Sources of Seasonal Predictability for the Euro-Mediterranean Sector

M Benassi[1*], S Materia[1], D Peano[1], P Ruggieri[1], S Gualdi[1,2]

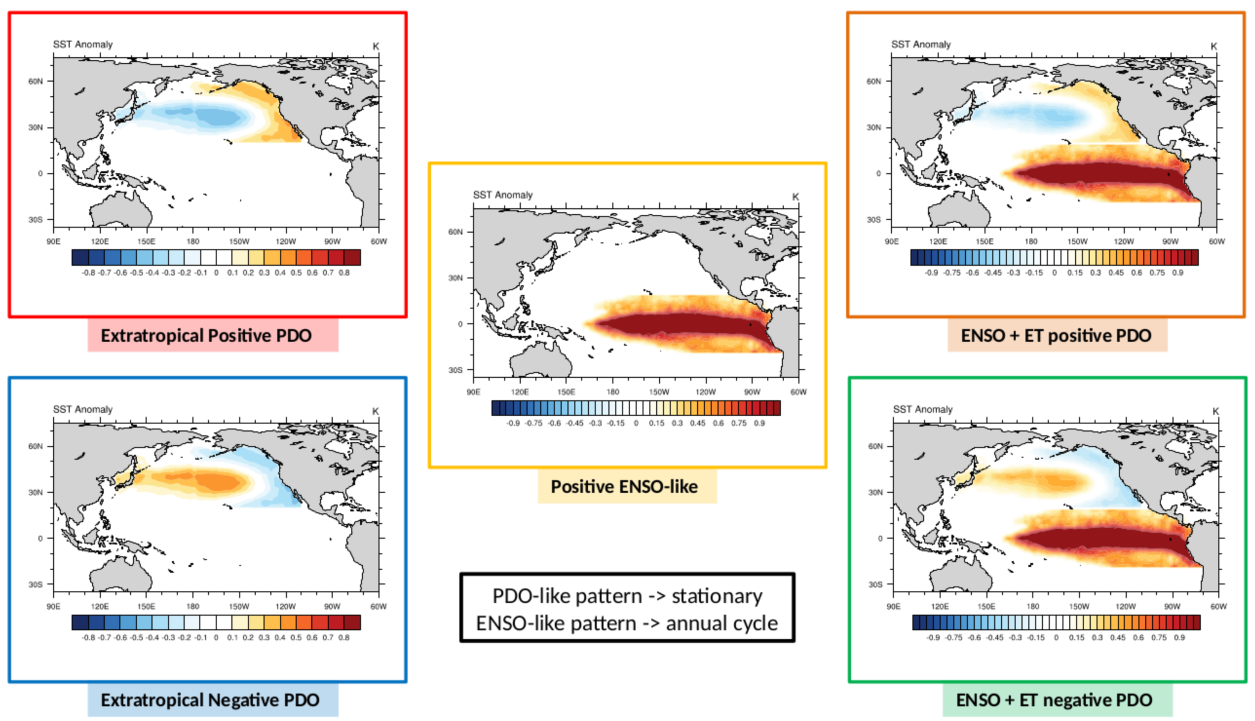
[1]Fondazione Centro Euro-Mediterraneo sui Cambiamenti Climatici, Italy. [2] Istituto Nazionale di Geofisica e Vulcanologia, Italy

*contact: marianna.benassi@cmcc.it

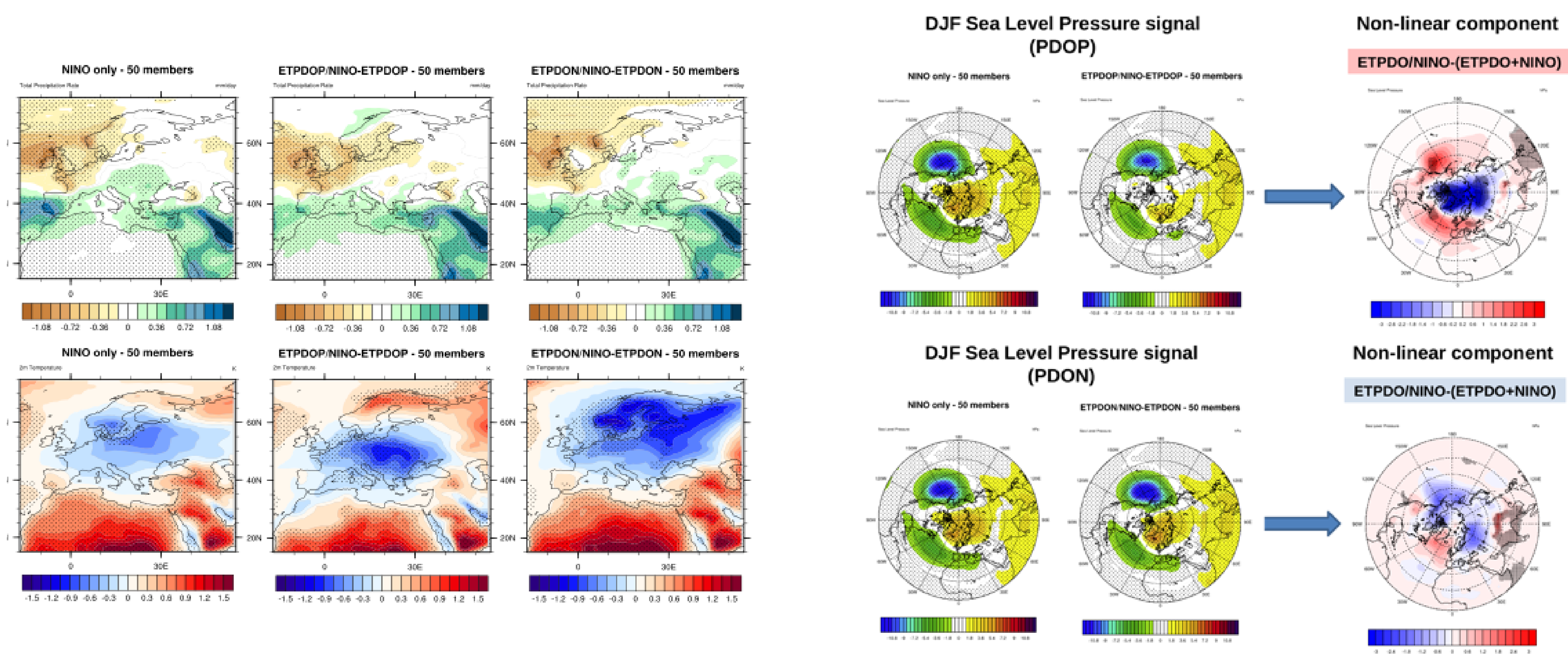
In the framework of the **MEDSCOPE** (MEDiterranean Services Chain based on Climate PrEdiction) project, we propose a new set of **sensitivity experiments**, which aim to investigate key mechanisms driving climate variability on the Euro-Mediterranean sector. This idealized approach enhances a deeper insight on remote and local processes, representing possible sources of predictability for the Euro-Mediterranean region at the seasonal to multi-annual time scale.

Remote Sources of Predictability

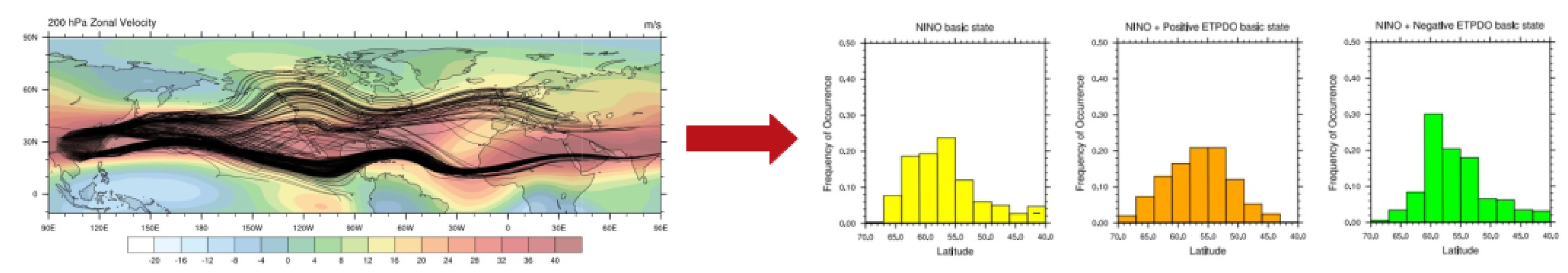
Different mechanisms have been proposed to illustrate **El Nino Southern Oscillation** (ENSO) **teleconnection** over the Euro-Mediterranean sector, involving the propagation of atmospheric planetary waves and changes in the zonal and meridional atmospheric circulation. The background sea surface temperature state may indeed influence these processes and therefore our goal is to establish the role of the **Pacific Decadal Oscillation** (PDO) phase in modulating ENSO fingerprint. A set of sensitivity experiments including different combinations of ENSO and PDO signals allows to investigate if and how the low frequency variability over the extra-tropical Pacific affects ENSO teleconnection over the Euro-Mediterranean domain.



By looking at the circulation over the Euro-Atlantic sector, some modulation may indeed be identified, with a **dampening** of the ENSO signal in the **positive PDO** case, and with an **enhancement** of the ENSO fingerprint when the **negative PDO** is taken into account. This modulation is reflected also on the ENSO teleconnection patterns of temperature and precipitation over the Euro-Mediterranean domain, where the position of the maxima is sensitive to the different phases of the PDO.

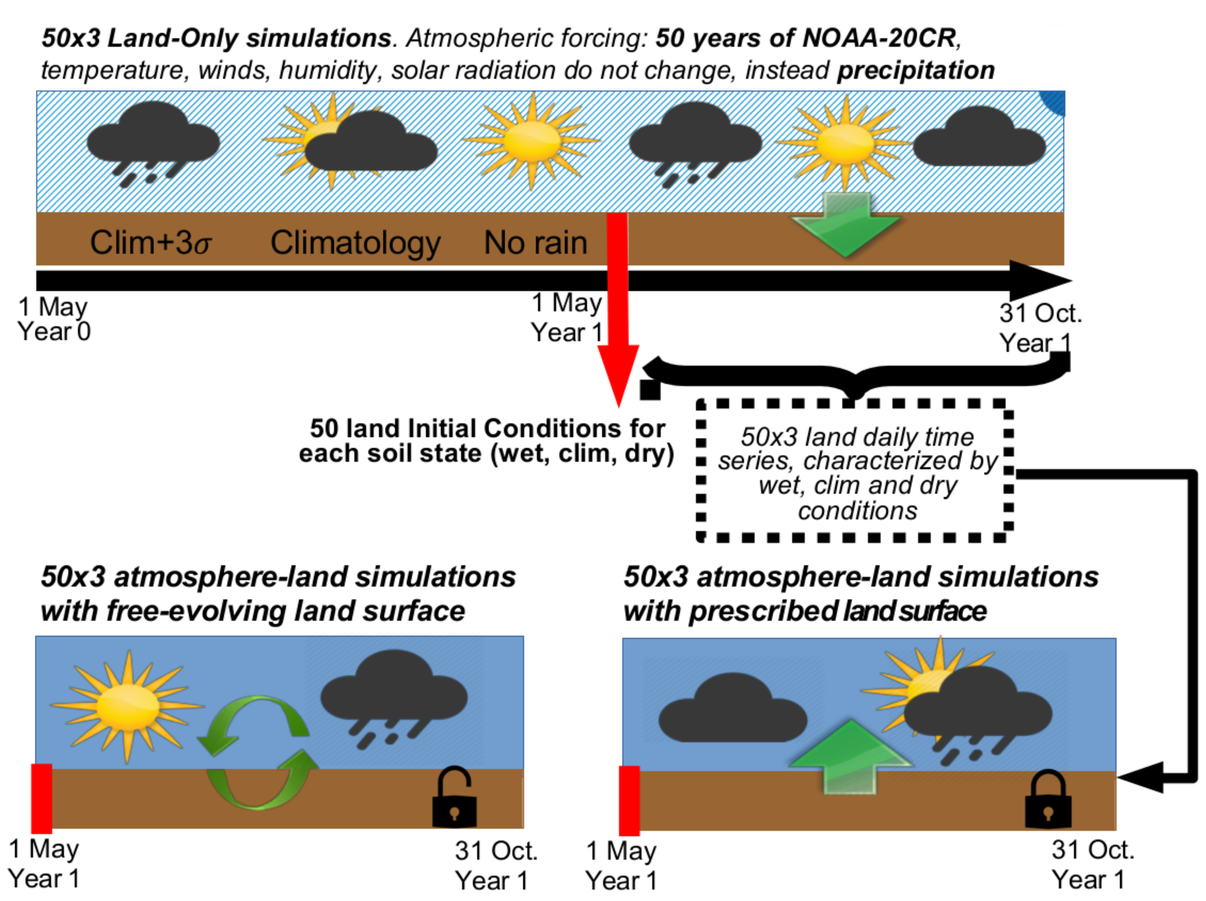


A possible **tropospheric pathway** is explored, accounting for the sensitivity to the basic state of the planetary wave propagation.

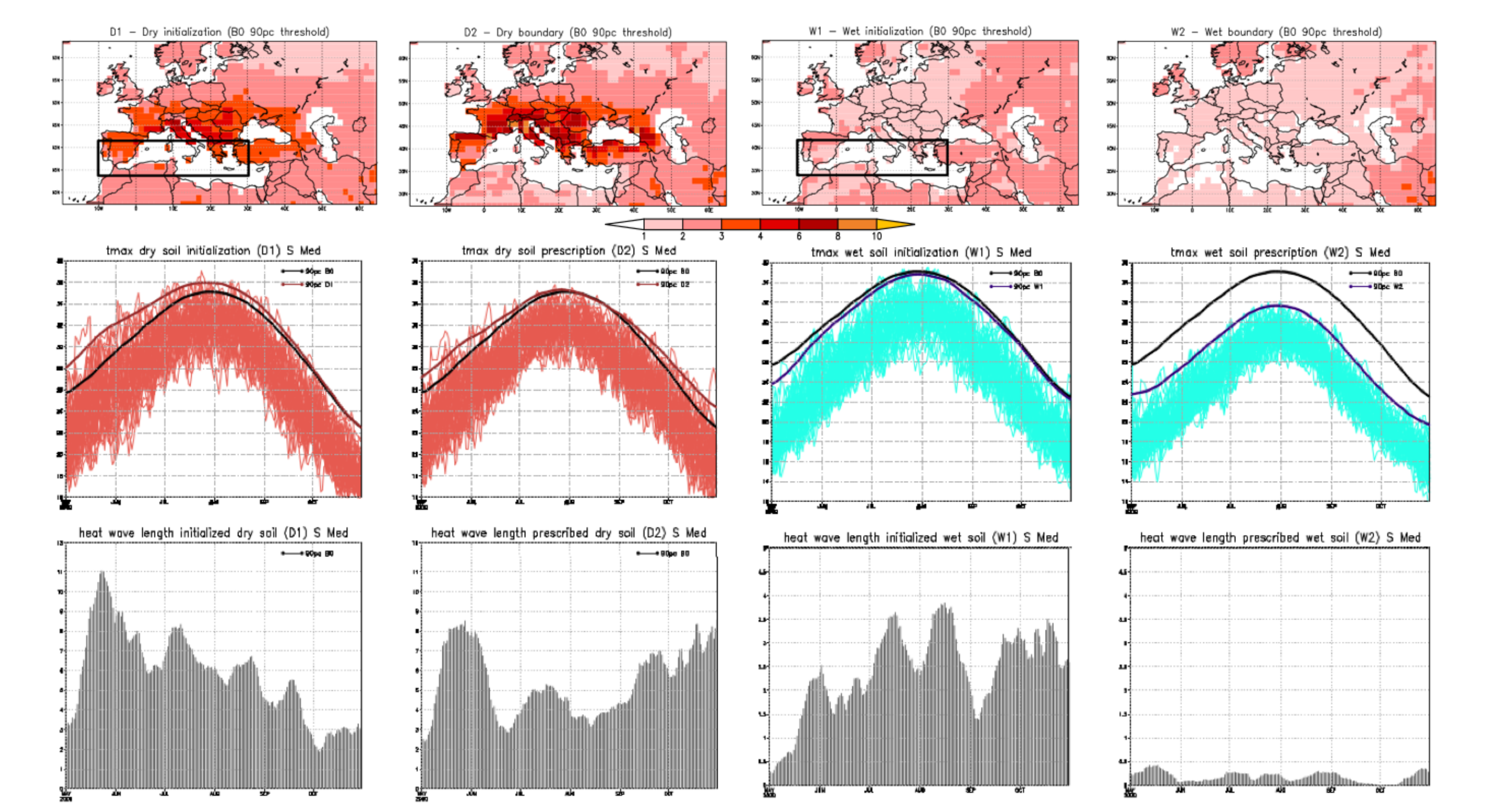


Local Sources of Predictability

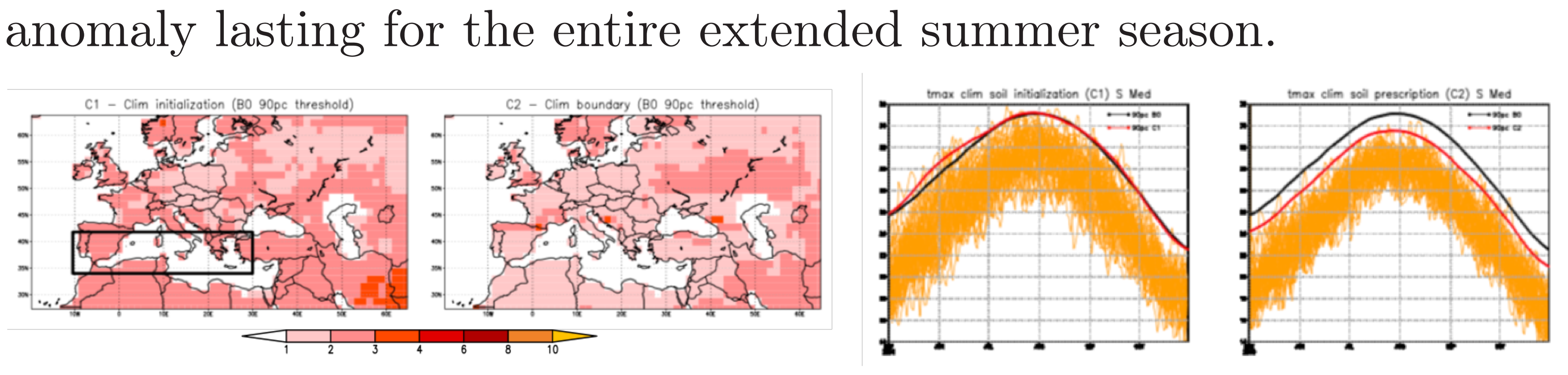
We aim to investigate the feedbacks between **soil moisture state** and the atmosphere, which are known to play a crucial role in shaping the duration and the intensity of **summer heat waves**. This new set of idealized experiments allows to investigate the atmospheric response to extremely dry and extremely wet soil conditions, with a special focus on the role of land surface model initialization. Three couples of experiments are considered with dry, wet, or climatological soil moisture conditions: for each couple the soil moisture state is defined as initial condition for a fully coupled experiment or, alternatively, it is kept constant for the entire duration of the simulation.



In this research, to detect heat waves, the Heat Wave Magnitude Index (HWMI, Russo *et al.*, 2014) is exploited. Insurgence of **severe** (HWMI > 3) to **very extreme** (HWMI > 8) heat waves may be noticed in the **dry experiments**, particularly when the land surface is prescribed to the dry state. In the wet experiments, the heat wave average magnitude is strongly reduced, and when the land surface is prescribed chances to generate heat waves are nearly canceled.



When the dry state is included as initial condition, the surface temperature is generally higher up to the end of August, while when the dry state is prescribed, the stronger warm anomalies are in September and October. In the wet case, the stronger anomalies are found when the soil moisture conditions are prescribed, with an intense cold anomaly lasting for the entire extended summer season.



In general, as confirmed by the climatological experiment, **feedbacks** between **land surface** and **atmosphere** are crucial to **enhance high temperatures**, and hence intense heat waves.

cmcc Centro Euro-Mediterraneo sui Cambiamenti Climatici
ERA4CS European Research Area for Climate Services
MEDSCOPE MEDiterranean Services Chain based On climate PrEdictions