

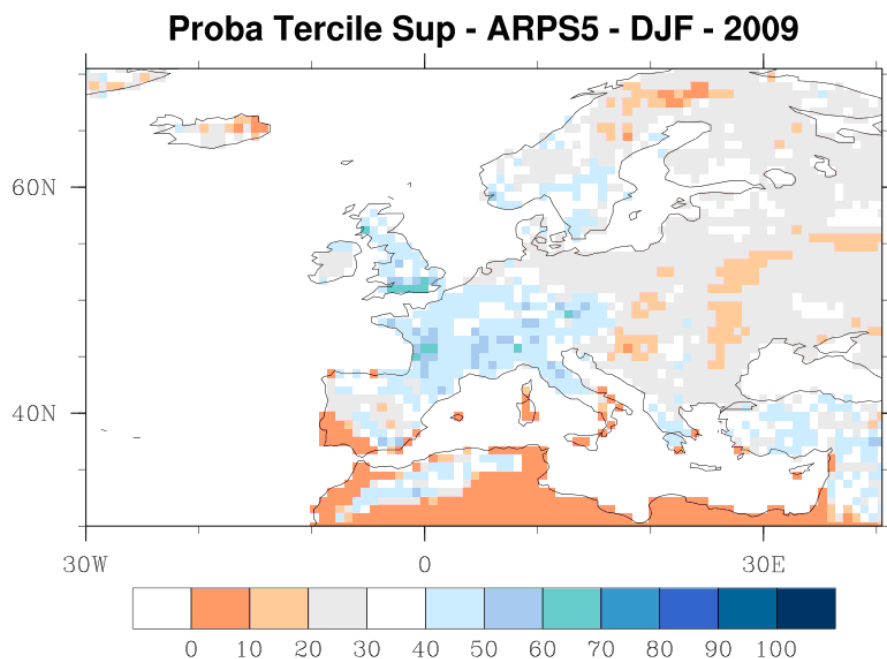
# Cold Spell Probability

**Definition** : Due to the chaotic nature of the atmosphere, the chronology of cold spells in the upcoming season is not expected to be correctly predicted. This product is rather based on seasonal number of cold spell days. The focus is on the December-January-February (DJF) season. For a forecasted year, maps show the probability of cold spell occurrence over Europe, in regards to the 1991-2014 hindcast period.

**Product description** : The product is available in terms of maps which represent, for a particular forecast year and each grid point, the percentage of runs above the 67<sup>th</sup> percentile for the mean number of cold spell days (based on the 15 runs ensemble of the 1991-2014 hindcast).

Red grid points correspond to areas with a low probability of cold spell occurrence compared with the hindcast 1991-2014 (under 30%).

Blue grid points correspond to areas with a high probability of cold spell occurrence (more than 40%).



**Figure 26** : Example of seasonal cold spell days probability for the 2009/2010 winter with MF Syst 5 (initialisation month : November, lead time 1 to 3)

## Specification :

- ❑ **Geographic region:** NW Corner 70.5N/30W ; SE Corner 30N/40.5E
- ❑ **Temporal resolution:** Quarterly
- ❑ **Availability:** Each month
- ❑ **Format:** PNG graphs
- ❑ **Units:** Probability (%)

## Data origin

- ❑ Seasonal Forecast Model MF Syst 5
- ❑ Forecast mode with 51 runs
- ❑ Climatology : Hindcast mode with 15 runs over the period 1991-2014.
- ❑ Daily mean surface temperature (T2M) from the ERA-Interim reanalysis is used for the model temperature correction.

## Methodology :

- Correction of the model data: Before proceeding to the cold spell diagnostic, daily mean surface temperature must be corrected using a quantile-mapping methodology, from the ERA-Interim daily T2M distribution.

- Diagnostic of cold spell occurrence: For each grid point and each day, a cold spell is detected if the corrected T2M is under the daily 10<sup>th</sup> percentile and a fixed 3°C threshold, during at least 3 consecutive days. The 3°C threshold has been added in order not to detect cold spell in regions where the 10<sup>th</sup> percentile is particularly high. See below mean number of cold spell days for ERA-Interim data using the combination of Q10+3°C thresholds (See Figure 27).

The number of cold spell days per season is computed, for each grid point, for the 15 runs over the period 1991-2014. Based on these cold spell days, 67<sup>th</sup> (higher tercile) percentiles are then calculated.

- For a seasonal forecast, the probability of cold spell occurrence corresponds to the percentage of runs which the number of cold spell days is higher than the 67<sup>th</sup> percentile.

**Performance** : The performance of the product is estimated by using the ROC score , calculated for each grid point (for higher tercile categorie). See below example for the Europe area (See Figure 28).

For perfect forecasts, all ensemble members will correctly predict the event in all years and the ROC points will be normalised to 1.0, the maximum possible value. Forecasts with little or no skill will obtain a normalised ROC score of approximately 0.5, climatological value.

In a general way, the skills are better in Western Europe (blue colour) than Eastern Europe (red colour).

**Recommended use** : The interest of this product is to focus on extreme event, much more relevant than mean temperature for number of activities.

The using of these products have to take into account the level of predictability, quite poor and variable according to the regions.

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