S2S4E
Climate Services for Clean Energy

CASE STUDY #7

COLD SPELL IN EUROPE

"Beast of the East"

Winter 2018

BASIC FACTS

- **Area:** Europe
- **Season:** winter
- **Year:** 2018
- **Forecast range:** sub-seasonal
- **Main interest:** electricity demand
- **Forecast variables:** temperature and electricity demand

This factsheet is based on S2S4E deliverable 4.1. To access the full report, please visit s2s4e.eu.

WHAT happened

An unanticipated cold spell resulted in below average weekly temperatures and triggered an increase in power demand for heating.

WHERE it affected

The cold spell affected mostly eastern and central Europe.

WHEN it occurred

This case study analyses the extreme cold temperatures that occurred from February 27th to March 5th, 2018.

Analysis of the event

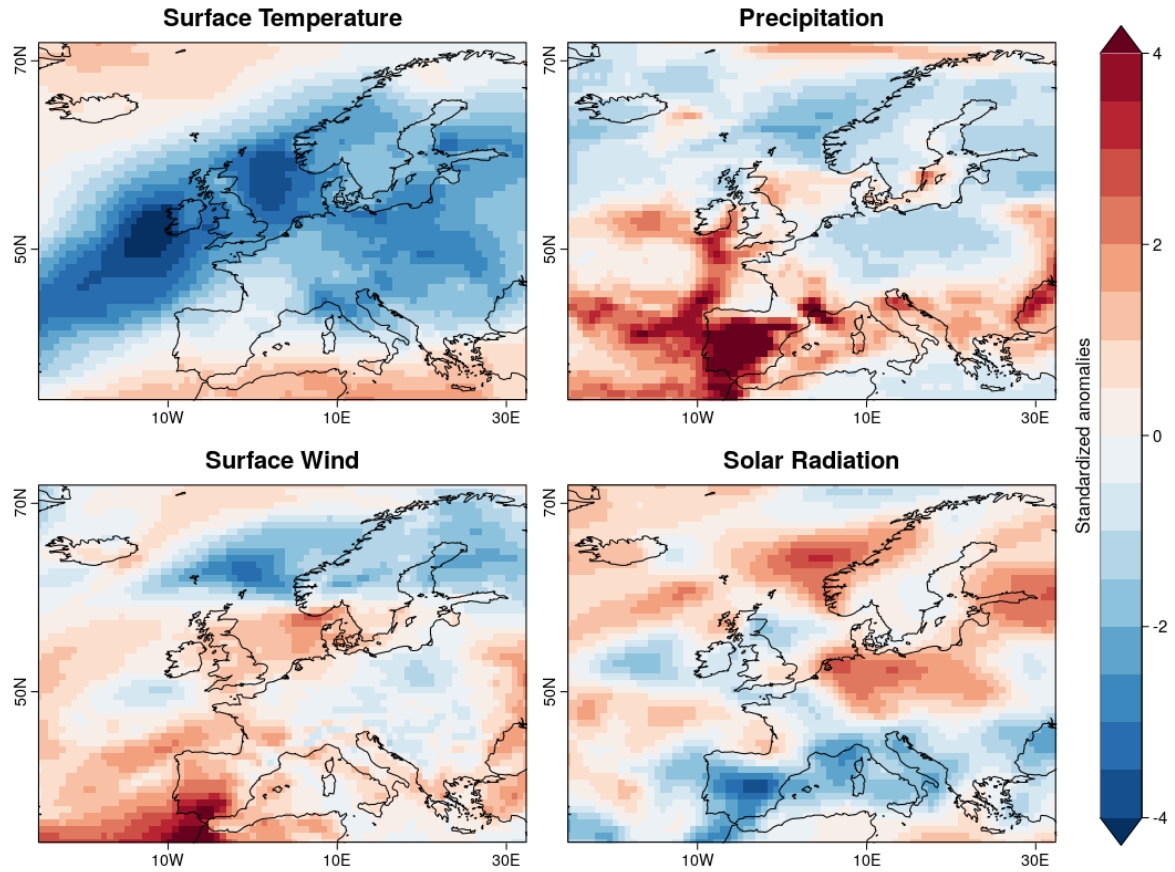

Figure 1. Standardized anomalies of temperature, precipitation, surface wind and solar radiation for the first quarter of 2018. ERA-Interim reanalysis.

From the last week of February to March 1st 2018, a strong cold spell, named "the beast from the east" by the media, led to extremely low temperatures across north, central and eastern Europe (Figure 1), and consequently increased energy consumption for heating. The increase in energy consumption in the study area was relevant for energy trading and Distribution System Operators (DSO) in eastern and central Europe countries (but not for South Western Europe which was not affected by the cold spell episode).

Weekly temperatures fell well below the climatological values, reaching extreme values (below the 10% percentile) during the last week of February and the first of March (Figure 2). During these weeks, observed daily temperature differed from climatological mean by about 8°C.

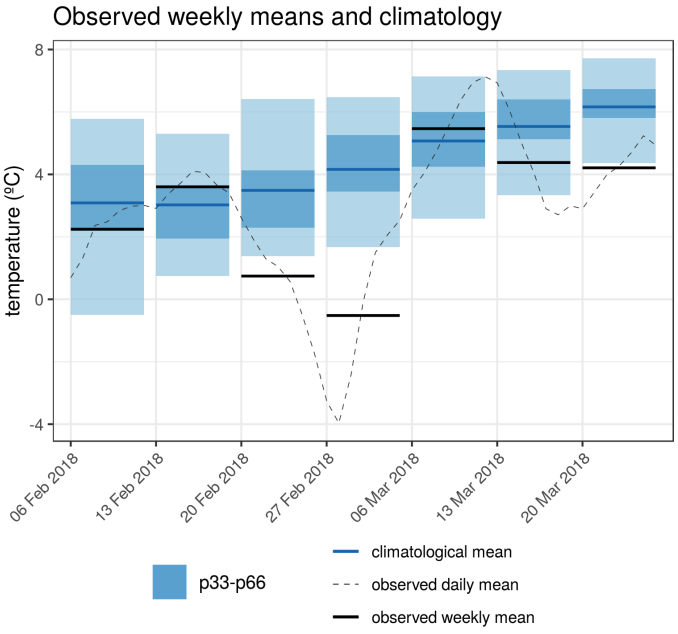

Figure 2. Observed temperature means for February though March 2018. ERA-Interim reanalysis.

Available forecasts

S2S4E sub-seasonal forecasts of temperature and electricity demand were produced for Europe and France respectively using ECMWF Monthly Prediction System. As seen in Table 1, the forecasts issued for temperature demonstrated to have high potential value, due to their high positive skill values, increasing with shorter lead times (0.18, 0.12, 0.31, 0.64).

Temperature forecasts issued one, two, three and four weeks in advance are presented in Figure 3. The temperature forecasts predicted the correct below normal tercile of the cold event. For the four forecasts issued, the probability of below normal temperatures increased as the lead time decreased. As such, one week before the event, the forecast indicated 100% probability of below normal conditions.

Shown in Figure 4, sub-seasonal forecasts of electricity demand were produced for France, a critical country for electricity demand during cold spells, due to the fact that a large proportion of domestic heating appliances is powered by electricity. Similarly to the temperature forecasts, the electricity demand forecast also predicted the above normal tercile for the increase in electricity demand, with 100% probability one week before the event.

Table 1. Probability skill scores for the temperature forecasts for February 27th to March 5th, 2018.

Skill (Temperature)	Forecast lead time			
	Days 26-32	Days 19-25	Days 12-18	Days 5-11
RPSS	0.18	0.12	0.31	0.64
BSS P10	0.09	0.06	0.19	0.42
BSS P90	0.15	0.02	0.09	0.35

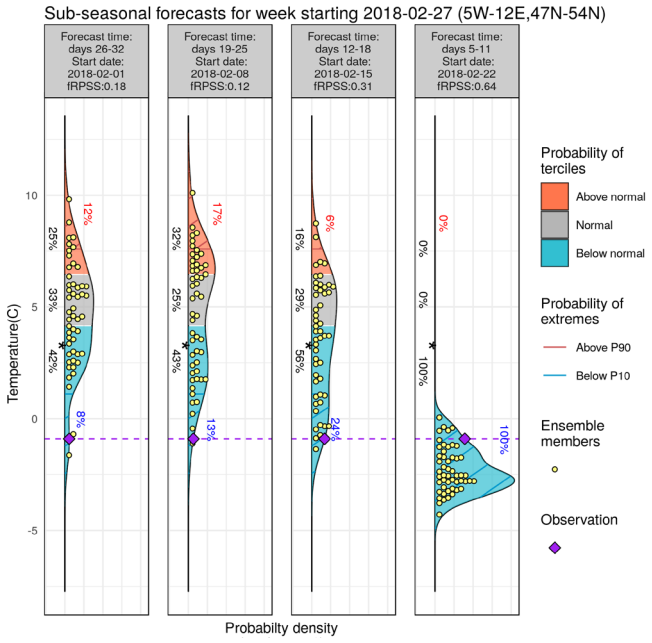

Figure 3. Sub-seasonal temperature forecasts for February 27th to March 5th, 2018. Issued four, three, two and one week in advance for domain (5W - 12E, 47N - 54N).

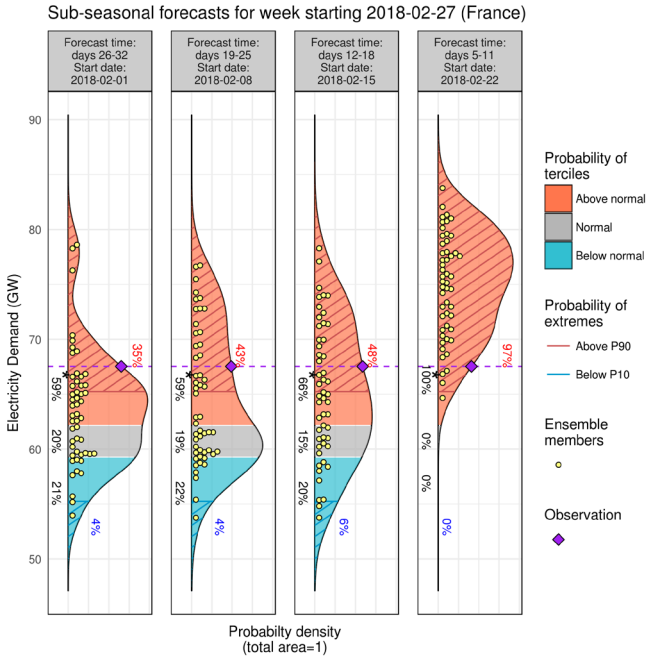

Figure 4. Sub-seasonal electricity demand forecasts for February 27th to March 5th, 2018. Issued four, three, two and one week in advance for France.

Conclusions

The fairRPSS values computed for the whole hindcast demonstrate that S2S4E sub-seasonal forecasts have skill for this time period and region to anticipate episodes of low temperature, especially two to one weeks in advance. This high skill highlights how sub-seasonal forecasts could be beneficial over the current practice of using climatological forecasts for decision-making with energy trading companies and within Distribution System Operators.

For this 2018 cold spell case study, the forecasts did correctly predict temperature in the below normal tercile and energy demand in the above normal tercile. For both forecasts, the probability of the correct tercile was very close to 100% one week before the event.

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