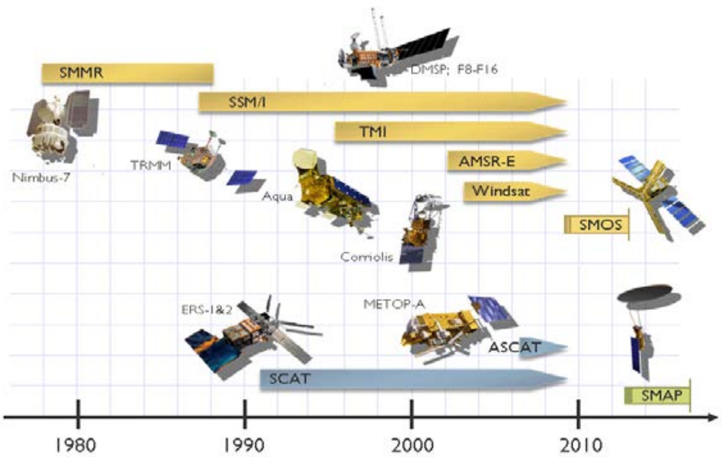
EMERGING NEW APPROACHES TO EVALUATE LANDSCAPE DRYNESS THROUGH THE USE OF SATELLITE REMOTE SENSING DATA, LAND SURFACE MODELLING AND DATA ASSIMILATION TECHNIQUES ARE AVAILABLE, MEASURING DRYNESS MORE SYSTEMATICALLY THAN THE EMPIRICAL METHODS. SATELLITE MEASUREMENTS CAN BE BLENDED WITH LAND SURFACE MODEL SIMULATIONS TO PROVIDE MORE ACCURATE, DETAILED AND CONFIDENT ESTIMATES AND FORECASTS OF LAND DRYNESS.

Estimating fuel moisture content using meteorologically based indices

Measurement of Fuel Moisture Content (FMC) by the oven-drying of plants is very slow and laborious. Therefore, it is desirable to predict FMC from more easily accessible parameters. The Australian operational Forest Fire Danger Index requires the calculation of a Drought Factor to represent FMC. Currently the Drought Factor is estimated using very crude models developed in the 1960's. The most prominent of these are the Keetch-Byram Drought Index (KBDI; Keetch & Byram 1968) developed by the US Forest Service, and the related Soil Dryness Index (SDI; Mount 1972) developed by Forestry Tasmania. These simple empirical soil moisture models are designed to be easily hand calculated and do not take into account different soil types, slope, aspect and many other factors.

Remote sensing of soil moisture

The only practical way to measure soil moisture daily over the whole of Australia is through satellite remote sensing.



Instrument	Resolution	Study Area	Literature Source	Validation Metric: Bias (m^3/m^3)	RMSD (m^3/m^3)	Temporal Correlation
AMSR-E*	60km	Australia	Draper et al., 2009	0.0	0.03	0.83
AMSR-E#	60km	Australia	Draper et al., 2009	-0.010 to 0.190	0.11	0.79
ASCAT+	35km	Australia	Abergel et al., 2012	0.01	0.06	0.80
SMOS+	40km	Australia	Abergel et al., 2012	-0.06	0.08	0.74
SMAP	9km	Launched January 2015				

Verification of soil moisture data

Normalised OzNet Soil Moisture observations vs. Model Analyses

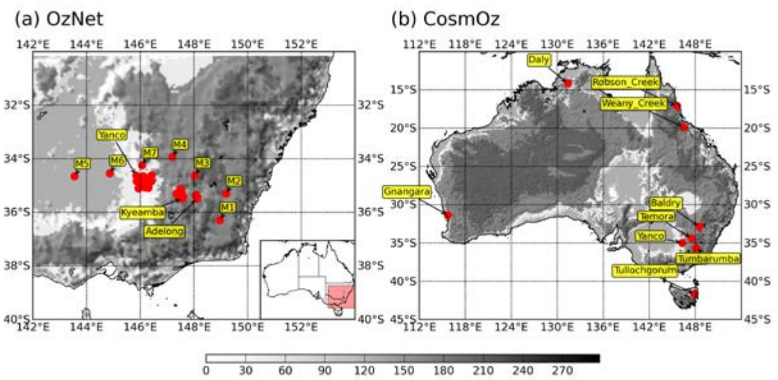
Data Set (2009 to 2011)	Correlation [-]	Bias [-]	RMSD [-]
ACCESS NWP 80km	0.72	0.02	0.19
Keetch Byram Drought Index	0.60	-0.39	0.43
Mount's Soil Dryness Index	0.71	-0.02	0.23
Antecedent Precipitation Index	0.66	0.14	0.26

Normalised CosmOz Soil Moisture observations vs. Model Analyses

Data Set (2012 to 2014)	Correlation [-]	Bias [-]	RMSD [-]
ACCESS NWP 40km	0.81	-0.03	0.15
Keetch Byram Drought Index	0.63	-0.35	0.42
Mount's Soil Dryness Index	0.76	-0.07	0.20
Antecedent Precipitation Index	0.73	0.14	0.23
Remotely Sensed ASCAT	0.76	-0.01	0.19

Ground based soil moisture observations

Ground based soil moisture observations are very useful for validation of remotely sensed and model soil moisture.



Land surface data assimilation

Data assimilation is the process through which the maximum amount of useful information can be extracted from observations and models. The only practical way to observe the land surface on a national scale is through satellite remote sensing. Unfortunately, such satellite data is prone to biases and corruption. Therefore, it is essential to quality control and bias correct the satellite data. In addition, satellite measurements are infrequent with measurement repeat times of about one day and contain gaps. Data assimilation can filter the random errors from the satellite measurements and fill in both the spatial and temporal gaps in the measurements.

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