Area Forecast Discussion: North Atlantic and Western Europe Date: Tuesday 29 January 2019
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1. **Big Picture Perspective:**

   In early January the stratospheric polar vortex entered a sudden stratospheric warming (SSW) event. This event was categorized by a rapid increase in the polar vortex temperatures followed by increased heights and a reversal of strong westerly winds to weak easterlies at 10-hPa. The observed easterly winds dropped below two standard deviations from the climatology. In attempt to restore balance in the atmosphere from the rapid warming the polar jet weakens and the wave pattern deepens, creating extreme trough and ridges. This pattern can be described by the negative phase of the arctic oscillation (AO) which can be triggered by SSW's. An AO signal is expected to remain negative throughout mid-February as indicated by the Global Forecast System (GFS) ensemble members. An unusual deepening mid-level trough fed by extreme cold air advection is expected to persist through day 6 across Europe and Northern Africa. A narrow ridge is building over Iceland while the trough feature over Europe becomes negatively tilted and cut offs by day 8. Storms track southeast from Greenland into Western and Central Europe early in the forecast period followed by northeast propagation by day 7 resulting from tight curvature between the narrow ridging and shortwave trough near 30W.

2. **Extended Range: Days 7–10**

   The cutoff low in the middle of the trough over Greenland will propagate towards Iceland in this period, pulling precipitable water from the central Atlantic northward with it. The onshore flow and vorticity advection associated with the cyclone will cause overrunning precip over Iceland towards the end of the period, which will be frozen or liquid depending on the elevation. A shortwave ridge just west of the coast throughout the period will cause persistent west-northwesterly flow in Spain, bringing moisture onshore and causing possible precipitation in areas of orographic lift. Barcelona will stay dry and close to climatological \temperatures in this period.

3. **Medium Range: Days 4–6**

A narrow ridge dominates Greenland and the Central Atlantic, dissipating as it propagates eastward while a trough digs into Europe. Heights rapidly drop over W. Europe at 500-hPa level (anomalies of 3 to 4 sigma) thanks to strong CAA caused by predominantly northerly flow as well as CVA just south of Barcelona, Spain. The plunging trough drives in frigid polar air towards the Mediterranean and Northern Africa. As a result 850-hPa temperature anomalies are 2 standard deviation below normal over these regions leading to a period of cooler temperatures. However, northerly flow has the possibility to keep temperatures closer to climatology because of downsloping over the Pyrenees Mountain range. Southeastern Europe remains relatively dry with storms moving northeast following the jet stream pattern. During this time on day 5, a ridge is building upstream from Iceland which can be attributed to substantial WAA and latent heat release associated with the approaching cyclone. By the end of the period the rapidly intensifying cyclone tracks over the Northern Atlantic causing a negatively inverted trough to kill the narrowing ridge.

4. **Short Range: Days 0–3**

The short wave trough currently located over the western European coast will continue to dig as it moves into central Europe, causing northwesterly flow into Barcelona in the first half of the period. The jetstream will stay just south of Iceland, keeping the upper level winds coming from the Northwest while the lower level winds shift to easterly due to an anticyclone over Greenland. Cold air advection southwest of the U.K. will cause heightfalls south of a shortwave ridge to the southeast of Iceland, weakening the upper-level winds into western Europe as the cyclone approaches the U.K.. Barcelona starts the period dry and slightly colder than normal before moving into the warm sector of the cyclone propagating southeast from Greenland. The warm sector will bring high values of integrated vapor transport into southern Europe causing widespread precipitation over the Iberian Peninsula. Iceland will stay anonymously cold throughout the period and will stay dry.

Probabilistic Forecasts

Reykjavik, Iceland:

Day 0-3:

Temperature

Max: 2ºC (10th), 0ºC (50th), -5ºC (90th)

Min: -2ºC (10th), -6ºC (50th), -10ºC (90th)

Precipitation

0.0 mm (10th), 0.1 mm (50th), 0.2 mm (90th)

Day 4-6:
Temperature
Max: 2ºC (10th), -1ºC (50th), -3ºC (90th)
Min: -1ºC (10th), -3ºC (50th), -4ºC (90th)
Precipitation
0.0 mm (10th), 0.2 mm (50th), 0.3 mm (90th)

Day 7-10:
Temperature
Max: 2ºC (10th), -1ºC (50th), -2ºC (90th)
Min: 1ºC (10th), -1ºC (50th), -2ºC (90th)
Precipitation
0.0 mm (10th), 0.1 mm (50th), 0.2 mm (90th)

Barcelona, Spain:
Day 0-3:
Temperature
Max: 10ºC (10th), 13ºC (50th), 15ºC (90th)
Min: 1ºC (10th), 4ºC (50th), 5ºC (90th)
Precipitation
0.0 mm (10th), 0.05 mm (50th), 0.1 mm (90th)

Day 4-6:
Temperature
Max: 10ºC (10th), 13ºC (50th), 14ºC (90th)
Min: 1ºC (10th), 4ºC (50th), 6ºC (90th)
Precipitation
0.0 mm (10th), 0.2 mm (50th), 0.3 mm (90th)

Day 7-10:
Temperature
Max: 10ºC (10th), 14ºC (50th), 16ºC (90th)
Min: 0ºC (10th), 5ºC (50th), 7ºC (90th)
Precipitation
0.0 mm (10th), 0.05 mm (50th), 0.1 mm (90th)