Table 1: Summary of review questions, corresponding expectations based on previous studies (when applicable), and results. Statistically significant support for/ rejection of hypotheses is indicated by checkmarks/ X's, whereas '-' indicates no significant relationship. Parentheses indicate partial overall support or rejection of hypotheses across all fluxes considered. Flux variables are defined in Table 2.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Forest autotrophic carbon fluxes | | | | | | | | | | |
| Review questions and hypothesized relationships | | Overall | GPP | NPP | ANPP | ANPP*stem* | ANPP*foliage* | BNPP | BNPP*fine.root* | R*auto* | R*root* | Support |
| **Q1. How do C fluxes vary with latitude?** | |  |  |  |  |  |  |  |  |  |  |  |
|  | continuous increase with decreasing latitude1, 2, 3 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | Fig. 2 |
|  | significantly decelerating increase with decreasing latitude1, 4 | 🗙 | 🗙 | 🗙 | 🗙 | 🗙 | 🗙 | 🗙 | 🗙 | 🗙 | 🗙 | Fig. 2 |
| **Q2. How do C fluxes vary with mean annual temperature (MAT) and precipitation (MAP)?** | | | | | | | | | | | | |
|  | continuous increase with MAT1, 5, 6, 7 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | Figs. 3, 4, S4, S5 |
|  | increase with MAP up to ≥ 2000 mm1, 4, 7 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | Figs. 4, S4, S5 |
|  | increase with MAT x MAP8, 9 | - | - | 🗙 | - | ✔ | - | - | - | - | - | Fig. 3, Table S3 |
| **Q3. How are C fluxes related to other climate variables?** | | | | | | | | | | | | |
|  | decelerating increase or unimodal relationship with PET | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | Figs. 4, S4, S5 |
|  | decelerating increase or unimodal relationship with VPD10 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | Figs. 4, S4, S5 |
|  | increase with solar radiation11, 12 | (✔) | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | - | Figs. S4, S5 |
| **Q4. How does seasonality influence annual C fluxes?** | | | | | | | | | | | | |
|  | decrease with temperature seasonality | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | Figs. 4, S6, S7 |
|  | decrease with precipitation seasonality13, 14 | - | - | - | - | 🗙 | - | - | - | - | - | Figs. S6, S7 |
|  | increase with growing season length15, 16, 17, 18 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | Figs. 4, S6, S7 |
|  | stronger relationship to growing season length than MAT16, 17 | (🗙) | 🗙 | 🗙 | 🗙 | - | 🗙 | 🗙 | 🗙 | 🗙 | 🗙 | Table S4 |
| **Q5. When standardised by growing season length, how do annual C fluxes vary with climate?** | | | | | | | | | | | | |
|  | increase with growing season temperature17 | (✔) | - | - | ✔ | - | ✔ | - | - | - | - | Figs. S8, S9 |
|  | increase with growing season PET | (✔) | ✔ | ✔ | - | ✔ | - | ✔ | ✔ | - | - | Figs. S8, S9 |
|  | increase with growing season precipitation18 | (✔) | - | - | ✔ | - | ✔ | - | - | - | - | Figs. S8, S9 |
|  | increase with growing season solar radiation | (✔) | - | - | - | - | - | ✔ | ✔ | - | - | Figs. S8, S9 |

1Luyssaert et al. (2007) 2Gillman et al. (2015) 3Simova and Storch (2017) 4Huston & Wolverton (2009) 5Schuur (2003) 6Piao et al. (2010) 7Wei et al. (2010) 8Taylor et al. (2017) 9Muller-Landau et al. (2020) 10Smith et al. (2020) 11Fyllas et al. (2017) 12Nemani et al. (2003) 13Wagner et al. (2014) 14Wagner et al. (2016) 15Malhi (2012) 16Michaletz et al. (2014) 17Chu et al. (2016) 18Fernandez-Martinez et al. (2014)