**Supplementary File 4: Studying the role of meteorological and geographic parameters on the stable isotope content of precipitation using the stepwise technique:**

Firstly, the role of meteorological and geographic parameters on δ18O in precipitation has been studied. The results show that elevation and latitude are the main meteorological and geographic parameters which control δ18O value in precipitation.

| **Model Summary c** | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Model | | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | | Durbin-Watson |
| R Square Change | F Change | df1 | df2 | Sig. F Change |
| dimension0 | 1 | .670a | .449 | .431 | 2.26589 | .449 | 26.035 | 1 | 32 | .000 |  |
| 2 | .783b | .614 | .589 | 1.92704 | .165 | 13.243 | 1 | 31 | .001 | 1.694 |
| a. Predictors: (Constant), Elevation | | | | | | | | | | | |
| b. Predictors: (Constant), Elevation, Latitude | | | | | | | | | | | |
| c. Dependent Variable: δ18O | | | | | | | | | | | |

| **Coefficients a** | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95,0% Confidence Interval for B | |
| B | Std. Error | Beta | Lower Bound | Upper Bound |
| 1 | (Constant) | .152 | 1.073 |  | .142 | .888 | -2.033 | 2.337 |
| Elevation | -.003 | .001 | -.670 | -5.102 | .000 | -.005 | -.002 |
| 2 | (Constant) | 13.048 | 3.659 |  | 3.566 | .001 | 5.585 | 20.511 |
| Elevation | -.003 | .001 | -.691 | -6.185 | .000 | -.005 | -.002 |
| Latitude | -.393 | .108 | -.407 | -3.639 | .001 | -.614 | -.173 |
| a. Dependent Variable: δ18O | | | | | | | | |

The final model for δ18O is as bellow:

δ18O = - 003(Elevation) - 0.393(Latitude) + 13.048

Studying the role of meteorological and geographic parameters on the δ2H in precipitation shows that elevation and latitude mainly controls the δ2H values in precipitation.

| **Model Summary c** | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Model | | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | | Durbin-Watson |
| R Square Change | F Change | df1 | df2 | Sig. F Change |
| dimension0 | 1 | .589a | .347 | .327 | 18.62283 | .347 | 17.006 | 1 | 32 | .000 |  |
| 2 | .805b | .649 | .626 | 13.88008 | .302 | 26.605 | 1 | 31 | .000 | 1.309 |
| a. Predictors: (Constant), Elevation | | | | | | | | | | | |
| b. Predictors: (Constant), Elevation, and Latitude | | | | | | | | | | | |
| c. Dependent Variable: δ2H | | | | | | | | | | | |

| **Coefficients a** | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95,0% Confidence Interval for B | |
| B | Std. Error | Beta | Lower Bound | Upper Bound |
| 1 | (Constant) | 9.642 | 8.817 |  | 1.094 | .282 | -8.317 | 27.601 |
| Elevation | -.022 | .005 | -.589 | -4.124 | .000 | -.033 | -.011 |
| 2 | (Constant) | 141.299 | 26.357 |  | 5.361 | .000 | 87.543 | 195.055 |
| Elevation | -.023 | .004 | -.618 | -5.800 | .000 | -.031 | -.015 |
| Latitude | -4.015 | .778 | -.550 | -5.158 | .000 | -5.603 | -2.427 |
| a. Dependent Variable: δ2H | | | | | | | | |

The final model for δ2H is as bellow:

δ2H = - 023 (Elevation) – 4.015 (Latitude) + 141.299

Studying the role of meteorological and geographic parameters which control the *d*-excess values in precipitation show that elevation, latitude and temperature are the main parameters which dominantly control *d*-excess values in precipitation.

| **Model Summary d** | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Model | | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | | Durbin-Watson |
| R Square Change | F Change | df1 | df2 | Sig. F Change |
| dimension0 | 1 | .535a | .286 | .264 | 4.87585 | .286 | 12.839 | 1 | 32 | .001 |  |
| 2 | .646b | .417 | .379 | 4.47847 | .130 | 6.931 | 1 | 31 | .013 |  |
| 3 | .729c | .531 | .484 | 4.08321 | .114 | 7.292 | 1 | 30 | .011 | 2.288 |
| a. Predictors: (Constant), Latitude | | | | | | | | | | | |
| b. Predictors: (Constant), Latitude, and Temperature | | | | | | | | | | | |
| c. Predictors: (Constant), Latitude, Temperature, and Elevation | | | | | | | | | | | |
| d. Dependent Variable: *d*-excess | | | | | | | | | | | |

| **Coefficients a** | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95,0% Confidence Interval for B | |
| B | Std. Error | Beta | Lower Bound | Upper Bound |
| 1 | (Constant) | 48.052 | 8.879 |  | 5.412 | .000 | 29.967 | 66.137 |
| Latitude | -.978 | .273 | -.535 | -3.583 | .001 | -1.535 | -.422 |
| 2 | (Constant) | 52.150 | 8.302 |  | 6.282 | .000 | 35.218 | 69.082 |
| Latitude | -1.202 | .265 | -.658 | -4.540 | .000 | -1.742 | -.662 |
| Temperature | .008 | .003 | .381 | 2.633 | .013 | .002 | .014 |
| 3 | (Constant) | 46.599 | 7.844 |  | 5.941 | .000 | 30.580 | 62.618 |
| Latitude | -1.192 | .241 | -.652 | -4.938 | .000 | -1.686 | -.699 |
| Temperature | .009 | .003 | .421 | 3.168 | .004 | .003 | .015 |
| Elevation | .003 | .001 | .340 | 2.700 | .011 | .001 | .006 |
| a. Dependent Variable: *d*-excess | | | | | | | | |

The final model for *d*-excess is as bellow:

*d*-excess= - 1.192 (Latitude) + .009 (Temperature) + 0.003(Elevation) + 46.599