CONSORZIO LaMMA

CLIMATE SERVICE FOR MONITORING AND FORECASTING DROUGHTS

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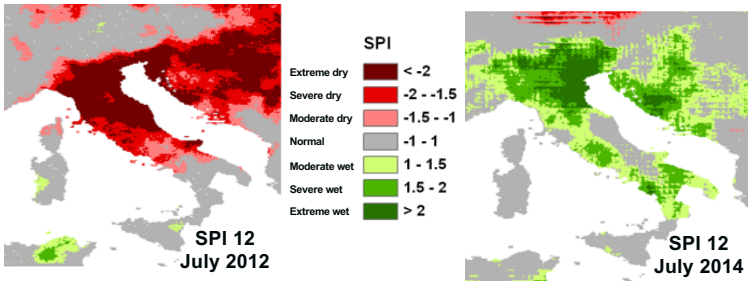
RAINFALL-BASED INDICES

SPI – Standardized precipitation Index *(McKee at al., 1993)*

Monthly dataset (Tuscany rain gauges; CHIRPS (*Funk et al., 2014*))



EDI – Effective Drought Index *(Byun & Wilhite, 1999)*

Daily dataset;

Long and up-to-date rainfall time series;

Standardized.

REMOTE SENSING INDICES

Frequent and detailed spatial information

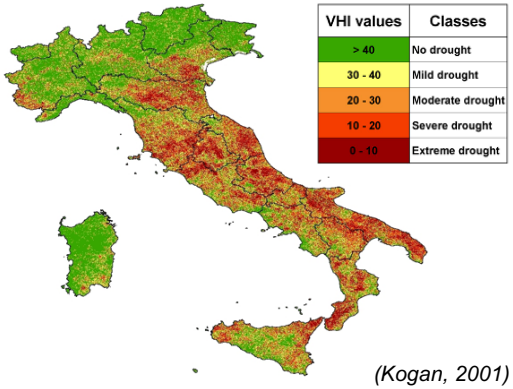
Application in periods with less cloud cover

VHI – Vegetation Health Index

Combination of two indices (TCI and VCI) that monitor temperature and moisture impacts on vegetation.

MODIS_LST: 8 days, 1 km

MODIS_NDVI: 16 days, 250 m



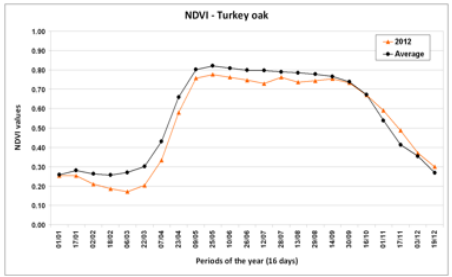
(Kogan, 2001)

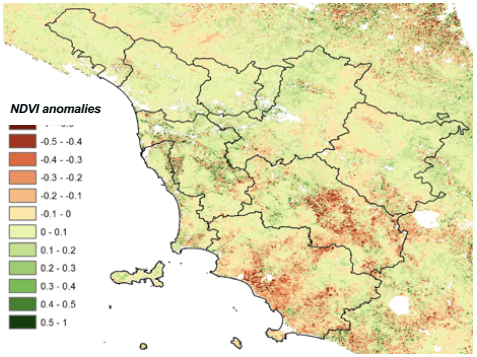
VHI = *a* * VCI + *b* * TCI

NDVI – Normalized Difference Vegetation Index

It characterizes greenness and vigor and, indirectly, the chlorophyll and moisture contents.

Multi-temporal profiles for growing season dynamics/anomalies.





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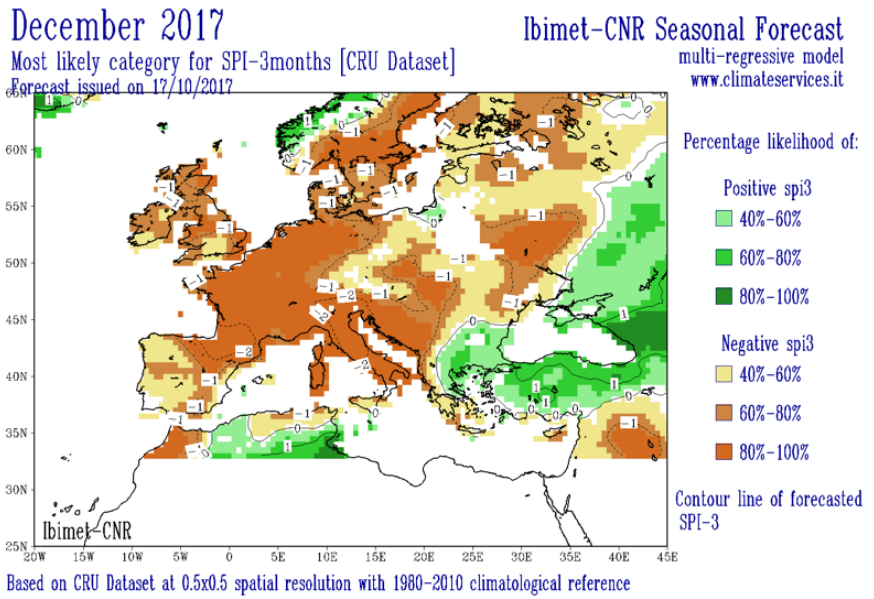
FORECASTING SYSTEM

SPI - 3 months (*Magno et al., 2018*)

Empirical physically-based approach (Multivariate Regression Model) to predict meteorological drought using the SPI 3 index.

3 phases replicated for each grid cell of the spatial domain: 1) selection of predictors; 2) estimation of parameters; 3) extrapolation.

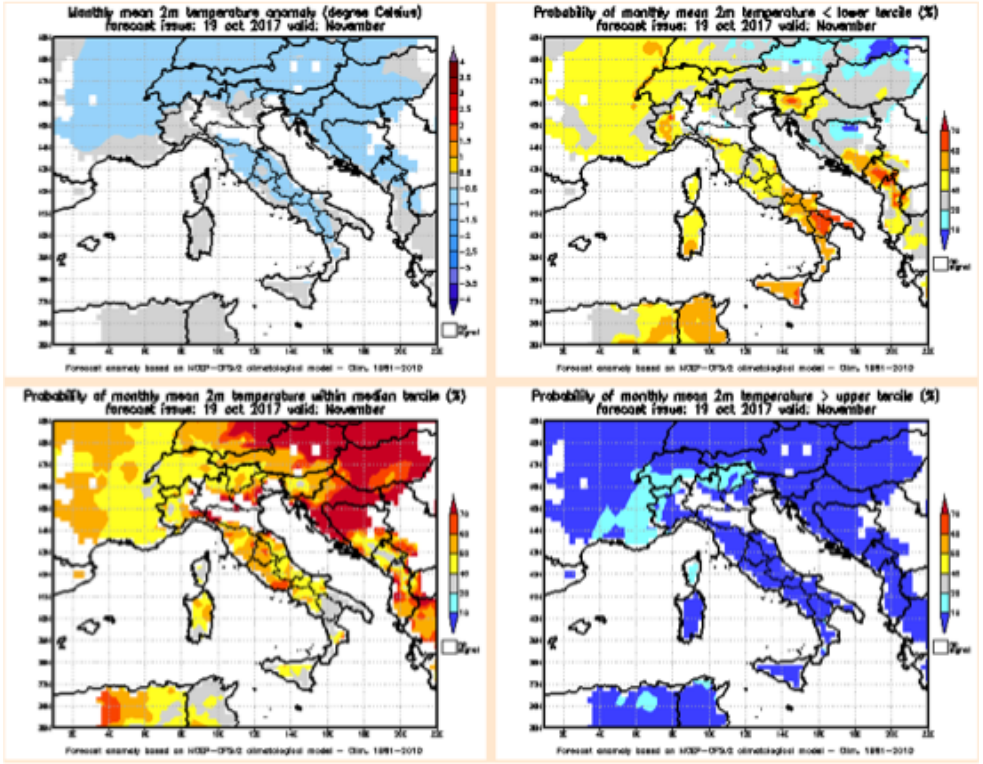
- First phase: double step procedure to select the best MR model in terms of predictive performance, i.e. which are the large scale atmospheric drivers (and their lags) to use as predictors for SPI3.
- Second phase: estimate the value of MR parameters that reproduce the linear relation between SPI3 and each driver selected at 1).
- Third phase: use the parameter estimates obtained at 2) to predict future SPI3 anomaly.



Rainfall and Temperature (*Messeri et al., 2017*)

Outlook for the next 1-3 months.

Coupled approach: "Teleconnective" approach, based on the interpretation of several atmospheric indices; "Probabilistic" approach based on circulation type classifications driven by an ensemble global model.



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CONSORZIO LaMMA

- Open
- Interoperable
- Customizable

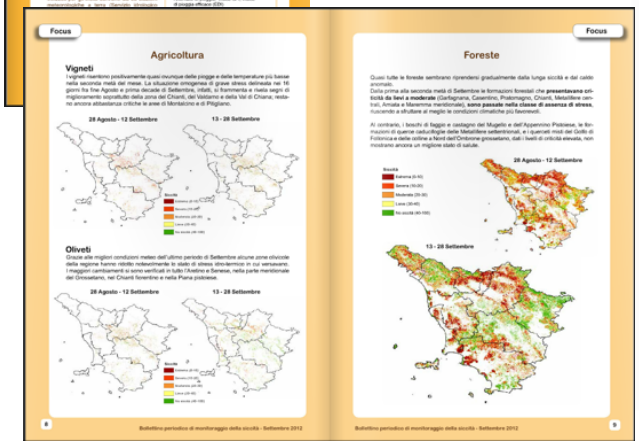
DROUGHT CLIMATE SERVICE

(*Magno et al., 2018*)

Monthly bulletins - Tuscany

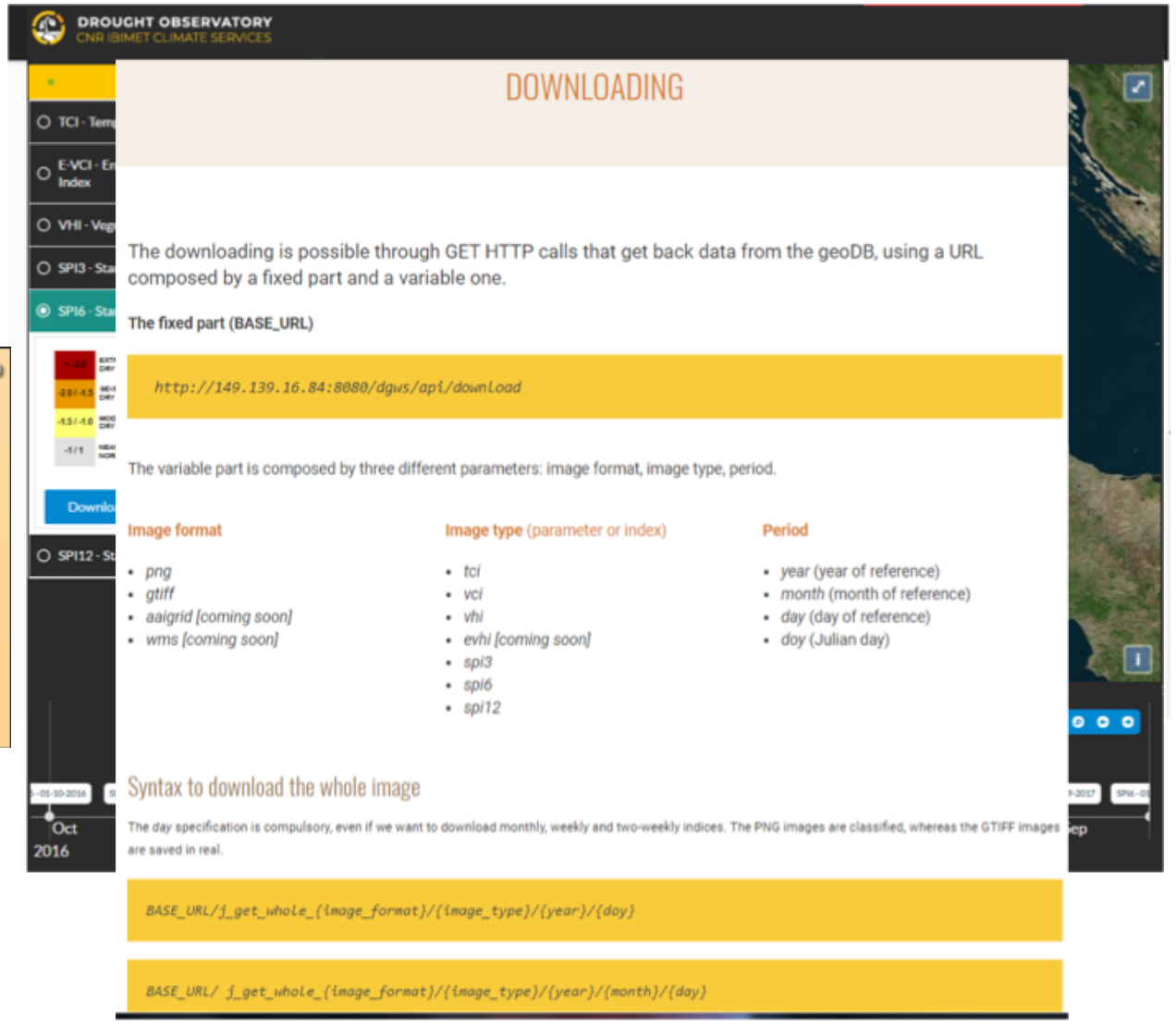
Previous month recap and forecasts of next months.

Analysis of forests and main crops condition (spring/summer).



On-line visualization and downloadable version

https://issuu.com/consorziolamma



https://drought.climateservices.it/ (coming soon)

ACTUAL EVAPOTRANSPIRATION

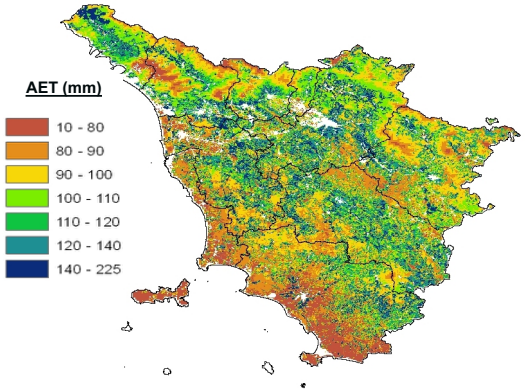
AET – Actual Evapotranspiration

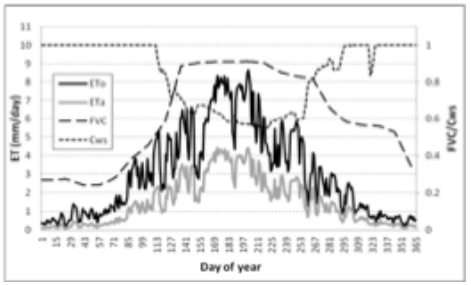
Estimates based on both in situ and satellite data;

Separation of Evaporation and Transpiration processes;

Inclusion of short term water stress (Cws & AW).

$$AET = ET_0 \, f(VI)$$





$$AET = ET_0 \, (FVC \, Kc_{veg} \, Cws + (1\text{-}FVC) \, Kc_{Soil} \, AW)$$

(*Chiesi et al., 2013; Maselli et al., 2014*)

ET_0 = *Estimation by several equations* (Jensen and Haise, 1963; Thornthwaite, 1948; FAO paper 56, 1998, etc.)

FVC = Fraction of active vegetation

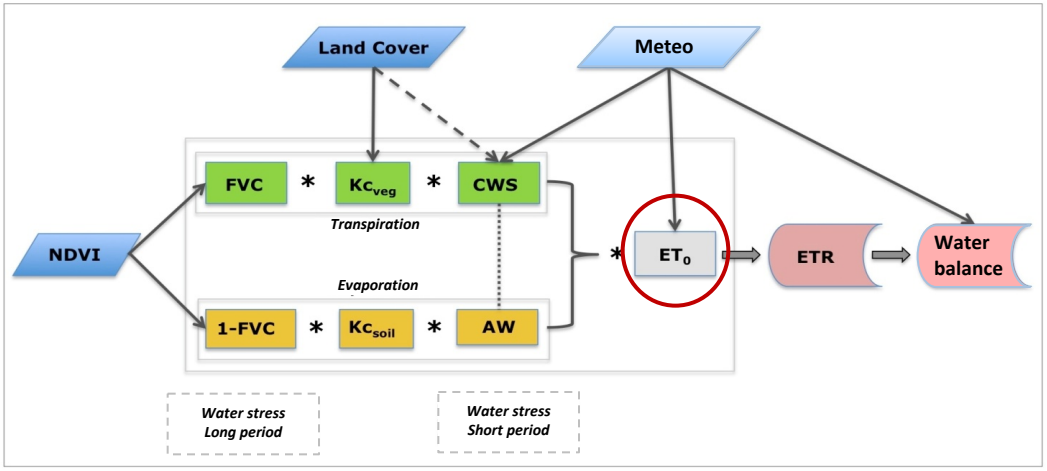
$$FVC = (NDVI - NDVI_{min})/(NDVI_{max} - NDVI_{min})$$

AW = Available Water (P/ET_0) AW=1 per $P>ET_0$

Cws = Coefficient of water stress

$$Cws = 0.5 + 0.5AW$$

Biome type	Kc_{Veg}	Cws, AW
Forest	0.7	Yes (2 months)
Grassland	1.2	Yes (1 month)
Annual crop	1.2	Yes (1 month) during months 1–5 and 10–12. No during months 6–9 if FVC > 0.6 = irrigation
Kc_{Soil}	0.2	



Get Connected

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