An operational chain of probabilistic seasonal forecast based on circulation type classifications driven by an ensemble global model

G. Messeri[1-2], A. Crisci[1], M. Rossi[1-2], R. Vallorani[1-2], B. Gozzini[2], and G. Maracchi[3]

corresponding author: messeri@lamma.rete.toscana.it

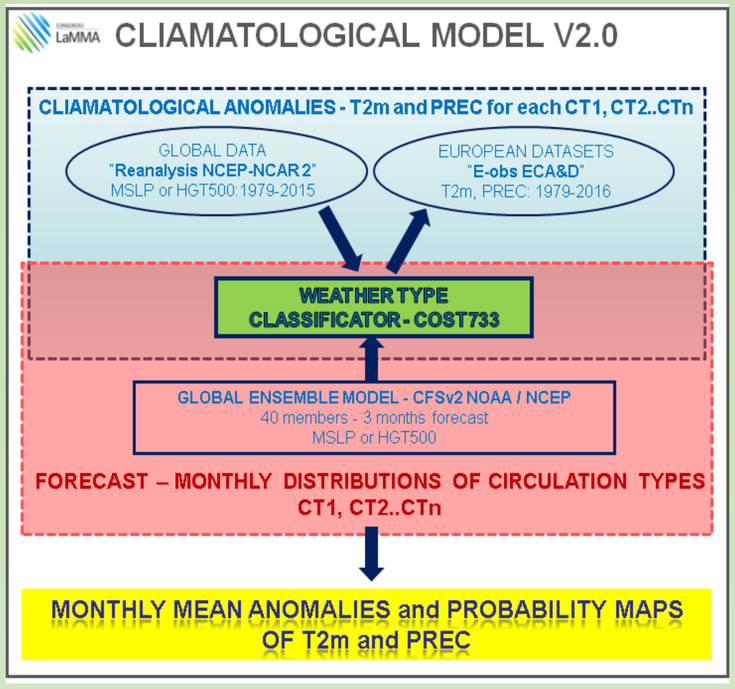
[1]IBIMET – CNR, Institute of Biometeorology - National Research Council, Firenze, Italy;

[2]Consorzio LaMMA – Laboratory of environmental modelling and monitoring for a sustainable development, Sesto Fiorentino (Firenze), Italy

[3]Accademia dei Georgofili, Firenze, Italy

The experimental climatological model runs operationally every day on Italy for the next 3 months (http://www.lamma.rete.toscana.it/meteo/modelli/cfs)

INPUT: 40 members of HGT500 and MSLP from CFSv2 NOAA/NCEP are converted into a series of daily circulation types for the next 3 months.



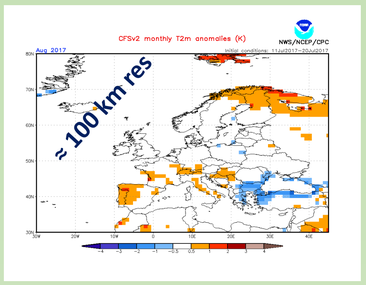
MODEL CORE: monthly forecast mean anomalies are computed as a weighted avarage of the climatol. mean anomalies of each circulation types. Weights are the predicted numbers of circulation types for the next 3 months on the basis of an ensemble global model.

OUTPUT:

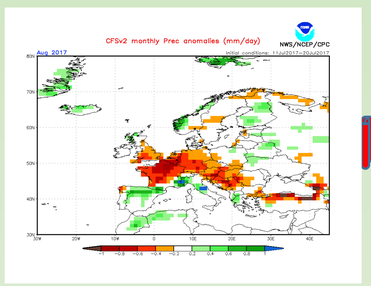
- ❑ **monthly mean anomalies maps:**
  - **Max 2 meter temperature**
  - **Min 2 meter temperature**
  - **Mean 2 meter temperature**
  - **Precipitation and Rainy days (>1mm)**
- ❑ **probability maps (Wilcoxon test applied to 40 ensemble members):**
  - **Probability (%) > upper tercile of clim. distrib.**
  - **Probability (%) < lower tercile of clim. distrib.**
  - **Probability (%) within median tercile of clim. distrib.**

Seasonal forecast maps – valid August init July 2017

CFSv2



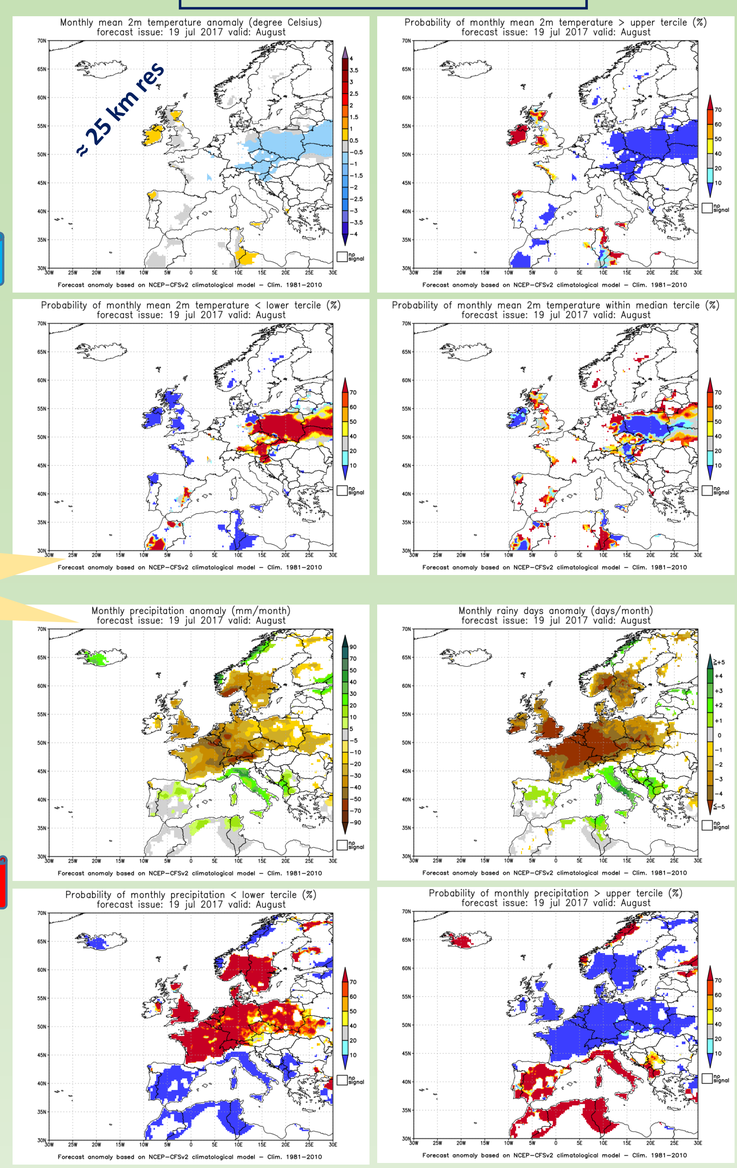
T2m



PREC

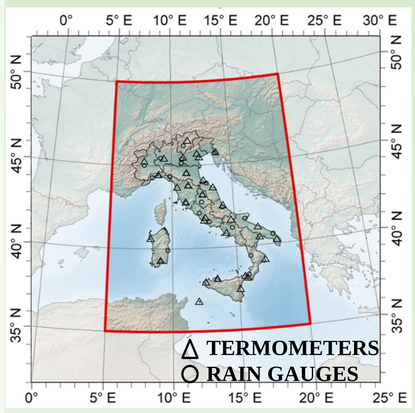
VERIFICATION of LaMMA model V2.0 are ongoing!

LaMMA model V2.0



What's behind the model V2.0 of LaMMA Consortium ?

A sensitivity analysis was first carried out in order to find the most performing circulation type classifications for surface temperature and precipitation in Italy.
Results of the study are part of the following paper:



Spatial domain and weather station used for the optimization algorithm

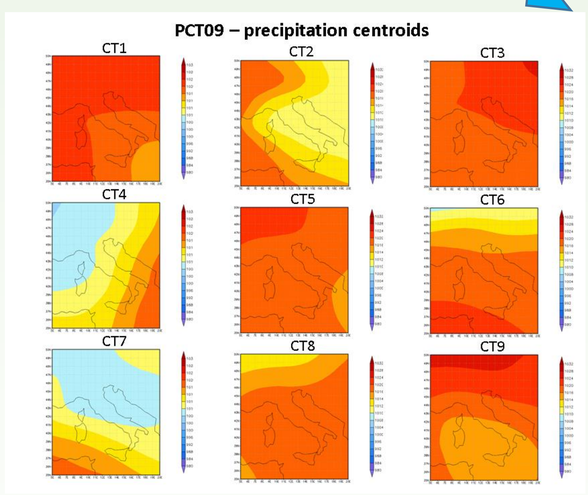
Vallorani R., Bartolini G., Betti G., Crisci A., Gozzini B., Grifoni D., Iannuccilli M., Messeri A., Messeria G., Morabito dM. and Maracchi G., ***"Circulation Type Classifications for temperature and precipitation stratification in Italy"***
International Journal of Climatology, June 2017, DOI: 10.1002/joc.5219

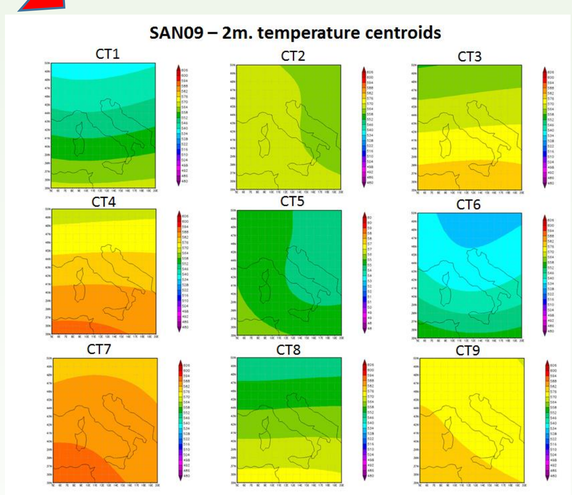
MAIN TOPICS OF THE STUDY:

SOFTWARE: COST733class-1.2 software package (Philip et al., 2014)
SPATIAL DOMAIN: specific domain centered in Italy was chosen (Fig.1)
CLASSIFICATIONS METHODS: GWT and **LIT** (threshold-based), **PCT** (PCA-based), **CKM** and **SAN** (optimization algorithms), **LND** (leader algorithms)
CLASSIFICATIONS VARIABLES: MSLP and **500HGT** NCEP Reanalysis 2
CALIBRATION PERIOD: 1979 - 2015
NUMBER OF TYPES/CLASSES: 8/9, 11/12 and 18
SURFACE DATA USED FOR EVALUATION: 32 temp. and 26 prec. stations

MAIN FINDINGS OF THE STUDY: the following two classification have been selected as the most performing ones over Italiay for precipitation and surface temperature

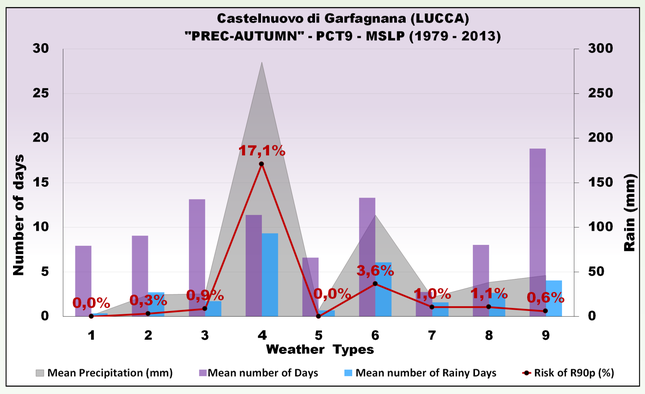
PREC T2m





Other applications and further developments

- ❑ **DEVELOPMENT OF SEASONAL FORECAST RISK MAPS FOR METEOROLOGICAL EXTREMES THROUGH THE CORRELATION OF THE HISTORICAL RISK OF EACH CIRCULATION TYPES AND THE PREDICTED FREQUENCIES OF CIRCULATION TYPES FOR THE NEXT THREE MONTHS: HEAVY RAINFALL, VERY WARM/COLD DAYS, DRY SPELLS…**
- ❑ **THE HISTORICAL RISK OF HEAVY RAINFALL HAS ALREADY BEEN CALCULATED FOR ITALY through the long term analisys of about 30 historical weather stations!**

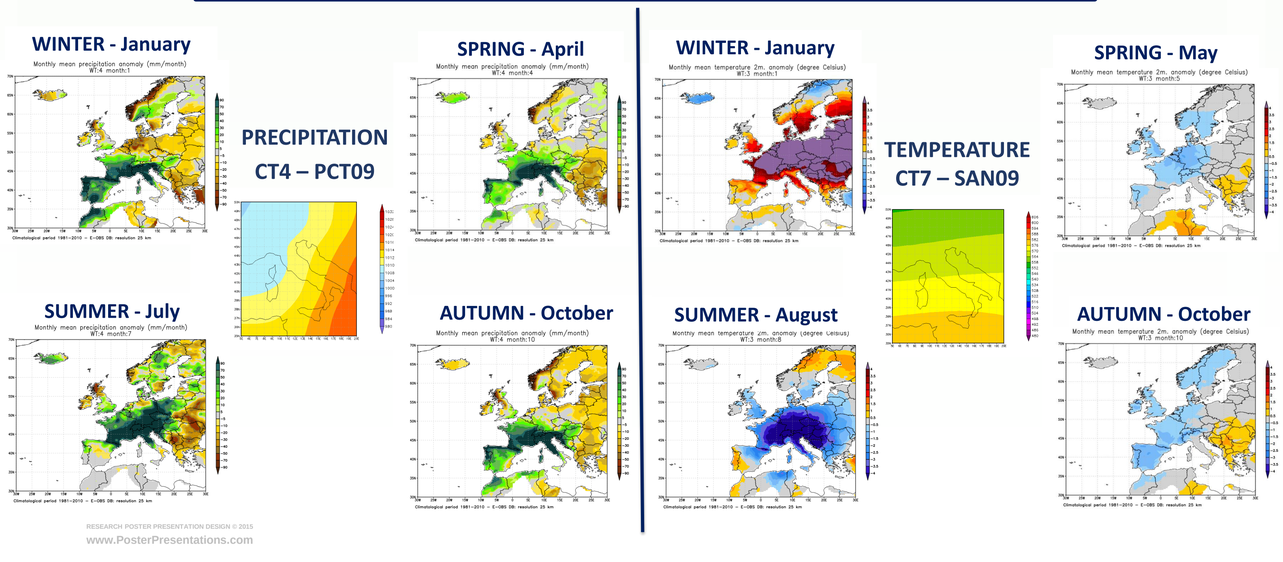


AUTUMN RISK OF VERY WET DAYS (R90p)

EMS2017-464 - ***Circulation types and extreme daily precipitation in the Italian Peninsula by M. Iannuccilli et al.***
Oral Session UP3.3, room Gallery on Tuesday, 05 Sep 2017, 11:45

- ❑ **DEVELOPMENT OF SEASONAL FORECAST MAPS FOR OTHER ENVIRONMENTAL OR WEATHER RELATED VARIABLES: WATER AND ENERGY CONSUMPTION AND MANAGEMENT, AGRICULTURE, CIVIL PROTECTION…**
- ❑ **TREND ANALYSIS AND CLIMATOLOGICAL STUDIES**
- ❑ **VERIFICATION OF THE PRESENT MODEL FOR SEASONAL FORECAST**

Monthly composite climatological anomaly maps



Bibliography and relevant links

- *Vallorani R., Bartolini G., Betti G., Crisci A., Gozzini B., Grifoni D., Iannuccilli M., Messeri A., Messeria G., Morabito M. and Maracchi G., "Circulation Type Classifications for temperature and precipitation stratification in Italy", Int. J. Climatol., June 2017, https://doi.org/joc.5219*
- *Huth R, Beck C, Kucerova M. 2015. Synoptic-climatological evaluation of the circulation pattern over Europe. Int. J. Climatol. . https://doi .org/10.1002/joc.4546*
- *Broderick C, Fealy R. 2014. An analysis of the synoptic and climatological applicability of circulation type classifications for Ireland. Int. J. Climatol. 35: 481–505. https://doi.org/10.1002/joc.3996*
- *Philipp A, Beck C, Huth R, Jacobeit J. 2014. Development and comparison of circulation type classifications using the COST 733 dataset and software. Int. J. Climatol. 36: 2673–2691. https://doi.org/10.1002/joc .3920*
- *Casado MJ, Pastor MA. 2013. Circulation types and winter precipitation in Spain. Int. J. Climatol. 36: 2727–2742. https://doi.org/10.1002/joc .3860*

Operational output of LaMMA climatologcal experimentl model V2.0:
http://www.lamma.rete.toscana.it/meteo/modelli/cfs
Output of CFSv2 NCEP/NOAA:
http://www.cpc.ncep.noaa.gov/products/CFSv2/CFSv2seasonal.shtml