Multi-model subseasonal forecasts of spring cold spells: potential value for the hazelnut agribusiness

P. Ruggieri(1), S. Materia(1), Á.G. Muñoz(2), M.C. Alvarez-Castro(1), S. Mason(2), F. Vitar(3) and S. Guidi(1,4)

(1) Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC), Bologna, Italy
(2) International Research Institute For Climate and Society (IRI), Columbia University.
(3) European Centre for Medium-Range Weather Forecast (ECMWF), Reading, UK.
(4) Istituto Nazionale Geofisico e Vulcanologia (INGV), Bologna, Italy

Producing sub-seasonal forecasts with two-to-six weeks target, is crucial for agribusiness, to allow mitigation strategies to be adopted for counteracting weather hazards. For example, spring frosts may result in dramatic losses at the harvest time. Here we present a multi-model ensemble that includes four climate prediction systems included in the Subseasonal-to-Seasonal (S2S) Prediction project, in an effort to test the quality of spring cold spell forecasts in the Turkish region Facing the Black Sea, which is global leader in the production of hazelusts. In a warming world where climate variability is projected to increase, forecast may be seen as an adaptation tool, useful to mitigate extreme event damages and to plan more profitable crop strategies of less environmental impact.

- Multiple forecast initializations (Mar 01, Mar 15, Apr 01) concatenated to increase sample size when assessing skill.
- Forecast skill decreases with time, but it remains much above 0.5 in a few areas at week 5.
- Regions of high and low skill are rather consistent throughout models.
- The Multi-System forecast quality is close to that of ECMWF and UKMO models at week 2, and the system is by far more skillful than each of the single models at week 5.

### Areas of hazelnut farming

- **Black Sea**
- **Turkey**
- **Mediterranean**

### Cost-Loss model

If CSPI occurs, a potential decision maker may lose part of the harvest (loss C). However, he may decide to take action against the cold spell: in this case, he will incur a cost C to take action, but he will avoid L. Having no info, the decision maker will guess about forthcoming cold spell. The forecast is meant to do better than a simple guess. The forecast value shows that there is, for some users more than 50% gain by using information from the forecast on lead weeks 1-2, and more than 10% even at weeks 3-4 and 5-6.

### Contingency tables

<table>
<thead>
<tr>
<th>Northern Coast of Turkey (all start dates)</th>
<th>ERAS YES</th>
<th>ERAS NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model YES</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>Model NO</td>
<td>7</td>
<td>87</td>
</tr>
<tr>
<td>Weeks 1-2</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>Model YES</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>Model NO</td>
<td>8</td>
<td>22</td>
</tr>
</tbody>
</table>

### References:


### CSPI detection

The contingency tables show that the MSys has a relatively good skill. The forecast is different depending on the outcome.

**RESOLUTION**: The outcome differs depending on the forecast.

**MAIN CONCLUSION**: Using a multi-system approach, low skill for 2- meter temperatures does not prevent the forecast from being potentially valuable to decision makers, if a different but related index (Cold Spell Power Index) is used instead.