S13. RECORD ANNUAL-MEAN WARMTH OVER EUROPE, THE NORTHEAST PACIFIC, AND THE NORTHWEST ATLANTIC DURING 2014: ASSESSMENT OF ANTHROPOGENIC INFLUENCE

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Estimating contributions to 2014 anomalies. The contributions to the 2014 anomalies (relative to 1881–1920 baseline) are estimated from ensemble means of the CMIP5-All and CMIP5-Nat runs. For CMIP5-All, the model historical runs were extended as necessary to 2014 using the RCP4.5 future forcing scenario. For the CMIP5-Nat runs, this procedure is not feasible, so we instead provided a range of estimates of the 2014 Natural-forcing-only response based on inspection of the CMIP5-Nat multimodel ensemble mean time series. That series suggests that a reasonable set of sensitivity runs for 2014 Natural-forcing-only contribution would include zero anomaly (low), use the last available anomaly from 2012 (mid) or use the highest ensemble mean value found in any year since the start of the CMIP5-Nat runs (Figs. 13.1c–e in main text). Note that for the WAtl region the CMIP5-Nat ensemble mean has the maximum temperature anomaly in 2012 so that this region has only two values (two blue circles) for the sensitivity test of the 2014 estimated temperature anomaly. It is noted that the natural forcing agents in question include volcanic and solar forcing. We make no attempt in this report to reconcile our 2014 natural forcing contribution sensitivity tests with any observed forcing estimates for solar and/or volcanic forcing.

We also estimate (Fig. 13.2e in main text) the contribution of each factor (internal variability, natural forcing, and anthropogenic forcing) to record warmth during 2014. For the internal variability contribution, we randomly sample a 10-year segment centered on 2014 (2010–19) from 25 climate models (CMIP5-All runs, ensemble means with RCP4.5 extensions). We repeat this 5000 times with replacement, and then compute the mean and standard deviation (standard error) of these distributions. For the contribution of natural forcing, we applied the same method as for the internal variability contribution except for using 10 climate models of CMIP5-Nat runs for the random sampling and using the 5-year averages ending in 2012 to estimate the response of the climate models to natural forcing. For the contribution of anthropogenic forcing, we randomly sample (5000 times) the 10-year All-Forcing segments minus the 5-year Natural-Forcing segments centered in 2014 and in 2010, respectively (from the 10 CMIP5 models having both All-Forcing and Natural-Forcing runs. In all cases, we compute the means and standard errors of the various estimates from the 5000-member samples.

Estimating uncertainties in the FAR estimates across the individual models. Our base-case FAR estimates are computed from the ensemble means of 25 CMIP5-All and 10 CMIP5-Nat climate model forcing runs. Due to model differences, however, there are still uncertainties in the FAR estimates. To explore these uncertainties, we re-compute the FAR estimates for each of the 10 individual CMIP5 models using paired CMIP5-All and –Nat runs for each model. These individual model estimates are shown in Fig. 13.2d of main text (black dots).