**Appendix 1**

**Appendix figure legend**

S1. Plot showing the mean rank and mean AICc weight of 20 models used in the multi-model inference approach to determine the best model forms that describes the ant species-area relationship. A. Barplot showing the mean rank of the model forms based on no residual checks (lower value means better performance). B. Barplot showing the AICc weight of the model forms tested with no residual checks (Higher value means better performance). C. Barplot showing the mean rank of the model forms with residual checks. D. Barplot showing the AICc weight of the model forms tested with residual checks.

Chart

Description automatically generated

S2. Plot showing the best threshold model (continuous one-threshold model; black lines) fitted to dataset 2 for mainland islands (n = 161) in (A) log-log and (B) semi-log space. Points are coloured by biogeographic realm, and the colours are consistent across plots (i.e. the legend in (b) applies to both plots). For color legend see figure 5 in the main manuscript.



S3. Mixed-effects piecewise model fit to insular islands (n = 320) in semi-log space. The model included a random intercept for biome. In each plot, the dashed line is the population estimate (i.e., the fixed effect piecewise relationship), while the solid line is the fixed effect plus the random effect for that biome (i.e., here, shifting the intercept). Note the varying x-axis range across the plots. The black star on the x-axis represents the breakpoint, which in this model is a fixed effect (i.e., it is the same in each plot).

Chart, line chart

Description automatically generated

S4. Mixed-effects piecewise model fit to insular islands (n = 320) in semi-log space. The model included a random intercept and a random breakpoint for biome. In each plot, the dashed line is the population estimate (i.e., the fixed effect piecewise relationship), while the solid line is the fixed effect plus the random effects for that biome (i.e., here, shifting the intercept and the breakpoint). Note the varying x-axis range across the plots. The black star on the x-axis represents the breakpoint of the fixed (population) effect relationship, while the black triangle is the biome specific breakpoint.

Chart, line chart

Description automatically generated

**Appendix table legend**

S1. Table showing the average c-value for insular and mainland datasets across all biogeographical realms.

|  |  |  |
| --- | --- | --- |
| Biogeographical Realm | Average insular *c*-value | Average mainland *c*-value |
| Afrotropics | 1.79 | 2.25 |
| Australasia | 1.88 | NA |
| Indomalaya | 2.00 | NA |
| Nearctic | 3.96 | 2.52 |
| Neotropic | 2.04 | 5.52 |
| Oceania | 2.03 | NA |
| Palearctic | 1.21 | 4.02 |

S2. A table showing the competing models under two different covariates, island range (order of magnitude) (*n* *=*18) and species–area relationship type (mainland or insular) (*n* *=* 19), assessing slope values (*z*) as a function of abiotic variables based on AICc (Akaike Information Criterion with correction for small sample sizes) rankings. Predictor variables for each model are shown along with each model's AICc score, the change in AICc for every lower ranked model, AICc weights, and the adjusted R2.

|  |  |  |  |
| --- | --- | --- | --- |
| **Model with island order of magnitude range (OMR) covariate** | **ΔAICc** | **Weight (*wi)*** | **Pseudo-R2** |
| *z* ~ OMR + Temperature | 0.0 | 0.326 | 0.18 |
| Null Model | 0.9 | 0.210 | 0 |
| *z* ~ OMR | 1.8 | 0.132 | 0.28 |
| *z* ~ OMR + Precipitation | 2.0 | 0.121 | 0.12 |
| *z* ~ OMR \* Temperature | 2.4 | 0.099 | 0.23 |
| *z* ~ OMR + Latitude | 2.7 | 0.084 | 0.09 |
| *z* ~ OMR \* Precipitation | 4.9 | 0.028 | 0.14 |
| *z* ~ OMR + Biogeographic realm + Precipitation | 18.8 | <0.001 | 0.46 |
| *z* ~ OMR + Biogeographic realm + Temperature | 26.3 | < 0.001 | 0.22 |
| **Model with ISAR type covariate** | **ΔAICc** | **Weight (*wi)*** | **Pseudo-R2** |
| *z* ~ ISAR type + Temperature | 0.0 | 0.546 | 0.21 |
| Null Model | 1.9 | 0.216 | 0 |
| *z* ~ ISAR type | 3.0 | 0.120 | 0.01 |
| *z* ~ ISAR type + Precipitation | 4.0 | 0.075 | 0.10 |
| *z* ~ ISAR type + Latitude | 5.0 | 0.044 | 0.04 |
| *z* ~ ISAR type + Biogeographic realm + Temperature | 22.8 | < 0.001 | 0.28 |
| *z* ~ ISAR type + Biogeographic realm + Precipitation | 27.6 | < 0.001 | 0.17 |

S3. Table showing the model output of the most plausible GLM model that included the covariate of island order of magnitude range (OMR). This model assessed z-values as a function of the covariate and the additive effect of temperature.

|  |  |  |  |
| --- | --- | --- | --- |
| Coefficients | Effect Size | Std. Error | p-value |
| Intercept | -1.37 | 0.12 | <0.05 |
| OMR | -0.07 | 0.12 | 0.58 |
| Temperature | -0.30 | 0.12 | 0.02 |

S4. Table showing the model output of the most plausible GLM model that included the covariate of ISAR type. This model assessed z-values as a function of the covariate and the additive effect of temperature.

|  |  |  |  |
| --- | --- | --- | --- |
| Coefficients | Effect Size | Std. Error | p-value |
| Intercept | -1.32 | 0.14 | <0.05 |
| OMR | -0.20 | 0.28 | 0.47 |
| Temperature | -0.32 | 0.13 | 0.02 |

S5. Threshold models comparison summary. Results are presented for the mainland global dataset, for both the log–log and semi-log transformations. For each model, the AICc and R2 values are provided, and for the threshold models the area value (km2) where the inflexion point is located (on a log scale) is provided (Th1). For each comparison, the intercept-only model is not included to save space as it was always the worst model. ContOne is the continuous one-threshold model, and ZslopeOne the left-horizontal one-threshold model. In log–log space the linear model is the power model, and in semi-log space it is the logarithmic model.

|  |  |  |  |
| --- | --- | --- | --- |
| **Model** | **AICc** | **R2** | **Th1** |
| Mainland: log–log |  |  |  |
| ContOne | 470.17 | 0.20 | -2.949 |
| ZslopeOne | 474.26 | 0.17 | -2.649 |
| Linear | 497.97 | 0.03 | NA |
| Mainland: semi-log |  |  |  |
| ZslopeOne | 1468.20 | 0.23 | -2.949 |
| ContOne | 1470.09 | 0.23 | -3.049 |
| Linear | 1490.75 | 0.1 | NA |