Supplementary Codes to

Geographically weighted temporally correlated logistic regression model

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Please first run the following basic code

```
prob[x_, beta_] := Exp[x.beta] / (1 + Exp[x.beta]);

(*rou[t1_,t2_,d_]:=Exp[-Abs[t1-t2]*Exp[d]];*)
rou[t1_, t2_, d_] := d^(Abs[t1 - t2]);

TNear[t_, tao_, DATA_] := Pick[DATA, Table[Abs[DATA[[i]][[5]] - t] ≤ tao, {i, 1, Length[DATA]}]];


GeoW[x_, y_, band_] := N[Exp[-((QuantityMagnitude[GeoDistance[x, y[[3 ;; 4]]]])^2) / (band^2)]];
(*GeoW[x_,y_,band_]:=N[If[EuclideanDistance[x,y[[3;;4]]]<band,(1-SquaredEuclideanDistance[x[[3;;4]],y[[3;;4]]]/(band^2))^2,0]];*)


Ker[x_] := (1 / Sqrt[2 * Pi]) * Exp[-(x^2) / 2];


op11[x_, beta_] := CDF[BinormalDistribution[0],
        {Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]], Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]]}];
op10[x_, beta_] := CDF[BinormalDistribution[0], {Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]],
            -Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]]}];
op00[x_, beta_] := CDF[BinormalDistribution[0], {-Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]],
            -Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]]}];

p11[x_, y_, beta_, d_] := CDF[BinormalDistribution[rou[x[[5]], y[[5]], d]],
        {Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]], Quantile[NormalDistribution[0, 1], prob[y[[6 ;; Length[x]]], beta]]}];
p10[x_, y_, beta_, d_] := CDF[NormalDistribution[0, 1], Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]]] - p11[x, y, beta, d];
p01[x_, y_, beta_, d_] := CDF[NormalDistribution[0, 1], Quantile[NormalDistribution[0, 1], prob[y[[6 ;; Length[x]]], beta]]] - p11[x, y, beta, d];
p00[x_, y_, beta_, d_] := 1 - p11[x, y, beta, d] - p10[x, y, beta, d] - p01[x, y, beta, d];



odp11[x_, beta_] := CDF[NormalDistribution[0, 1], Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]]] *
            (Exp[x[[6 ;; Length[x]]].beta] / (1 + Exp[x[[6 ;; Length[x]]].beta])^2) * x[[6 ;; Length[x]]] +
        CDF[NormalDistribution[0, 1], Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]]] *
            (Exp[x[[6 ;; Length[x]]].beta] / (1 + Exp[x[[6 ;; Length[x]]].beta])^2) * x[[6 ;; Length[x]]];
odp10[x_, beta_] := CDF[NormalDistribution[0, 1], -Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]]] *
            (Exp[x[[6 ;; Length[x]]].beta] / (1 + Exp[x[[6 ;; Length[x]]].beta])^2) * x[[6 ;; Length[x]]] -
        CDF[NormalDistribution[0, 1], Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]]] *
            (Exp[x[[6 ;; Length[x]]].beta] / (1 + Exp[x[[6 ;; Length[x]]].beta])^2) * x[[6 ;; Length[x]]];
odp00[x_, beta_] := -CDF[NormalDistribution[0, 1], -Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]]] *
            (Exp[x[[6 ;; Length[x]]].beta] / (1 + Exp[x[[6 ;; Length[x]]].beta])^2) * x[[6 ;; Length[x]]] -
        CDF[NormalDistribution[0, 1], -Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]]] *
            (Exp[x[[6 ;; Length[x]]].beta] / (1 + Exp[x[[6 ;; Length[x]]].beta])^2) * x[[6 ;; Length[x]]];
```

```
dp11[x_, y_, beta_, d_] :=
    CDF[NormalDistribution[0, 1], (Quantile[NormalDistribution[0, 1], prob[y[[6 ;; Length[x]]], beta]] - Quantile[NormalDistribution[0, 1],
                prob[x[[6 ;; Length[x]]], beta]] * rou[x[[5]], y[[5]], d]) / (Sqrt[1 - (rou[x[[5]], y[[5]], d])^2)] *
          (Exp[x[[6 ;; Length[x]]].beta] / (1 + Exp[x[[6 ;; Length[x]]].beta])^2) * x[[6 ;; Length[x]]] +
      CDF[NormalDistribution[0, 1], (Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]] -
                Quantile[NormalDistribution[0, 1], prob[y[[6 ;; Length[x]]], beta]] * rou[x[[5]], y[[5]], d]) /
            (Sqrt[1 - (rou[x[[5]], y[[5]], d])^2)] * (Exp[y[[6 ;; Length[x]]].beta] / (1 + Exp[y[[6 ;; Length[x]]].beta])^2) * y[[6 ;; Length[x]]];
dp10[x_, y_, beta_, d_] := CDF[NormalDistribution[0, 1], (-Quantile[NormalDistribution[0, 1], prob[y[[6 ;; Length[x]]], beta]] +
                Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]] * rou[x[[5]], y[[5]], d]) /
            (Sqrt[1 - (rou[x[[5]], y[[5]], d])^2)] * (Exp[x[[6 ;; Length[x]]].beta] / (1 + Exp[x[[6 ;; Length[x]]].beta])^2) * x[[6 ;; Length[x]]] -
      CDF[NormalDistribution[0, 1], (Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]] -
                Quantile[NormalDistribution[0, 1], prob[y[[6 ;; Length[x]]], beta]] * rou[x[[5]], y[[5]], d]) /
            (Sqrt[1 - (rou[x[[5]], y[[5]], d])^2)] * (Exp[y[[6 ;; Length[x]]].beta] / (1 + Exp[y[[6 ;; Length[x]]].beta])^2) * y[[6 ;; Length[x]]];
dp01[x_, y_, beta_, d_] := -CDF[NormalDistribution[0, 1], (Quantile[NormalDistribution[0, 1], prob[y[[6 ;; Length[x]]], beta]] -
                Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]] * rou[x[[5]], y[[5]], d]) /
            (Sqrt[1 - (rou[x[[5]], y[[5]], d])^2)] * (Exp[x[[6 ;; Length[x]]].beta] / (1 + Exp[x[[6 ;; Length[x]]].beta])^2) * x[[6 ;; Length[x]]] +
      CDF[NormalDistribution[0, 1], (-Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]] +
                Quantile[NormalDistribution[0, 1], prob[y[[6 ;; Length[x]]], beta]] * rou[x[[5]], y[[5]], d]) /
            (Sqrt[1 - (rou[x[[5]], y[[5]], d])^2)] * (Exp[y[[6 ;; Length[x]]].beta] / (1 + Exp[y[[6 ;; Length[x]]].beta])^2) * y[[6 ;; Length[x]]];
dp00[x_, y_, beta_, d_] := -CDF[NormalDistribution[0, 1], (-Quantile[NormalDistribution[0, 1], prob[y[[6 ;; Length[x]]], beta]] +
                Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]] * rou[x[[5]], y[[5]], d]) /
            (Sqrt[1 - (rou[x[[5]], y[[5]], d])^2)] * (Exp[x[[6 ;; Length[x]]].beta] / (1 + Exp[x[[6 ;; Length[x]]].beta])^2) * x[[6 ;; Length[x]]] -
      CDF[NormalDistribution[0, 1], (-Quantile[NormalDistribution[0, 1], prob[x[[6 ;; Length[x]]], beta]] +
                Quantile[NormalDistribution[0, 1], prob[y[[6 ;; Length[x]]], beta]] * rou[x[[5]], y[[5]], d]) /
            (Sqrt[1 - (rou[x[[5]], y[[5]], d])^2)] * (Exp[y[[6 ;; Length[x]]].beta] / (1 + Exp[y[[6 ;; Length[x]]].beta])^2) * y[[6 ;; Length[x]]];
```

```
I1[x_, beta_] := Binomial[x[[1]], 2] * (1 / op11[x, beta]) * odp11[x, beta] +
      x[[1]] * (x[[2]] - x[[1]]) * (1 / op10[x, beta]) * odp10[x, beta] + Binomial[x[[2]] - x[[1]], 2] * (1 / op00[x, beta]) * odp00[x, beta];
```

```
O1[x_, y_, beta_, d_] := x[[1]] * y[[1]] * (1 / p11[x, y, beta, d]) * dp11[x, y, beta, d] +
      x[[1]] * (y[[2]] - y[[1]]) * (1 / p10[x, y, beta, d]) * dp10[x, y, beta, d] + y[[1]] * (x[[2]] - x[[1]]) * (1 / p01[x, y, beta, d]) * dp01[x, y, beta, d] +
      (x[[2]] - x[[1]]) * (y[[2]] - y[[1]]) * (1 / p00[x, y, beta, d]) * dp00[x, y, beta, d];
```

```
Od2p[x_, y_, beta_, d_] := -x[[2]] * y[[2]] * ((Outer[Times, dp11[x, y, beta, d], dp11[x, y, beta, d]] * (1 / p11[x, y, beta, d])) +
        (Outer[Times, dp10[x, y, beta, d], dp10[x, y, beta, d]] * (1 / p10[x, y, beta, d])) +
        (Outer[Times, dp01[x, y, beta, d], dp01[x, y, beta, d]] * (1 / p01[x, y, beta, d])) +
        (Outer[Times, dp00[x, y, beta, d], dp00[x, y, beta, d]] * (1 / p00[x, y, beta, d])));
```

```
Id2p[x_, beta_] := -Binomial[x[[2]], 2] *
      (Outer[Times, odp11[x, beta], odp11[x, beta]] * (1 / op11[x, beta]) + 2 * Outer[Times, odp10[x, beta], odp10[x, beta]] * (1 / op10[x, beta]) +
        Outer[Times, odp00[x, beta], odp00[x, beta]] * (1 / op00[x, beta]));
```

```
GTDE1[beta_, d_, DATA_] := (DR = 0;
    Do[DR += I1[DATA[[i]], beta], {i, 1, Length[DATA]}];
    Do[DR += O1[DATA[[i]], DATA[[j]], beta, d], {i, 1, Length[DATA] - 1}, {j, i + 1, Length[DATA]}]; DR);

DE1[a_, b_, band_, beta_, d_, DATA_] := (D1R = 0;
    D1Set = Split[DATA, #1[[3 ;; 4]] == #2[[3 ;; 4]] &];
    Do[
      D1R += GeoW[{a, b}, D1Set[[i]][[1]], band] * (1 / (Total[D1Set[[i]][[All, 2]]] - 1)) * GTDE1[beta, d, D1Set[[i]]], {i, 1, Length[D1Set]}];
    D1R);


GTDE2[beta_, d_, DATA_] := (FSI = 0;
    Do[FSI += Id2p[DATA[[i]], beta], {i, 1, Length[DATA]}];
    Do[FSI += Od2p[DATA[[i]], DATA[[j]], beta, d], {i, 1, Length[DATA] - 1}, {j, i + 1, Length[DATA]}]; FSI);

DE2[a_, b_, band_, beta_, d_, DATA_] := (D2R = 0;
    D1Set = Split[DATA, #1[[3 ;; 4]] == #2[[3 ;; 4]] &];
    Do[
      D2R += GeoW[{a, b}, D1Set[[i]][[1]], band] * (1 / (Total[D1Set[[i]][[All, 2]]] - 1)) * GTDE2[beta, d, D1Set[[i]]], {i, 1, Length[D1Set]}];
    D2R);


InLik[x_, beta_] :=
  Binomial[x[[1]], 2] * Log[op11[x, beta]] + x[[1]] * (x[[2]] - x[[1]]) * Log[op10[x, beta]] + Binomial[x[[2]] - x[[1]], 2] * Log[op00[x, beta]];
OutLik[x_, y_, beta_, d_] := x[[1]] * y[[1]] * Log[p11[x, y, beta, d]] + x[[1]] * (y[[2]] - y[[1]]) * Log[p10[x, y, beta, d]] +
    y[[1]] * (x[[2]] - x[[1]]) * Log[p01[x, y, beta, d]] + (x[[2]] - x[[1]]) * (y[[2]] - y[[1]]) * Log[p00[x, y, beta, d]];
GTLik[beta_, d_, DATA_] := (1 / (Total[DATA[[All, 2]]] - 1)) * (L = 0;
      Do[L += InLik[DATA[[i]], beta], {i, 1, Length[DATA]}];
      Do[L += OutLik[DATA[[i]], DATA[[j]], beta, d], {i, 1, Length[DATA] - 1}, {j, i + 1, Length[DATA]}]; L);
Lik[a_, b_, band_, beta_, d_, DATA_] := (Lik1 = 0;
    D1Set = Split[DATA, #1[[3 ;; 4]] == #2[[3 ;; 4]] &];
    Do[Lik1 += GeoW[{a, b}, D1Set[[i]][[1]], band] * GTLik[beta, d, D1Set[[i]]], {i, 1, Length[D1Set]}]; Lik1);


FinCom[a_, d_, u_, v_, band_, DATA_] := (beta = a;
  Do[beta = N[beta - Inverse[N[DE2[u, v, band, beta, d, DATA]]].N[DE1[u, v, band, beta, d, DATA]]];
    Print[beta];
    Print[N[Lik[u, v, band, beta, d, DATA]]], {i, 7}])
BetaFinCom[a_, d_, u_, v_, band_, DATA_] := (beta = a;
  Do[beta = N[beta - Inverse[N[DE2[u, v, band, beta, d, DATA]]].N[DE1[u, v, band, beta, d, DATA]]], {i, 7}]; beta)
```

```
LikFinCom[d_, u_, v_, band_, DATA_] := (beta = Table[0, {n, Length[DATA[[1]]] - 5}];
    Do[beta = N[beta - Inverse[N[DE2[u, v, band, beta, d, DATA]]].N[DE1[u, v, band, beta, d, DATA]]], {i, 7}];
    N[Lik[u, v, band, beta, d, DATA]])


PlotLik[a_, b_, n_, u_, v_, band_, DATA_] := (A = Table[0, {i, a, b, n}];
    Do[A[[Round[((i - a) / n) + 1]]] = LikFinCom[i, u, v, band, DATA], {i, a, b, n}];
    ListLinePlot[Transpose[Join[{Table[i, {i, a, b, n}]}, {A}]], AxesLabel → {Autocorrelation Parameter, Log - Likelihood}, ImageSize → Large])


ResAP[a_, b_, n_, u_, v_, band_, DATA_] := (ArP = Table[0, {i, a, b, n}];
      Pamd = Table[0, {i, a, b, n}];
      Do[ArP[[Round[((i - a) / n) + 1]]] = LikFinCom[i, u, v, band, DATA], {i, a, b, n}];
      Do[If[ArP[[j]] == Max[ArP], Pamd[[j]] = (j - 1) * n + a, Pamd[[j]] = 0], {j, 1, Length[ArP]}];
      Total[Pamd]);


BetaM[Ini_, a_, b_, u_, v_, band_, DATA_] := Manipulate[BetaFinCom[Ini, d, u, v, band, DATA], {d, a, b}]

DEV[u_, v_, band_, beta_, d_, DATA_] := (D1V = 0;
      D1Set = Split[DATA, #1[[3 ;; 4]] == #2[[3 ;; 4]] &];
      Do[D1V += (GeoW[{u, v}, D1Set[[i]][[1]], band]^2) * Outer[Times, (1 / (Total[D1Set[[i]][[All, 2]]] - 1)) * GTDE1[beta, d, D1Set[[i]]],
            (1 / (Total[D1Set[[i]][[All, 2]]] - 1)) * GTDE1[beta, d, D1Set[[i]]]], {i, 1, Length[D1Set]}];
      D1V);
RawVar[u_, v_, band_, d_, DATA_] :=
    Inverse[N[DE2[u, v, band, BetaFinCom[Table[0, {n, Length[DATA[[1]]] - 5}], d, u, v, band, DATA], d, DATA]]].
      DEV[u, v, band, BetaFinCom[Table[0, {n, Length[DATA[[1]]] - 5}], d, u, v, band, DATA], d, DATA].
      Inverse[N[DE2[u, v, band, BetaFinCom[Table[0, {n, Length[DATA[[1]]] - 5}], d, u, v, band, DATA], d, DATA]]];


RawTe[u_, v_, band_, d_, DATA_] := (B = Table[0, {n, Length[DATA[[1]]] - 5}];
      beta = BetaFinCom[Table[0, {n, Length[DATA[[1]]] - 5}], d, u, v, band, DATA];
      betaVar = RawVar[u, v, band, d, DATA];
      Do[
        B[[i]] = N[beta[[i]]] - 1.96 * N[Sqrt[betaVar[[i]][[i]]]] < 0 < N[beta[[i]]] + 1.96 * N[Sqrt[betaVar[[i]][[i]]]], {i, 1, Length[DATA[[1]]] - 5}];
      B);


PaDEV[u_, v_, band_, betaa_, betab_, d_, DATAa_, DATAb_] := (PaD1V = 0;
      D1Set = Split[DATAa, #1[[3 ;; 4]] == #2[[3 ;; 4]] &];
      D2Set = Split[DATAb, #1[[3 ;; 4]] == #2[[3 ;; 4]] &];
      Do[If[D1Set[[i]][[1]][[3 ;; 4]] == D2Set[[j]][[1]][[3 ;; 4]],
          PaD1V += (GeoW[{u, v}, D1Set[[i]][[1]], band]^2) * Outer[Times, (1 / (Total[D1Set[[i]][[All, 2]]] - 1)) * GTDE1[betaa, d, D1Set[[i]]],
              (1 / (Total[D2Set[[j]][[All, 2]]] - 1)) * GTDE1[betab, d, D2Set[[j]]]],
          PaD1V += 0], {i, 1, Length[D1Set]}, {j, 1, Length[D2Set]}];
      PaD1V);
```

```
PaRawCv[u_, v_, band_, betaa_, betab_, d_, DATAa_, DATAb_] := Inverse[N[DE2[u, v, band, betaa, d, DATAa]]].
      PaDEV[u, v, band, betaa, betab, d, DATAa, DATAb].Inverse[N[DE2[u, v, band, betab, d, DATAb]]];


RawEs[Tim_, tao_, d_, u_, v_, band_, DATA_] := (betaa = Table[0, {j, Length[DATA[[1]]] - 5}];
      betaH = Table[betaa, {j, Length[Tim]}];
      ste = 1; Do[betaH[[ste]] = BetaFinCom[betaa, d, u, v, band, TNear[t, tao, DATA]]; ste += 1, {t, Tim}]; betaH);


RawCv[Tim_, tao_, d_, u_, v_, band_, betaS_, DATA_] := Table[PaRawCv[u, v, band, betaS[[i]],
        betaS[[j]], d, TNear[Tim[[i]], tao, DATA], TNear[Tim[[j]], tao, DATA]], {i, Length[Tim]}, {j, Length[Tim]}];



RefineEs[t_, p_, h_, Tim_, betaS_] := (DesM = Table[Table[0, {j, 0, p}], {i, Length[Tim]}];
      Do[DesM[[n]] = Table[Tim[[n]]^m, {m, 0, p}], {n, Length[Tim]}];
      Omig = DiagonalMatrix[Table[Ker[(t - l)/h], {l, Tim}]] ;
      Table[t^j, {j, 0, p}].Inverse[Transpose[DesM].Omig.DesM].Transpose[DesM].Omig.betaS);



RefineVar[t_, p_, h_, Tim_, Cv_] := (A = 0;
    DesM = Table[Table[0, {j, 0, p}], {i, Length[Tim]}];
    Do[DesM[[n]] = Table[Tim[[n]]^m, {m, 0, p}], {n, Length[Tim]}];
    Omig = DiagonalMatrix[Table[Ker[(t - l)/h], {l, Tim}]] ;
    Do[A += (Table[t^j, {j, 0, p}].Inverse[Transpose[DesM].Omig.DesM].Transpose[DesM].Omig[[i]]) * (Table[t^j, {j, 0, p}].
          Inverse[Transpose[DesM].Omig.DesM].Transpose[DesM].Omig[[j]]) * Cv[[i, j]], {i, 1, Length[Tim]}, {j, 1, Length[Tim]}];
    A)


PlotRefine[a_, b_, n_, p_, h_, Tim_, betaS_, Cv_] := Plot[{RefineEs[x, p, h, Tim, betaS][[n]] - 1.96 * Sqrt[RefineVar[x, p, h, Tim, Cv][[n, n]]],
      RefineEs[x, p, h, Tim, betaS][[n]], RefineEs[x, p, h, Tim, betaS][[n]] + 1.96 * Sqrt[RefineVar[x, p, h, Tim, Cv][[n, n]]]},
    {x, a, b}, Filling → {1 → {3}}, AxesLabel → {Time, Beta}, ImageSize → Large];
```

Now we import our data, please point to your own address

```
DA = Import["(*please specify the address here*).xlsx"][[1]];
DA = Drop[DA, 1]; (*drop the head*)
```

As specified in the paper, the temporal correlation parameter is determined by exhaustive search, this can be done by function “LikFinCom”, “LikFinCom” can give us the value of the log-likelihood given any location and the temporal correlation parameter. In the following example, we are going to calculate the log-likelihood of France with coordinates (46,2) when the temporal correlation parameter is -0.4. Note that the correlation structure adopted here is AR(1) correlation structure

```
LikFinCom[-0.4(*the pre-defined temporal correlation parameter*), 46(*latitude of France*),
  2(*longitude of France*), 1450(*geographical bandwidth*), DA(*our data set*)]
```

−124 698.

In our paper, we search the correlation parameter in -1 to 1 with a step-size of 0.01, the largest log-likelihood of France and Thailand are presented as follows

```
LikFinCom[0.17(*the parameter which gives the largest log−likelihood when searching step−size is 0.01*),
  46(*latitude of France*), 2(*longitude of France*), 1450, DA]
```

−124 036.

```
LikFinCom[0.19(*the parameter which gives the largest log−likelihood when searching step−size is 0.01*),
  15(*latitude of Thailand*), 100(*longitude of Thailand*), 1450, DA]
```

−15 316.6

As specified in the paper, the geographical bandwidth is 1450 and the temporal correlation parameter is 0.17 for France and 0.19 for Thailand. We can now compute the raw estimator and its log-likelihood value by using function "FinCom". See the following example, we will calculate the raw estimator for France in Jan-2012 (time index 25):

```
FinCom[{0, 0, 0, 0}(*specify the initial value for intercept, temperature, precipitation and RH*), 0.17
  (*temporal correlation parameter*), 46(*latitude*), 2(*longitude*), 1450(*geographical bandwidth*),
  TNear[25(*specify the time index*), 3(*specify the τ of the τ−nearest temporal set*), DA(*our data set*)]]
```

{1.74831, −0.064805, −0.00432249, −3.03936}

−33 695.

{3.67617, −0.104106, −0.00901672, −5.24608}

−32 030.1

{4.34401, −0.112787, −0.0120615, −5.94532}

−31 877.3

{4.40476, −0.113085, −0.0126516, −6.00112}

−31 874.3

{4.40551, −0.113084, −0.0126666, −6.00159}

−31 874.3

{4.40551, −0.113085, −0.0126666, −6.00159}

−31 874.3

{4.40551, −0.113085, −0.0126666, −6.00159}

−31 874.3

Now we show the example of France as what we present in the paper

We need first compute all raw estimators by using function "RawEs". Note that time index 25 relates to Jan-2012 and time index 48 relates to Dec-2013, the geographical center of France has coordinates (46,2), we skip time index 33 because of insufficient samples, the loss would be offset by smoothing the raw estimators, the result is stored in "Es"

```
Es = RawEs[{25, 26, 27, 28, 29, 30, 31, 32, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48}
    (*specify the time index set, here we would attain raw estimators from Jan−2012 to Dec−2013 except Sep−2012*),
    3(*specify the τ of the τ−nearest temporal set*), 0.17(*temporal correlation parameter*),
    46(*latitude*), 2(*longitude*), 1450(*geographical bandwidth*), DA(*our data set*)];
```

We now compute the corresponding covariance of the raw estimator by using function “RawCv”, the result is stored in “Cv”

```
Cv = RawCv[{25, 26, 27, 28, 29, 30, 31, 32, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48}(*specify the time index set,
      here we would attain the covariance of raw estimators from Jan−2012 to Dec−2013 except Sep−2012*), 3
      (*specify the τ of the τ−nearest temporal set*), 0.17(*temporal correlation parameter*), 46(*latitude*), 2
      (*longitude*), 1450(*geographical bandwidth*), Es(*the value of raw estimaors*), DA(*our data set*)];
```

We can refine the raw estimator by using function “RefineEs”, which is the GWTCLR estimator. In the following example, we are going to compute the refined estimator in Jan-2012 for France, note that we re-define the time index set (1 relates to Jan-2012 and 24 relates to Dec-2013).

```
RefineEs[1.0(*specify the time index of refined estimator, here we specify Jan−2012,
  note that you can imput any real number between 1 and 24*), 2(*order of the smoothing kernel*), 4
  (*bandwidth of the smoothing kernel*), {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}
  (*specify the time index set*), Es(*the value of raw estimaors*)]
```

```
{4.53588, −0.076548, −0.0133913, −6.51661}
```

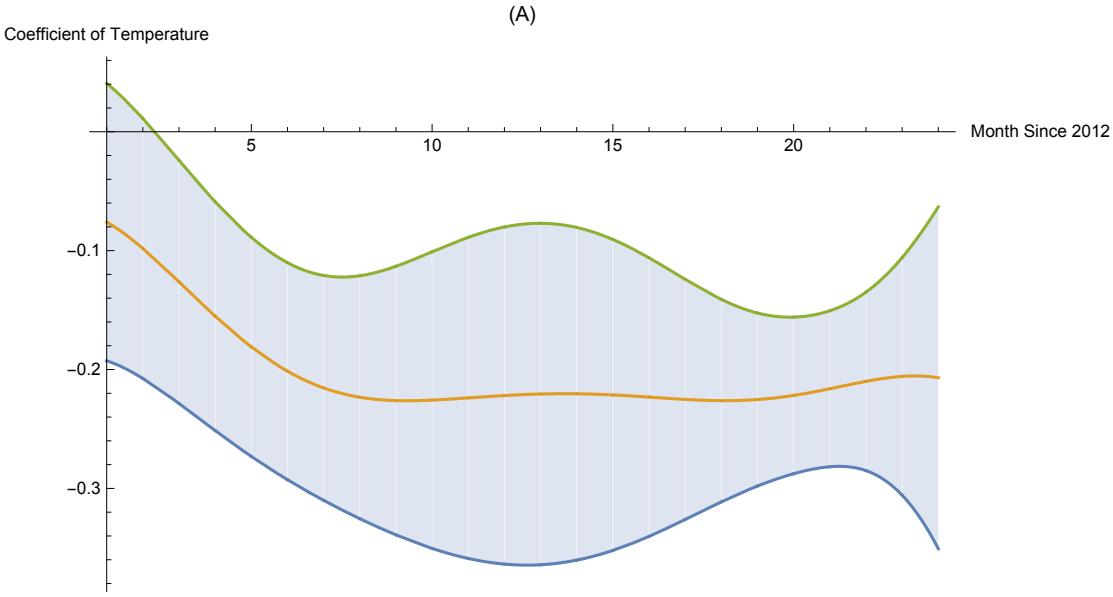
We can also refine the covariance of the raw estimator by using function "RefineVar". In the following example, we are going to compute the refined covariance in Jan-2012 for France, note that we re-define the time index set (1 relates to Jan-2012 and 24 relates to Dec-2013).

```
RefineVar[1.0(*specify the time index of refined estimator, here we specify Jan−2012,
  note that you can imput any real number between 1 and 24*), 2(*order of the smoothing kernel*), 4
  (*bandwidth of the smoothing kernel*), {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}
  (*specify the time index set*), Cv(*the value of original covariance*)]
```

$$\left\{\{10.1674, -0.187401, -0.00334813, -12.3211\}, \{-0.187401, 0.00357939, 0.0000458471, 0.226804\},\right.$$
$$\left.\left\{-0.00334813, 0.0000458471, 6.19366\times10^{-6}, 0.00412306\right\}, \{-12.3211, 0.226804, 0.00412306, 14.9486\}\right\}$$

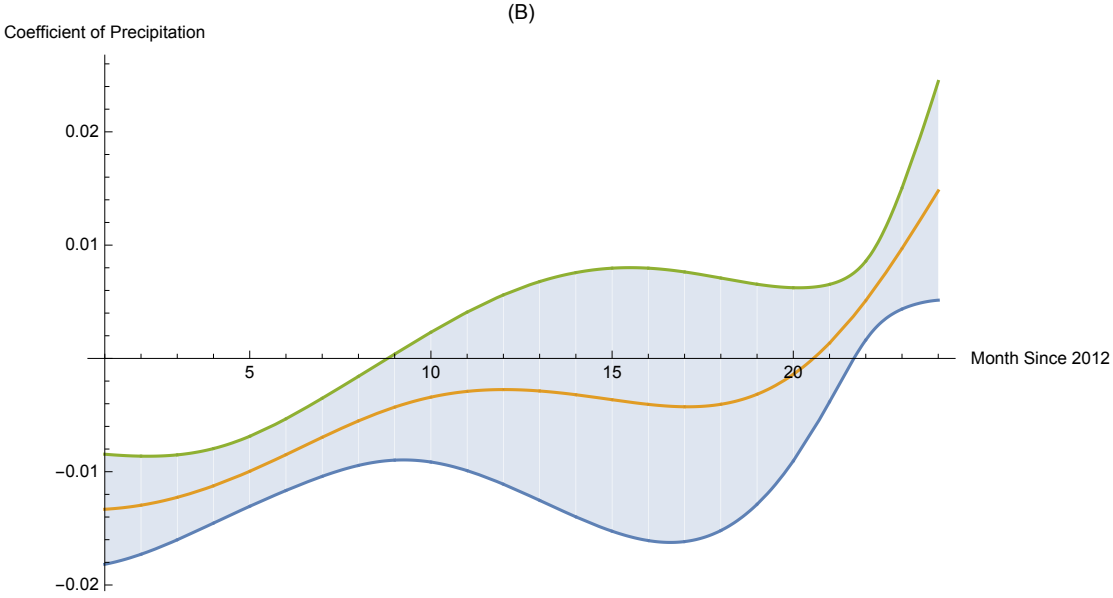
Now we can draw the graph to see how does the coefficient change from Jan-2012 to Dec-2013

```
(*For coefficient of temperature*)
Plot[{RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es][[
      2(*temperature is the second element of the estimator*)]] -
    1.96 * Sqrt[RefineVar[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Cv][[2, 2]]],
   RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es][[2]],
   RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es][[2]] +
    1.96 * Sqrt[RefineVar[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Cv][[2, 2]]]},
  {x, 1, 24}, Filling → {1 → {3}}, AxesLabel → {"Month Since 2012", "Coefficient of Temperature"}, ImageSize → Large,
  Exclusions → {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, PlotLabel → "(A)"]
```



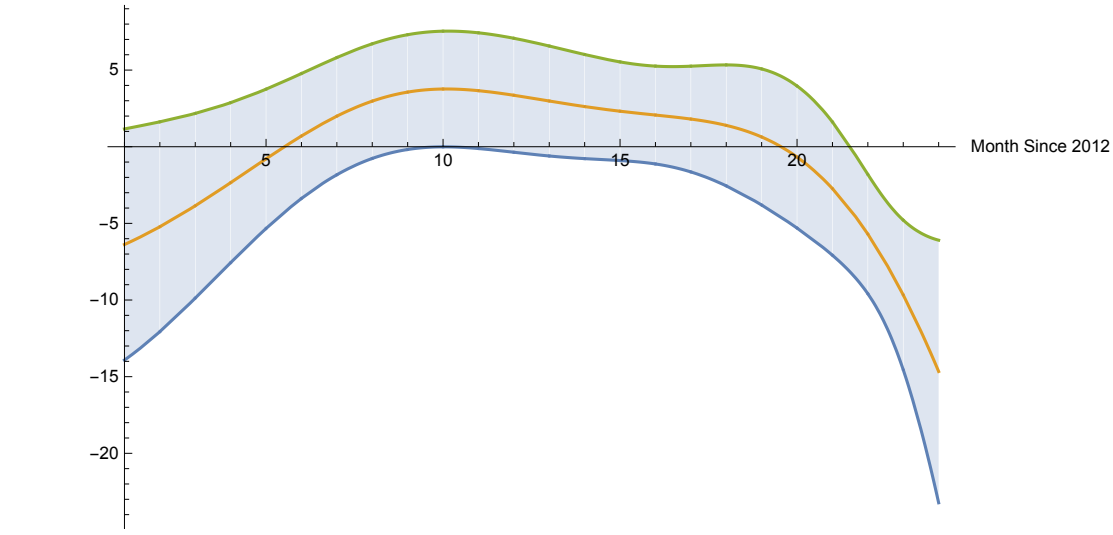
```
(*For coefficient of precipitation*)
Plot[{RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es][[
      3(*precipitation is the third element of the estimator*)]] -
    1.96 * Sqrt[RefineVar[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Cv][[3, 3]]],
   RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es][[3]],
   RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es][[3]] +
    1.96 * Sqrt[RefineVar[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Cv][[3, 3]]]},
  {x, 1, 24}, Filling → {1 → {3}}, AxesLabel → {"Month Since 2012", "Coefficient of Precipitation"}, ImageSize → Large,
  Exclusions → {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, PlotLabel → "(B)"]
```

(B)




```
(*For coefficient of RH*)
Plot[{RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es][[
      4(*RH is the fourth element of the estimator*)]] -
    1.96 * Sqrt[RefineVar[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Cv][[4, 4]]],
   RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es][[4]],
   RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es][[4]] +
    1.96 * Sqrt[RefineVar[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Cv][[4, 4]]]},
  {x, 1, 24}, Filling → {1 → {3}}, AxesLabel → {"Month Since 2012", "Coefficient of Relative Humidity"}, ImageSize → Large,
  Exclusions → {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, PlotLabel → "(C)"]
```

(C)

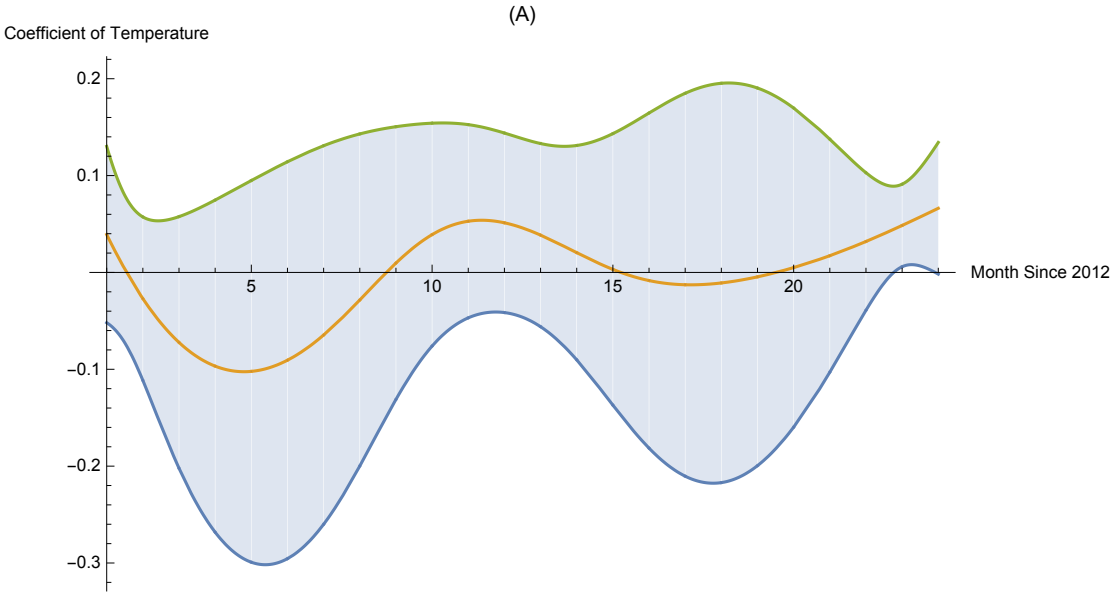


Now we show the example of Thailand as what we present in the paper, the process is same as France

Note that the geographical center of Thailand has coordinates (15,100), and the temporal correlation parameter is 0.19

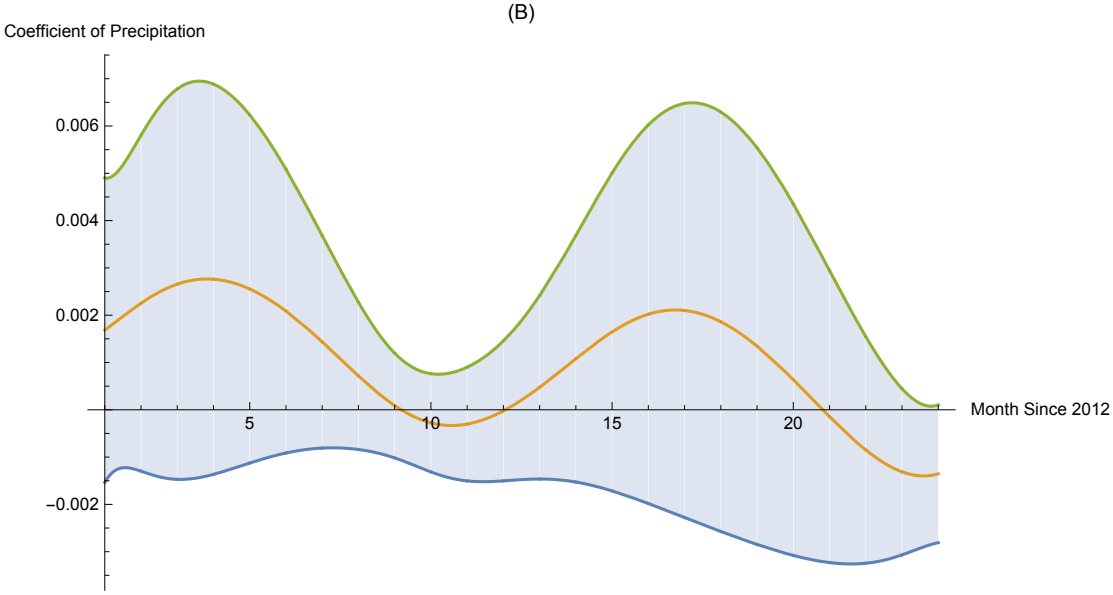
```
Es2 = RawEs[{25, 26, 27, 28, 29, 30, 31, 32, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48}, 3, 0.19, 15, 100, 1450, DA];
Cv2 = RawCv[{25, 26, 27, 28, 29, 30, 31, 32, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48}, 3, 0.19, 15, 100, 1450, Es2, DA];

(*For coefficient of temperature*)
Plot[{RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es2][[2]] -
    1.96 * Sqrt[RefineVar[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Cv2][[2, 2]]],
  RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es2][[2]],
  RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es2][[2]] +
    1.96 * Sqrt[RefineVar[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Cv2][[2, 2]]]},
 {x, 1, 24}, Filling → {1 → {3}}, AxesLabel → {"Month Since 2012", "Coefficient of Temperature"}, ImageSize → Large,
 Exclusions → {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, PlotLabel → "(A)"]
```



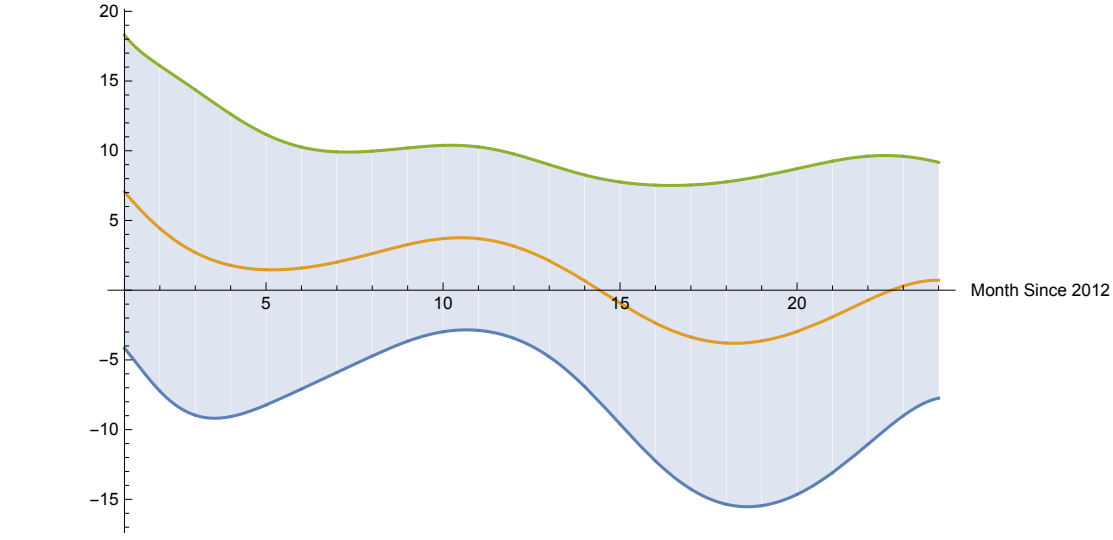
```
(*For coefficient of precipitation*)
Plot[{RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es2][[3]] -
      1.96 * Sqrt[RefineVar[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Cv2][[3, 3]]],
    RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es2][[3]],
    RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es2][[3]] +
      1.96 * Sqrt[RefineVar[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Cv2][[3, 3]]]},
  {x, 1, 24}, Filling → {1 → {3}}, AxesLabel → {"Month Since 2012", "Coefficient of Precipitation"}, ImageSize → Large,
  Exclusions → {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, PlotLabel → "(B)"]
```

(B)




```
(*For coefficient of RH*)
Plot[{RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es2][[4]] -
      1.96 * Sqrt[RefineVar[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Cv2][[4, 4]]],
    RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es2][[4]],
    RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es2][[4]] +
      1.96 * Sqrt[RefineVar[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Cv2][[4, 4]]]},
  {x, 1, 24}, Filling → {1 → {3}}, AxesLabel → {"Month Since 2012", "Coefficient of Relative Humidity"}, ImageSize → Large,
  Exclusions → {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, PlotLabel → "(C)"]
```

(C)



Now we show how to project these result to the map

Please first run the following code to import the raw estimator of the 22 countries

```
Es1 = {{4.3103790750280755`, −0.09347943468376584`, −0.012856250085036752`, −6.010140404085008`},
      {3.8063808224067093`, −0.08257602302979479`, −0.013530860694731032`, −5.384515284270297`},
      {2.8875796667110185`, −0.07217296018150102`, −0.014575362686395253`, −4.167394276079998`},
      {2.638777990665243`, −0.08352180227361924`, −0.011330857083901625`, −3.8840146877605544`},
      {2.757436722652374`, −0.10271030572445354`, −0.009126044750950569`, −3.908420899988653`},
      {0.2506747018476168`, −0.23066058687164204`, −0.01497970618866562`, 1.617265406425387`},
      {5.716866584881538`, −0.38211626167156765`, −0.011996933702432067`, −4.149101374670637`},
      {−3.592399378560568`, −0.08996111868408274`, 0.002218711725136751`, 0.5122139358643778`},
      {−10.132973805971403`, −0.17100211226275952`, 0.0028746143946025687`, 10.266862811992262`},
      {−1.5301437848488224`, −0.17590826499043113`, −0.0036987657824508304`, 1.5435083087051047`},
      {0.011148624851505539`, −0.17115255538160973`, −0.0012837956532694283`, −0.4166337916683993`},
      {0.32137462427711866`, −0.15357835696515842`, −0.002903705614663258`, −0.6661671257330513`},
      {0.029080250896879056`, −0.1485554601702332`, −0.0027569877261937976`, −0.34577219757636235`},
      {−0.8100617624677771`, −0.12673066928685994`, −0.0024590293119852082`, 0.6243823171547414`},
      {−1.6116467221206545`, −0.12448118601485417`, −0.00030055726289942745`, 1.4789962659836184`},
      {−2.5218947202878894`, −0.14841475149411407`, 0.00108906549278368`, 2.7135490744475677`},
      {−0.3215602341174306`, −0.21251924852554513`, 0.003697499472991376`, −0.030583920064506078`},
      {5.743422727124703`, −0.36945061742234075`, −0.01782283639639022`, −4.221924681256512`},
      {−1.9079090527964557`, −0.0946591844475363`, 0.005938326634114265`, −2.496679280685416`},
      {−5.361981720682678`, −0.11308758326096915`, 0.0011856185038383892`, 2.547362407914159`},
      {3.1139311842570656`, −0.18339458370040967`, 0.011443504804660902`, −7.158908471971672`},
      {7.38360900965705`, −0.19203949830218303`, 0.011213180950898492`, −11.500011910084428`},
      {7.293838857555111`, −0.15844940567579802`, 0.008914834055786783`, −11.212460573572491`}};
Es2 = {{3.8888186150737822`, −0.0800958366210289`, −0.012700215686602314`, −5.551819073406812`},
      {3.4040922673396286`, −0.0702531013990767`, −0.013373489658605358`, −4.939780295686611`},
      {2.4332841783093273`, −0.05946557840922183`, −0.01492877781419557`, −3.6195249271862773`},
      {2.203357387917137`, −0.07009299989344064`, −0.01200266369544186`, −3.347343836723367`},
      {2.440160067482059`, −0.09046397913772813`, −0.009829369904128643`, −3.5171646099107496`},
      {0.2750697634473079`, −0.20633799903546926`, −0.015163500304869116`, 1.3131572006099252`},
      {5.717764177453933`, −0.36119895559337767`, −0.010453349899900877`, −4.596259316564883`},
      {−3.139731774352354`, −0.09039196968086695`, 0.0015062348405209599`, 0.14766547389324555`},
      {−9.82610435055227`, −0.15551386008119225`, 0.0033674677274289438`, 9.791813704141392`},
      {−1.450265604790142`, −0.15645741215044043`, −0.003237704270114152`, 1.336076830902103`},
      {−0.09920902939810337`, −0.1499014169779841`, −0.001070684391688141`, −0.3719436193470835`},
      {0.2238421906326439`, −0.13174047541722655`, −0.002663643152820062`, −0.6341950027307447`},
      {−0.0819033722316101`, −0.12645240870926466`, −0.0025467349756147857`, −0.29330615023721035`},
      {−0.9192415106292496`, −0.1069261765623652`, −0.002186828539889865`, 0.6814086251914836`},
      {−1.6283737925898087`, −0.10757748387399352`, −0.00023887060107892507`, 1.4519364637289203`},
      {−2.3464347754842545`, −0.13489086088627655`, 0.0009070543410230785`, 2.4816786094931933`},
      {0.35058534242818334`, −0.1951787145771357`, 0.0037130536397964957`, −0.9968114904817613`},
      {6.65657801061383`, −0.3485149073267328`, −0.014966342938341799`, −5.92712570079975`},
      {−0.11286885061339533`, −0.10393385918596264`, 0.006435821081483205`, −4.549437820838602`},
      {−4.630179484554941`, −0.10730243810414376`, 0.0020580571232003088`, 1.5233492762349503`},
      {3.155033509089904`, −0.17461145132390407`, 0.01115201804601052`, −7.245283034555096`},
      {6.77130075174153 84`, −0.18152817985313519`, 0.010370127429767895`, −10.711233385699309`},
      {6.925961939242277`, −0.14507957002553795`, 0.008084856557472988`, −10.72800213240081`}};
Es3 = {{3.367153334510832`, −0.07104614652369946`, −0.012819191323157808`, −4.908616500546991`},
      {2.869443191833921`, −0.06068555890397713`, −0.013488946237894123`, −4.284716642360007`},
      {1.807770756824798`, −0.04826173500776917`, −0.015162929866288253`, −2.852015764382561`},
      {1.6695708478691529`, −0.06098013353484424`, −0.012250961264718143`, −2.685075745693242`},
      {1.9109903792375023`, −0.08178281559167257`, −0.010129248502427534`, −2.854011231626325`},
```

{−0.22639000876672175`, −0.20476136782194515`, −0.015163066898477866`, 1.9972379838270016`},
{5.363219365476577`, −0.3569569074512709`, −0.010021546746547478`, −4.2064014043301245`},
{−3.3514391127959624`, −0.08543662045390077`, 0.0009943359186073261`, 0.5181091926997365`},
{−10.389819212541887`, −0.14828995231009046`, 0.0029492045705594824`, 10.429022236580035`},
{−1.8294010134715906`, −0.15247831549656826`, −0.003121627073035584`, 1.7675135396805552`},
{−0.27565308504932223`, −0.1465405210311227`, −0.001578119270154725`, −0.104233388900725`},
{0.03039871604742035`, −0.1269085352485253`, −0.003154703953850551`, −0.3469609445245941`},
{−0.28884548171987323`, −0.12166462183317875`, −0.003025347551096986`, 0.008525827463931874`},
{−1.1218045853367102`, −0.1031417918036863`, −0.002564045702354308`, 0.970588719726835`},
{−1.6318191120901178`, −0.10666039367111971`, −0.0009204398681249796`, 1.531811560048401`},
{−2.201119611779324`, −0.1384162538378741`, −0.0001459483578411446 8`, 2.426381660999198`},
{0.33782263937507373`, −0.19626902089490766`, 0.0024393731607025683`, −0.8235016468340481`},
{6.415059406258813`, −0.3624973026146968`, −0.01433831429638838`, −5.435096823084506`},
{0.8706422250016179`, −0.11899285662429393`, 0.005658706433212096`, −5.34990388178099`},
{−4.7606632767671115`, −0.10071631350642388`, 0.0023625439565873505`, 1.5958196832539318`},
{3.045747092406821`, −0.1755693326975927`, 0.010648357389939349`, −7.073162100845524`},
{6.984073203485453`, −0.18748110113153735`, 0.010330010862954604`, −10.927025130552536`},
{6.805420759484076`, −0.14620094424106214`, 0.0077802329606673675`, −10.505559721065627`}};
Es4 = {{4.121204393510064`, −0.0925540551222127`, −0.012939693213845312`, −5.759187779883073`},
{3.598349331420516`, −0.08082937778832903`, −0.01362671834416338`, −5.1162489814033645`},
{2.6355193653719353`, −0.06944340944379758`, −0.014581954399842266`, −3.857653159708239`},
{2.4300188643781113`, −0.08227154672477457`, −0.011209196912409977`, −3.627170335679289`},
{2.500990302045342`, −0.10114963387439643`, −0.009010654720712311`, −3.589437656995438`},
{−0.07035615110198334`, −0.23791818205755544`, −0.014931062793033125`, 2.148408288521682`},
{5.478745781995843`, −0.38576875710209957`, −0.012266378370072797`, −3.73946064137818`},
{−4.091184875474966`, −0.08395380342559619`, 0.0019687601021341748`, 1.116229588815853`},
{−10.621753578316627`, −0.17222040049126808`, 0.0024945814395506355`, 10.861086191105535`},
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Es20 = {{−8.571052210119332`, 0.12983996876762782`, 0.0007955927124505584`, 4.883119727692465`},
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{−5.8352302736551485`, −0.0029620658433763287`, 0.000756734942607326`, 5.29953247628682`},
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{2.032538361487651`, −0.12429796049408041`, 0.0033053511752958167`, −1.3975438832640854`},
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We can draw the graph to see how does the coefficient of these 22 countries change from Jan-2012 to Dec-2013

```
(*For temperature*)
Plot[{RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es1][[2]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es2][[2]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es3][[2]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es4][[2]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es5][[2]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es6][[2]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es7][[2]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es8][[2]],
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    RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es20][[2]],
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    RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es22][[2]]},
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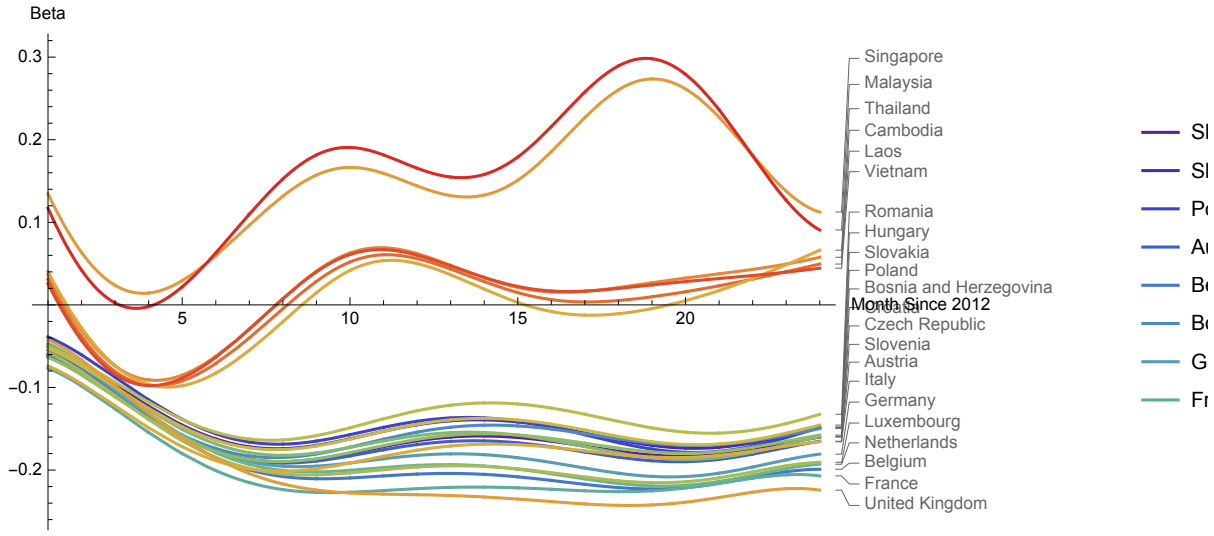
Beta
0.3
0.2
0.1
−0.1
−0.2
5
10
15
20
Month Since 2012
Singapore
Malaysia
Thailand
Cambodia
Laos
Vietnam
Romania
Hungary
Slovakia
Poland
Bosnia and Herzegovina
Czech Republic
Slovenia
Austria
Italy
Germany
Luxembourg
Netherlands
Belgium
France
United Kingdom

```
(*For precipitation*)
Plot[{RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es1][[3]],
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    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es4][[3]],
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    RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es21][[3]],
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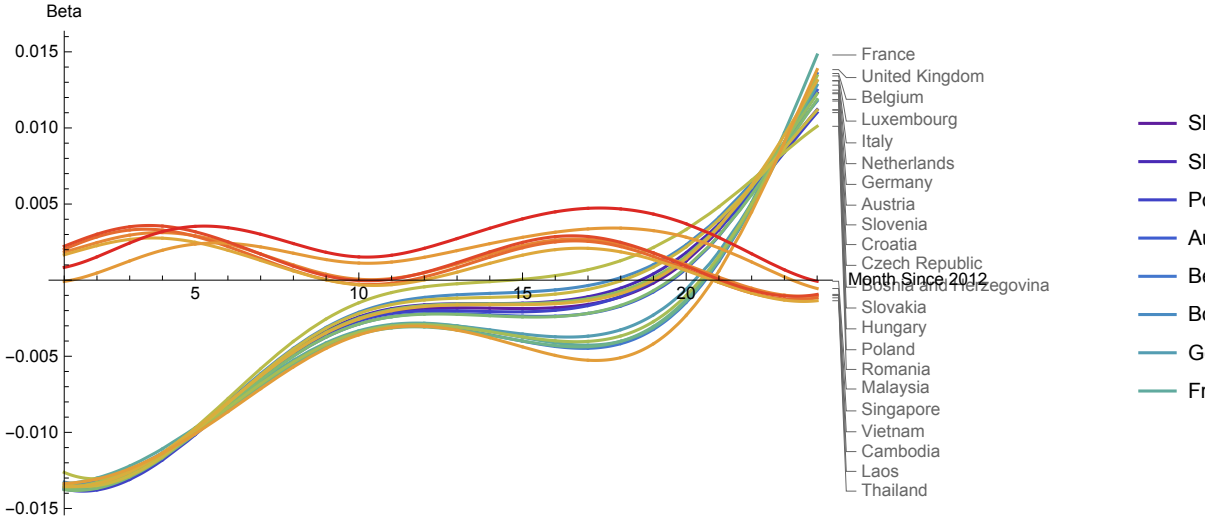
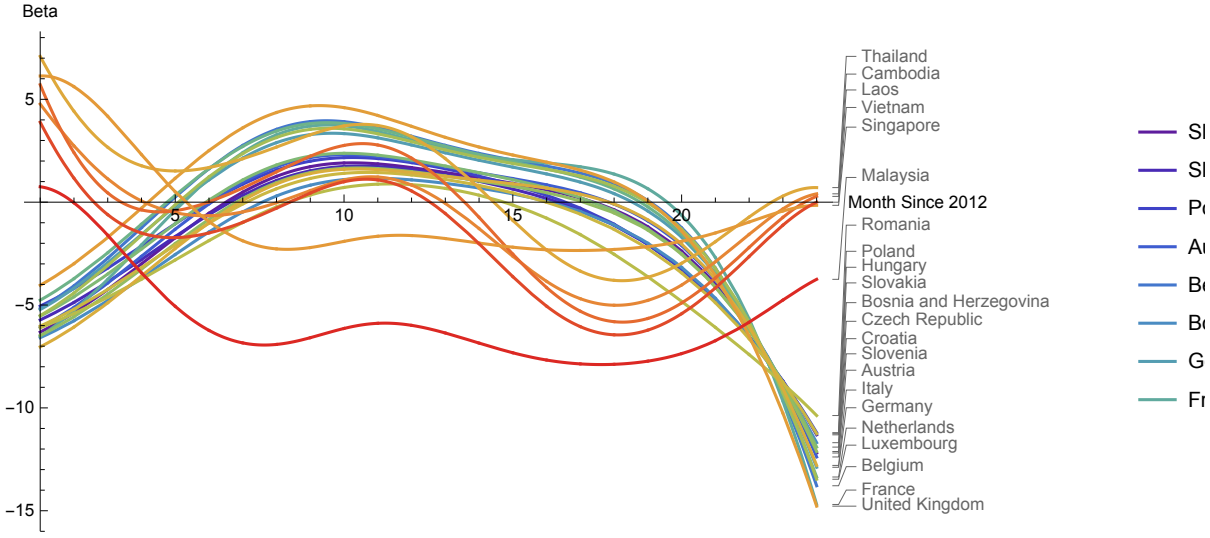
      ColorData["Rainbow"][0.74], ColorData["Rainbow"][0.79], ColorData["Rainbow"][0.84], ColorData["Rainbow"][0.89],
      ColorData["Rainbow"][0.76], ColorData["Rainbow"][0.8], ColorData["Rainbow"][0.94], ColorData["Rainbow"][0.99]}]
```



```
(*For RH*)
Plot[{RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es1][[4]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es2][[4]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es3][[4]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es4][[4]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es5][[4]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es6][[4]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es7][[4]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es8][[4]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es9][[4]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es10][[4]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es11][[4]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es12][[4]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es13][[4]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es14][[4]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es15][[4]],
    RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es16][[4]],
    RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es17][[4]],
    RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es18][[4]],
    RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es19][[4]],
    RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es20][[4]],
    RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es21][[4]],
    RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es22][[4]]},
  {x, 1, 24}, AxesLabel → {"Month Since 2012", Beta}, ImageSize → Large,
  Exclusions → {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24},
  PlotLabels → {"Slovenia", "Slovakia", "Poland", "Austria", "Belgium", "Bosnia and Herzegovina",
    "Germany", "France", "Netherlands", "Czech Republic", "Croatia", "Luxembourg", "Romania", "Hungary",
    "Italy", "United Kingdom", "Cambodia", "Laos", "Thailand", "Singapore", "Vietnam", "Malaysia"},
  PlotLegends → {"Slovenia", "Slovakia", "Poland", "Austria", "Belgium", "Bosnia and Herzegovina", "Germany",
    "France", "Netherlands", "Czech Republic", "Croatia", "Luxembourg", "Romania", "Hungary",
    "Italy", "United Kingdom", "Cambodia", "Laos", "Thailand", "Singapore", "Vietnam", "Malaysia"},
  PlotStyle → {ColorData["Rainbow"][0.04], ColorData["Rainbow"][0.09], ColorData["Rainbow"][0.14],
    ColorData["Rainbow"][0.19], ColorData["Rainbow"][0.24], ColorData["Rainbow"][0.29],
    ColorData["Rainbow"][0.34], ColorData["Rainbow"][0.39], ColorData["Rainbow"][0.44], ColorData["Rainbow"][0.49],
    ColorData["Rainbow"][0.54], ColorData["Rainbow"][0.59], ColorData["Rainbow"][0.64], ColorData["Rainbow"][0.69],
    ColorData["Rainbow"][0.74], ColorData["Rainbow"][0.79], ColorData["Rainbow"][0.84], ColorData["Rainbow"][0.89],
    ColorData["Rainbow"][0.76], ColorData["Rainbow"][0.8], ColorData["Rainbow"][0.94], ColorData["Rainbow"][0.99]}]
```



We can also draw the geographical heat map to see the spatial difference of these coefficients
Please first run the following code

```
TemCoun1[x_] := GeoRegionValuePlot[{ Slovenia (country) → ColorData["Rainbow"][
    Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es1][[2]],
     {-0.3, 0.3}, {0, 1}]], Slovakia (country) → ColorData["Rainbow"][
    Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es2][[2]],
     {-0.3, 0.3}, {0, 1}]], Poland (country) → ColorData["Rainbow"][
    Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es3][[2]],
     {-0.3, 0.3}, {0, 1}]], Austria (country) → ColorData["Rainbow"][
    Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es4][[2]],
     {-0.3, 0.3}, {0, 1}]], Belgium (country) -> ColorData["Rainbow"][Rescale[
     RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es5][[2]], {-0.3, 0.3}, {0, 1}]],
  Bosnia and Herzegovina (country) -> ColorData["Rainbow"][Rescale[
     RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es6][[2]], {-0.3, 0.3}, {0, 1}]],
  Germany (country) -> ColorData["Rainbow"][Rescale[
     RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es7][[2]], {-0.3, 0.3}, {0, 1}]],
  France (country) -> ColorData["Rainbow"][Rescale[
     RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es8][[2]], {-0.3, 0.3}, {0, 1}]],
  Netherlands (country) -> ColorData["Rainbow"][Rescale[
     RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es9][[2]], {-0.3, 0.3}, {0, 1}]],
  Czech Republic (country) -> ColorData["Rainbow"][
    Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es10][[2]],
     {-0.3, 0.3}, {0, 1}]], Croatia (country) -> ColorData["Rainbow"][
    Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es11][[2]],
     {-0.3, 0.3}, {0, 1}]], Luxembourg (country) -> ColorData["Rainbow"][
    Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es12][[2]],
     {-0.3, 0.3}, {0, 1}]], Romania (country) -> ColorData["Rainbow"][
    Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es13][[2]],
     {-0.3, 0.3}, {0, 1}]], Hungary (country) -> ColorData["Rainbow"][
    Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es14][[2]],
     {-0.3, 0.3}, {0, 1}]], Italy (country) -> ColorData["Rainbow"][Rescale[
     RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es15][[2]], {-0.3, 0.3}, {0, 1}]],
  United Kingdom (country) -> ColorData["Rainbow"][Rescale[RefineEs[x, 2, 4,
       {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es16][[2]], {-0.3, 0.3}, {0, 1}]]}]
TemCoun2[x_] := GeoRegionValuePlot[{ Cambodia (country) → ColorData["Rainbow"][
    Rescale[RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es17][[2]],
     {-0.3, 0.3}, {0, 1}]], Laos (country) → ColorData["Rainbow"][
    Rescale[RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es18][[2]],
     {-0.3, 0.3}, {0, 1}]], Thailand (country) → ColorData["Rainbow"][
    Rescale[RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es19][[2]],
     {-0.3, 0.3}, {0, 1}]], Singapore (country) → ColorData["Rainbow"][
```

```
Rescale[RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es20][[2]],
  {−0.3, 0.3}, {0, 1}]], Vietnam (country) −> ColorData["Rainbow"][Rescale[
  RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es21][[2]], {−0.3, 0.3}, {0, 1}]],
 Malaysia (country) −> ColorData["Rainbow"][Rescale[RefineEs[x, 2, 3,
   {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es22][[2]], {−0.3, 0.3}, {0, 1}]]}]
PreC1[x_] := GeoRegionValuePlot[{ Slovenia (country) → ColorData["Rainbow"][
 Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es1][[3]],
  {−0.015, 0.015}, {0, 1}]], Slovakia (country) → ColorData["Rainbow"][
 Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es2][[3]],
  {−0.015, 0.015}, {0, 1}]], Poland (country) → ColorData["Rainbow"][
 Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es3][[3]],
  {−0.015, 0.015}, {0, 1}]], Austria (country) → ColorData["Rainbow"][
 Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es4][[3]],
  {−0.015, 0.015}, {0, 1}]], Belgium (country) −> ColorData["Rainbow"][
 Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es5][[3]],
  {−0.015, 0.015}, {0, 1}]], Bosnia and Herzegovina (country) −> ColorData["Rainbow"][
 Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es6][[3]],
  {−0.015, 0.015}, {0, 1}]], Germany (country) −> ColorData["Rainbow"][
 Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es7][[3]],
  {−0.015, 0.015}, {0, 1}]], France (country) −> ColorData["Rainbow"][
 Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es8][[3]],
  {−0.015, 0.015}, {0, 1}]], Netherlands (country) −> ColorData["Rainbow"][
 Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es9][[3]],
  {−0.015, 0.015}, {0, 1}]], Czech Republic (country) −> ColorData["Rainbow"][
 Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es10][[3]],
  {−0.015, 0.015}, {0, 1}]], Croatia (country) −> ColorData["Rainbow"][
 Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es11][[3]],
  {−0.015, 0.015}, {0, 1}]], Luxembourg (country) −> ColorData["Rainbow"][
 Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es12][[3]],
  {−0.015, 0.015}, {0, 1}]], Romania (country) −> ColorData["Rainbow"][
 Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es13][[3]],
  {−0.015, 0.015}, {0, 1}]], Hungary (country) −> ColorData["Rainbow"][
 Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es14][[3]],
  {−0.015, 0.015}, {0, 1}]], Italy (country) −> ColorData["Rainbow"][
 Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es15][[3]],
  {−0.015, 0.015}, {0, 1}]], United Kingdom (country) −> ColorData["Rainbow"][
 Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es16][[3]],
  {−0.015, 0.015}, {0, 1}]}]
PreC2[x_] := GeoRegionValuePlot[{ Cambodia (country) → ColorData["Rainbow"][
 Rescale[RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es17][[3]],
  {−0.015, 0.015}, {0, 1}]], Laos (country) → ColorData["Rainbow"][
 Rescale[RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es18][[3]],
```

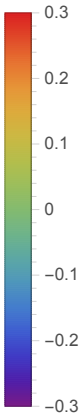
```
{−0.015, 0.015}, {0, 1}]], Thailand (country) → ColorData["Rainbow"][
Rescale[RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es19][[3]],
{−0.015, 0.015}, {0, 1}]], Singapore (country) → ColorData["Rainbow"][
Rescale[RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es20][[3]],
{−0.015, 0.015}, {0, 1}]], Vietnam (country) −> ColorData["Rainbow"][
Rescale[RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es21][[3]],
{−0.015, 0.015}, {0, 1}]], Malaysia (country) −> ColorData["Rainbow"][
Rescale[RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es22][[3]],
{−0.015, 0.015}, {0, 1}]]}]
AHC1[x_] := GeoRegionValuePlot[{ Slovenia (country) → ColorData["Rainbow"][Rescale[
RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es1][[4]], {−10, 8}, {0, 1}]],
Slovakia (country) → ColorData["Rainbow"][Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15,
16, 17, 18, 19, 20, 21, 22, 23, 24}, Es2][[4]], {−10, 8}, {0, 1}]], Poland (country) → ColorData["Rainbow"][
Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es3][[4]],
{−10, 8}, {0, 1}]], Austria (country) → ColorData["Rainbow"][
Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es4][[4]],
{−10, 8}, {0, 1}]], Belgium (country) −> ColorData["Rainbow"][Rescale[
RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es5][[4]], {−10, 8}, {0, 1}]],
Bosnia and Herzegovina (country) −> ColorData["Rainbow"][Rescale[
RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es6][[4]], {−10, 8}, {0, 1}]],
Germany (country) −> ColorData["Rainbow"][Rescale[
RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es7][[4]], {−10, 8}, {0, 1}]],
France (country) −> ColorData["Rainbow"][Rescale[
RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es8][[4]], {−10, 8}, {0, 1}]],
Netherlands (country) −> ColorData["Rainbow"][Rescale[
RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es9][[4]], {−10, 8}, {0, 1}]],
Czech Republic (country) −> ColorData["Rainbow"][Rescale[
RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es10][[4]], {−10, 8}, {0, 1}]],
Croatia (country) −> ColorData["Rainbow"][Rescale[
RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es11][[4]], {−10, 8}, {0, 1}]],
Luxembourg (country) −> ColorData["Rainbow"][Rescale[
RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es12][[4]], {−10, 8}, {0, 1}]],
Romania (country) −> ColorData["Rainbow"][Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15,
16, 17, 18, 19, 20, 21, 22, 23, 24}, Es13][[4]], {−10, 8}, {0, 1}]], Hungary (country) −> ColorData["Rainbow"][
Rescale[RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es14][[4]],
{−10, 8}, {0, 1}]], Italy (country) −> ColorData["Rainbow"][Rescale[
RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es15][[4]], {−10, 8}, {0, 1}]],
United Kingdom (country) −> ColorData["Rainbow"][Rescale[
RefineEs[x, 2, 4, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es16][[4]], {−10, 8}, {0, 1}]}]
AHC2[x_] := GeoRegionValuePlot[{ Cambodia (country) → ColorData["Rainbow"][
Rescale[RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es17][[4]],
```

```
    {−10, 8}, {0, 1}]], Laos (country) → ColorData["Rainbow"][
  Rescale[RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es18][[4]],
    {−10, 8}, {0, 1}]], Thailand (country) → ColorData["Rainbow"][Rescale[
    RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es19][[4]], {−10, 8}, {0, 1}]],
 Singapore (country) → ColorData["Rainbow"][Rescale[
    RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es20][[4]], {−10, 8}, {0, 1}]],
 Vietnam (country) −> ColorData["Rainbow"][Rescale[
    RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es21][[4]], {−10, 8}, {0, 1}]],
 Malaysia (country) −> ColorData["Rainbow"][Rescale[
    RefineEs[x, 2, 3, {1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}, Es22][[4]], {−10, 8}, {0, 1}]]}]
```

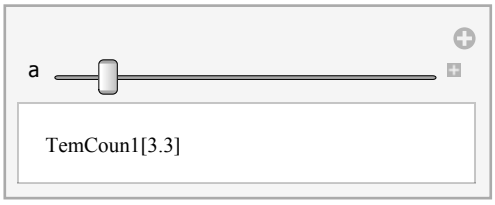
We have defined six function above. “TemCoun1”, “PreC1” and “AHC1” are functions of temperature, precipitation and RH for European countries, the other three are functions for Southeast Asia countries

We use function “BarLegend” to get colorbar, we use function “TemCoun1” to draw the heat map of temperature in European countries

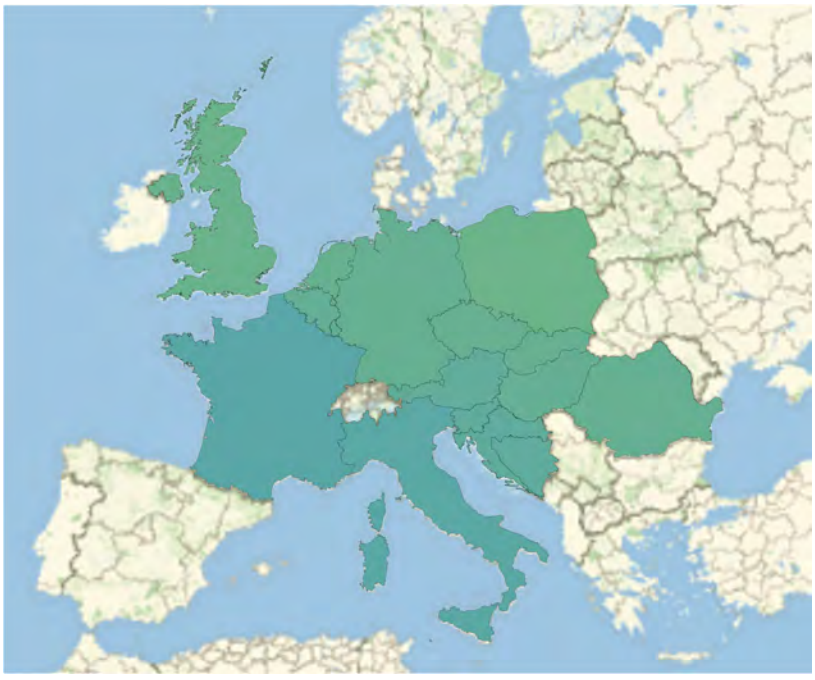
```
(*Colorbar for temperature*)
BarLegend[{"Rainbow", {−0.3, 0.3}}]
```



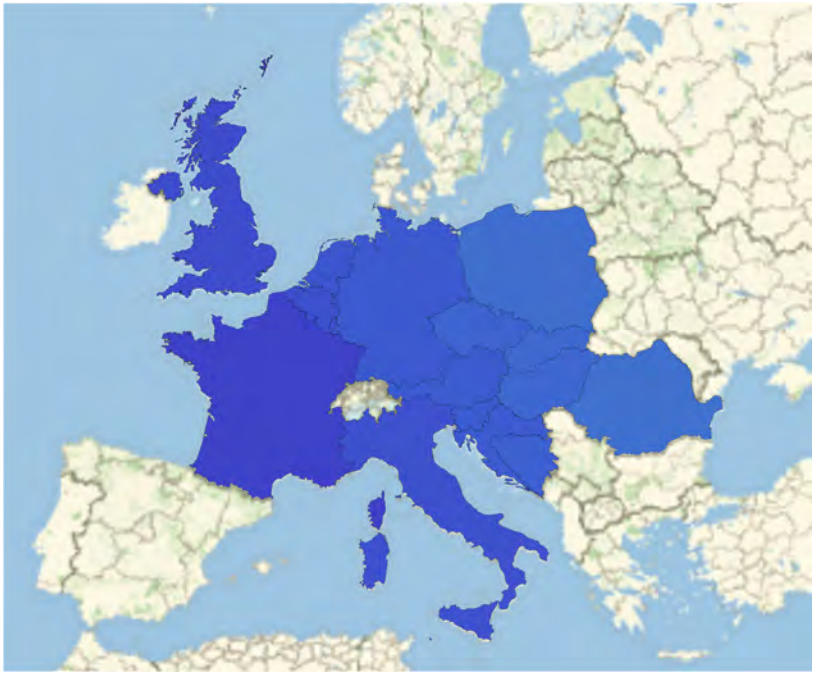

```
(*You can use function "Manipulate" to see the animation of the heat map!*)
Manipulate[TemCoun1[a], {a, 1, 24}]
```



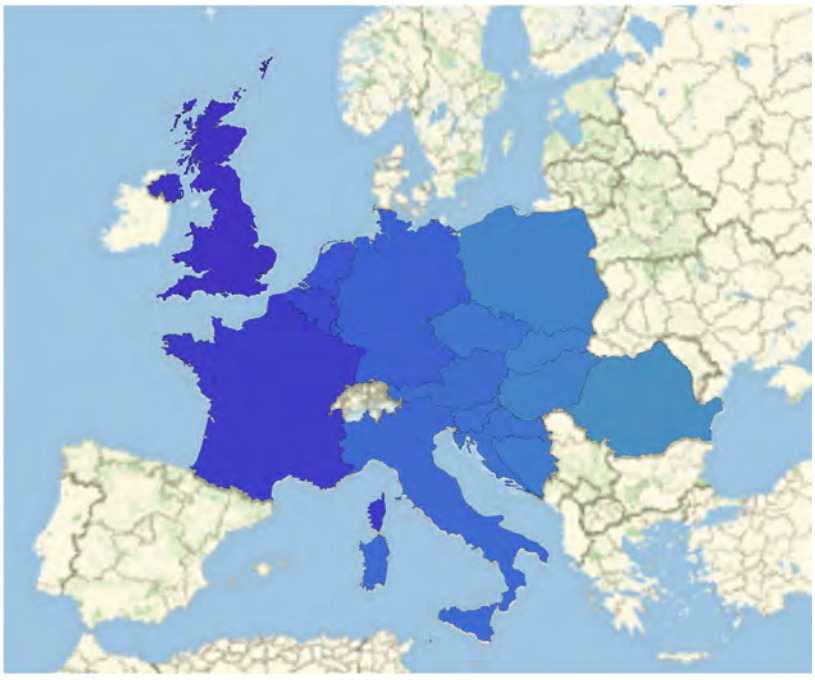
(∗For temperature in Jan−2012, Europe∗)
TemCoun1[1.0]



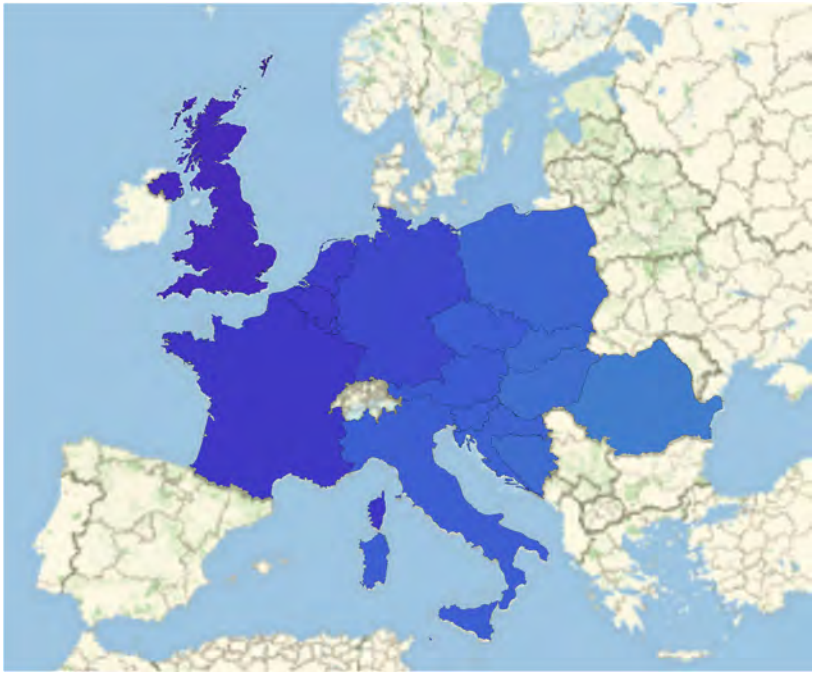
(∗For temperature in Jul−2012, Europe∗)
TemCoun1[7.0]



(∗For temperature in Jan−2013, Europe∗)
TemCoun1[13.0]

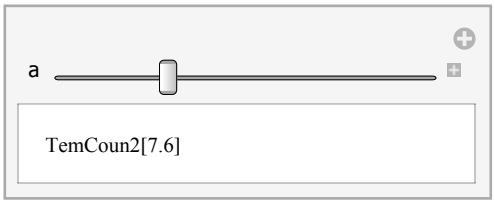


(∗For temperature in Jul−2013, Europe∗)
TemCoun1[19.0]

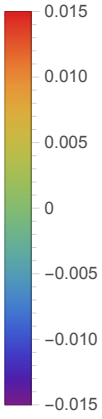


(*Same process can be applied to heat map of other factor.*)

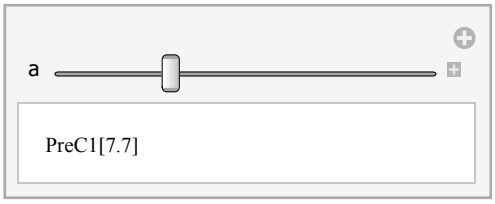
(∗For temperature of Southeast asia∗)
Manipulate[TemCoun2[a], {a, 1, 25}]



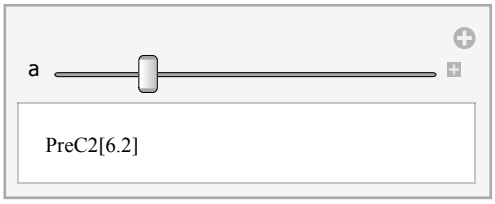
(∗colorbar for precipitation∗)
BarLegend[{"Rainbow", {−0.015, 0.015}}]



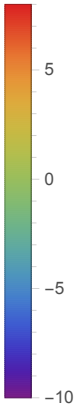
(∗For precipitation of European countries∗)
Manipulate[PreC1[a], {a, 1, 25}]



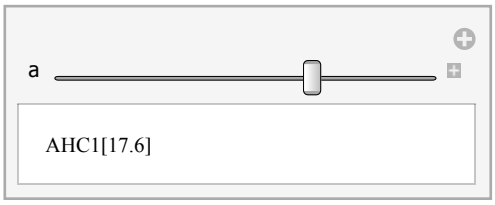
(∗For precipitation of Southeast asia∗)
Manipulate[PreC2[a], {a, 1, 25}]



```
(*colorbar for RH*)
BarLegend[{"Rainbow", {-10, 8}}]
```




```
(*For RH of European countries*)
Manipulate[AHC1[a], {a, 1, 25}]
```




```
(*For RH of Southeast asia*)
Manipulate[AHC2[a], {a, 1, 25}]
```