Supporting Information for

Timing of the compensation of winter respiratory carbon losses provides explanatory power for net ecosystem productivity of forests


1Swiss Federal Research Institute WSL, Zürcherstrasse 111, 8903 Birmensdorf, Switzerland. 2ETH Zürich, Institute of Agricultural Sciences, Universitätstrasse 2, 8092 Zürich, Switzerland. 3TU Dresden, Institut für Hydrologie und Meteorologie, LS Meteorologie, Pienner Str. 23, 01737 Tharandt, Germany. 4Fundación CEAM, C/ Charles R. Darwin 14, Parque Tecnológico, 46980 Paterna, Valencia, Spain. 5CzechGlobe - Global Change Research Institute CAS, Bělidla 986/4a, 603 00 Brno, Czech Republic. 6University of Liege—Gembloux Agro-Bio Tech, TERRA, Exchanges Ecosystem Atmosphere, Avenue de la Faculté, 8, B-5030 Gembloux, Belgium. 7Georg-August-University of Göttingen, Bioclimatology, Büsgenweg 2, 37077 Göttingen, Germany. 8Thünen Institute of Climate-Smart Agriculture, Bundesallee 50, 38116 Braunschweig, Germany. 9Technical University of Denmark (DTU), Department of Environmental Engineering, Miljøvej Bygningsorvet 115, 2800 Kgs. Lyngby, Denmark. 10Lund University, Department of Physical Geography and Ecosystem Science, Sölvegatan 12, 22362 Lund, Sweden. 11Oregon State University, 328 Richardson Hall, Corvallis, OR 97331, USA. 12National Research Council of Italy, Institute for Agricultural and Forestry Systems in the Mediterranean (IS-AFOM), Via Patacca 85, Ercolano (NA), Italy. 13Queen’s University, Department of Geography and Planning, Kingston, Ontario, Canada. 14Ufficio Amministrazione forestale, Palazzo 6, via Brennero 6, 39100 Bolzano, Italy. 15Free University of Bolzano, Piazza Università, 5, 39100 Bolzano, Italy. 16Wageningen UR, Alterra - Climate Change and Adaptive Land and Water Management, P.O. Box 47, 6700 AA, Wageningen, The Netherlands. 17VU University Amsterdam, De Boelelaan 1085, 1081 HV Amsterdam, The Netherlands.
Figure S1. Length of 'biological years' in days for the dynamic integration method (of net ecosystem productivity, NEPc) (see Fig. 1). The integration periods vary from less than 224 days (seven months) to more than 484 days (16 months). However, the average length is with 363.9 days very close to an actual calendar year (classical method). Site-years included: 347.
Figure S AU-TUM. Daily net ecosystem productivity (NEP) [g C m^{-2} d^{-1}] and integrated NEP (NEPc) [g C m^{-2} y^{-1}/integration period^{-1}] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Tumbarumba, Australia (AU-TUM, Tab. 1).
Figure S BE-VIE. Daily net ecosystem productivity (NEP) [g C m$^{-2}$ d$^{-1}$] and integrated NEP (NEP$_c$) [g C m$^{-2}$ y$^{-1}$/integration period$^{-1}$] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Vielsalm, Belgium (BE-VIE, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S CA-GRO. Daily net ecosystem productivity (NEP) [g C m$^{-2}$ d$^{-1}$] and integrated NEP (NEPc) [g C m$^{-2}$ y$^{-1}$/integration period$^{-1}$] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Ontario, Groundhog River, Boreal Mixedwood Forest, Canada (CA-GRO, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S CA-QFO. Daily net ecosystem productivity (NEP) [g C m^{-2} d^{-1}] and integrated NEP (NEP_c) [g C m^{-2} y^{-1}/integration period^{-1}] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Quebec, Eastern Boreal, Mature Black Spruce, Canada (CA-QFO, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S CH-DAV. Daily net ecosystem productivity (NEP) [g C m\(^{-2}\) d\(^{-1}\)] and integrated NEP (NEPc) [g C m\(^{-2}\) y\(^{-1}\)/integration period\(^{-1}\)] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Seehornwald, Davos, Switzerland (CH-DAV, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S CH-LAE. Daily net ecosystem productivity (NEP) [g C m$^{-2}$ d$^{-1}$] and integrated NEP (NEP$_{c}$) [g C m$^{-2}$ y$^{-1}$/integration period$^{-1}$] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Lägeren, Switzerland (CH-LAE, Tab. 1). The red vertical lines depict the compensation days (cDOY).
**Figure S CZ-BK1.** Daily net ecosystem productivity (NEP) [g C m$^{-2}$ d$^{-1}$] and integrated NEP (NEP$_c$) [g C m$^{-2}$ y$^{-1}$/integration period$^{-1}$] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Bily Kriz, Czech Republic (CZ-BK1, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S DE-HAI. Daily net ecosystem productivity (NEP) [g C m$^{-2}$ d$^{-1}$] and integrated NEP (NEP$_c$) [g C m$^{-2}$ y$^{-1}$/integration period$^{-1}$] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Hainich, Germany (DE-HAI, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S DE-THA. Daily net ecosystem productivity (NEP) [g C m\(^{-2}\) d\(^{-1}\)] and integrated NEP (NEP\(_{c}\)) [g C m\(^{-2}\) y\(^{-1}\)/integration period\(^{-1}\)] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Tharand, Germany (DE-THA, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S DK-SOR. Daily net ecosystem productivity (NEP) [g C m\(^{-2}\) d\(^{-1}\)] and integrated NEP (NEPc) [g C m\(^{-2}\) y\(^{-1}\)/integration period\(^{-1}\)] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Soroe, Denmark (DK-SOR, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S ES-ES1. Daily net ecosystem productivity (NEP) [g C m⁻² d⁻¹] and integrated NEP (NEPc) [g C m⁻² y⁻¹/integration period⁻¹] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for El Saler, Spain (ES-ES1, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S FI-HYY. Daily net ecosystem productivity (NEP) [g C m^{-2} d^{-1}] and integrated NEP (NEPc) [g C m^{-2} y^{-1}/integration period^{-1}] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Hyytiälä, Finland (FI-HYY, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S FR-PUE. Daily net ecosystem productivity (NEP) [g C m$^{-2}$ d$^{-1}$] and integrated NEP (NEP$_c$) [g C m$^{-2}$ y$^{-1}$/integration period$^{-1}$] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Puechabon, France (FR-PUE, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S IT-COL. Daily net ecosystem productivity (NEP) [g C m\(^{-2}\) d\(^{-1}\)] and integrated NEP (NEPc) [g C m\(^{-2}\) y\(^{-1}\)/integration period\(^{-1}\)] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Collelongo, Italy (IT-COL, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S IT-REN. Daily net ecosystem productivity (NEP) [g C m\(^{-2}\) d\(^{-1}\)] and integrated NEP (NEPc) [g C m\(^{-2}\) y\(^{-1}\)/integration period\(^{-1}\)] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Renon, Italy (IT-REN, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S NL-LOO. Daily net ecosystem productivity (NEP) [g C m$^{-2}$ d$^{-1}$] and integrated NEP (NEP$_c$) [g C m$^{-2}$ y$^{-1}$/integration period$^{-1}$] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Loobos, The Netherlands (NL-LOO, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S PL-TUC. Daily net ecosystem productivity (NEP) [g C m$^{-2}$ d$^{-1}$] and integrated NEP (NEPc) [g C m$^{-2}$ y$^{-1}$/integration period] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Tuczno, Poland (PL-TUC, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S PT-ESP. Daily net ecosystem productivity (NEP) [g C m\(^{-2}\) d\(^{-1}\)] and integrated NEP (NEP\(_c\)) [g C m\(^{-2}\) y\(^{-1}\)/integration period\(^{-1}\)] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Espirra, Portugal (PT-ESP, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S RU-FYO. Daily net ecosystem productivity (NEP) [g C m\(^{-2}\) d\(^{-1}\)] and integrated NEP (NEPC) [g C m\(^{-2}\) y\(^{-1}\)/integration period\(^{-1}\)] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Fyodorovskoye, Russia (RU-FYO, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S SE-NOR. Daily net ecosystem productivity (NEP) [g C m⁻² d⁻¹] and integrated NEP (NEPc) [g C m⁻² y⁻¹/integration period⁻¹] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Norunda, Sweden (SE-NOR, Tab. 1). The red vertical lines depict the compensation days (cDOY).
**Figure S US-HA1.** Daily net ecosystem productivity (NEP) [g C m$^{-2}$ d$^{-1}$] and integrated NEP (NEPc) [g C m$^{-2}$ y$^{-1}$/integration period$^{-1}$] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Harvard Forest EMS Tower (HFR1), USA (US-HA1, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S US-ME2. Daily net ecosystem productivity (NEP) [g C m$^{-2}$ d$^{-1}$] and integrated NEP (NEP$_c$) [g C m$^{-2}$ y$^{-1}$/integration period$^{-1}$] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Metolius-intermediate aged ponderosa pine, USA (US-ME2, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S US-MMS. Daily net ecosystem productivity (NEP) [g C m\(^{-2}\) d\(^{-1}\)] and integrated NEP (NEP\(_c\)) [g C m\(^{-2}\) y\(^{-1}\)/integration period\(^{-1}\)] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Morgan Monroe State Forest, USA (US-MMS, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S US-NR1. Daily net ecosystem productivity (NEP) \([\text{g C m}^{-2} \text{ d}^{-1}]\) and integrated NEP (NEPc) \([\text{g C m}^{-2} \text{ y}^{-1}/\text{integration period}^{-1}]\) for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Niwot Ridge Forest (LTER NWT1), USA (US-NR1, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S US-UMB. Daily net ecosystem productivity (NEP) [g C m\(^{-2}\) d\(^{-1}\)] and integrated NEP (NEP\(_c\)) [g C m\(^{-2}\) y\(^{-1}\)/integration period\(^{-1}\)] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Univ. of Mich. Biological Station, USA (US-UMB, Tab. 1). The red vertical lines depict the compensation days (cDOY).
Figure S US-WCR. Daily net ecosystem productivity (NEP) [g C m\(^{-2}\) d\(^{-1}\)] and integrated NEP (NEP\(_c\)) [g C m\(^{-2}\) y\(^{-1}\)/integration period\(^{-1}\)] for three integration approaches (classical, Urbanski, dynamic, see Fig. 1) for Willow Creek, USA (US-WCR, Tab. 1). The red vertical lines depict the compensation days (cDOY).