

# Minkyu Moon

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## PROFESSIONAL EXPERIENCES

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2022 - present Research Assistant Professor, **Boston University**  
2020 - 2022 Postdoctoral Associate, **Boston University**  
2016 - 2020 Research Assistant, **Boston University**  
2014 - 2016 Research Associate, **National Center for AgroMeteorology**  
2011 - 2014 Research Assistant, **Seoul National University**

## EDUCATION

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2020 **Ph.D.** Department of Earth and Environment, **Boston University**  
2014/2012 **M.S./B.S.** Department of Forest Sciences, **Seoul National University**

## AWARDS & HONORS

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2021 Top 25 reviewers of *Remote Sensing of Environment* for the calendar year of 2020  
2020 Outstanding Student Presentation Award, AGU 2019 Fall Meeting  
2014 Best Oral Presentation Award, 2014 Annual Conference of Ecological Society of Korea  
2013 Seoul National University Alumni Scholarships, Kwanak Corporation  
2012 - 2013 Scholarships granted by College of Agriculture and Life sciences, SNU  
2012 - 2013 AFoCO Student Scholarship, Korea Forest Service  
2004/2007 National Scholarship for Science and Engineering, Korea Student Aid Foundation

## RESEARCH EXPERIENCES

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2023 - present Quantifying the resilience of coastal marshes to climate change, National Aeronautics and Space Administration  
2021 - present Long-term changes and variability in global ecosystem phenology from MODIS, National Aeronautics and Space Administration  
2018 - present Improved understanding of feedbacks between ecosystem phenology and the weather-environment nexus at local-to-continental scales, National Science Foundation  
2018 - 2022 An operational multisource land surface phenology product from Landsat and Sentinel-2, National Aeronautics and Space Administration  
2016 - 2018 Development and validation of a global land surface phenology product from VIIRS for EOS-MODIS continuity, National Aeronautics and Space Administration  
2014 - 2016 Construction the foundation of core technologies for custom-made agricultural & forest meteorological services, Korea Meteorological Administration  
2012 - 2014 Time series analysis of northern temperate forest characteristics and the development of forest management for climate change adaptation, Korea Forest Service

## PUBLICATIONS

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### In review/revision

- [2] Gao, X., Gray, J., Richardson, AD., Friedl, MA., **Moon, M.** On fitting process-based spring phenology models using observational data. *In review*
- [1] Carrillo, CM., Li, X., Alessi, MJ., Seyednasrollah, B., Frohling S., Young AM., **Moon, M.**, Evans, CP., Friedl, MA., Richardson, AD., Ault, TR. A pattern of land-atmosphere coupling in North America derived using a linear inverse modeling framework. *In revision*

### Published

- [19] Blonder, B., Brodrick, P., Chadwick, K., Carroll, E., Cruz-de Hoyos, R., Exposito-Alonso, M., Hately, S., **Moon, M.**, Ray, C., Trang, H., Walton, J. 2023 Climate lags and genetics determine phenology in quaking aspen (*Populus tremuloides*). *New Phytologist*, 238:2313–2328
- [18] Gao, X., McGregor, I., Gray, J., Friedl, MA., **Moon, M.** 2023 Observations of satellite land surface phenology indicate that maximum leaf greenness is more associated with global vegetation productivity than growing season length. *Global Biogeochemical Cycles*, 37, e2022GB007462
- [17] Li, X., Ault, T., Richardson, AD., Carrillo, CM., Lawrence, DM., Lombardozzi, D., Frohling Steve., Herrera, DA., **Moon, M.** 2023 Impacts of shifting phenology on boundary layer height in North America in the spring and fall. *Agricultural and Forest Meteorology*, 330: 109286
- [16] Young, AM., Friedl, MA., Novick, Kim., Scott RL., **Moon, M.**, Frohling S., Carrillo, CM., Richardson, AD. 2022 Disentangling the relative drivers of seasonal evapotranspiration across a continental-scale aridity gradient. *Journal of Geophysical Research: Biogeosciences*, 127(8); e2022JG006916
- [15] **Moon, M.**, Richardson, AD., Milliman, T., Friedl, MA. 2022 A high spatial resolution land surface phenology dataset for AmeriFlux and NEON sites. *Scientific Data*, 9: 448
- [14] **Moon, M.**, Richardson, AD., O’Keefe, J., Friedl, MA. 2022 Senescence in temperate broadleaf trees exhibits species-specific dependence on photoperiod versus thermal forcing. *Agricultural and Forest Meteorology*, 322: 109026
- [13] **Moon, M.**, Richardson, AD., Friedl, MA. 2021 Multiscale Assessment of Land Surface Phenology from Harmonized Landsat 8 and Sentinel-2, PlanetScope, and PhenoCam Imagery. *Remote Sensing of Environment*, 266: 112716
- [12] Young, AM., Friedl, MA., Seyednasrollah, B., Beamesderfer, E., Carrillo, CM., Li, X., **Moon, M.**, Arain, MA., Baldocchi, DD., Blanken, PD., Bohrer, G., Burns, SP., Chu, H., Desai, AR., Griffis, TJ., Hollinger, DY., Litvak, ME., Novick, Kim., Scott, RL., Suyker, AE., Verfaillie, J., Wood, JD., Richardson, AD. 2021 Seasonality in aerodynamic resistance across a range of North American ecosystems. *Agricultural and Forest Meteorology*, 310: 108613
- [11] **Moon, M.**, Seyednasrollah, B., Richardson, AD., Friedl, MA. 2021 Using time series of MODIS land surface phenology to model temperature and photoperiod controls on spring greenup in North American deciduous forests. *Remote Sensing of Environment*, 260: 112466
- [10] Park, J., Cho, S., **Moon, M.**, Ryu, D., Kim, H. 2021 Developing stand transpiration model relating canopy conductance to stand sapwood area in a Korean pine. *iForest - Biogeosciences and Forestry*, 14(2): 186-194
- [9] Bolton, DK., Melaas, EK., Gray, JM., **Moon, M.**, Eklundh, L., Friedl, MA. 2020 Continental-scale land surface phenology from Harmonized Landsat 8 and Sentinel-2 imagery. *Remote Sensing of Environment*, 240: 111685

- [8] **Moon, M.**, Li, D., Liao, W., Rigden, AJ., Friedl, MA. 2020 Modification of surface energy balance during springtime: The relative importance of biophysical and meteorological changes. *Agricultural and Forest Meteorology*, 284: 107905
- [7] **Moon, M.**, Zhang, X., Henebry, GM., Liu, L., Gray, JM., Melaas, EK., Friedl, MA. 2019 Long-term continuity in land surface phenology measurements: a comparative assessment of the MODIS land cover dynamics and VIIRS land surface phenology products. *Remote Sensing of Environment*, 226: 74-92
- [6] Kang, M., Ichii, K., Kim, J., Indrawati, YM., Park, J., **Moon, M.**, Lim, JH., Chun, JH. 2019 New gap-filling strategies for long-period flux data gaps using a data-driven approach. *Atmosphere*, 10: 568
- [5] Zhang, X., Liu, L., Liu, Y., Jayavelu S., Wang, J., **Moon, M.**, Henebry, GM., Friedl, MA., Schaaf, C. 2018 Generation and evaluation of the VIIRS land surface phenology product. *Remote Sensing of Environment*, 216: 212-229
- [4] Park, J., Kim, T., **Moon, M.**, Cho, S., Ryu, D., Kim, H. 2018 Effects of thinning intensities on tree water use, growth, and resultant water use efficiency of 50-year-old *Pinus koraiensis* forest over four years. *Forest Ecology and Management*, 408:121-128
- [3] **Moon, M.**, Kim, T., Park, J., Cho, S., Ryu, D., Suh, S., Kim, H. 2016 Changes in spatial variations of sap flow in Korean pine trees due to environmental factors and their effects on estimates of stand transpiration. *Journal of Mountain Science*, 13(6): 1024-1034
- [2] **Moon, M.**, Kang, K., Park, I., Kim, T., Kim, H. 2015 Effects of leaf nitrogen allocation on the photosynthetic nitrogen-use efficiency of seedlings of three tropical species in Indonesia. *Journal of the Korean Society for Applied Biological Chemistry*, 58(4): 511-519
- [1] **Moon, M.**, Kim, T., Park, J., Cho, S., Ryu, D., Kim, H. 2015. Variation in sap flux density and its effect on stand transpiration estimates of Korean pine stands. *Journal of Forest Research*, 20(1): 85-93

### In Korean

- [7] Lee, M., Park, J., Cho, S., **Moon, M.**, Ryu, D., Lee, H., Lee, H., Kim, S., Kim, T., Byeon, S., Jeon, J., Bhusal, N., Kim, H. 2020. Sapflux measurement database using Granier's heat dissipation method and heat pulse method. *Korean Journal of Agricultural and Forest Meteorology*, 22(4): 327-339
- [6] Kang, M., Kim, J., Yang, H., Lim, JH., Chun, JH., **Moon, M.** 2019. On securing continuity of long-term observation eddy flux data: field intercomparison between open- and enclosed-path gas analyzers. *Korean Journal of Agricultural and Forest Meteorology*, 21(3): 135-145
- [5] **Moon, M.**, Kang, M., Thakuri, BM., Lee, J. 2015. Errors in net ecosystem exchanges of CO<sub>2</sub>, water vapor, and heat caused by storage fluxes calculated by single-level scalar measurements over a rice paddy. *Korean Journal of Agricultural and Forest Meteorology*, 17(3): 227-235
- [4] Song, J., Lee, SL., Kang, M., **Moon, M.**, Kim, J. 2015. High-resolution atmospheric simulation in Cheongmicheon farmland during the summer 2014 special observation period. *Korean Journal of Agricultural and Forest Meteorology*, 17(3): 384-398
- [3] Kang, N., Yun, J., Talucder, M.S.A., **Moon, M.**, Kang, M., Shim, K., Kim, J. 2015. Corrections on CH<sub>4</sub> fluxes measured in a rice paddy by eddy covariance method with an open-path wavelength modulation spectroscopy. *Korean Journal of Agricultural and Forest Meteorology*, 17: 1-10
- [2] Ryu, D., Bae, J., Park, J., Cho, S., **Moon, M.**, Oh, C., Kim, H. 2014. Responses of native trees species in Korea under elevated carbon dioxide condition – open top chamber experiment. *Korean Journal of Agricultural and Forest Meteorology*, 16: 197-210

- [1] Ryu, D., **Moon, M.**, Park, J., Cho, S., Kim, T., Kim, H. 2014. Development of allometric equation for V age-class *Pinus koraiensis* in Mt. Taehwa plantation, Gyeonggi-do. *Korean Journal of Agricultural and Forest Meteorology*, 16: 29-38

### **Public Dataset**

- [1] **Moon, M.**, Richardson, AD., Milliman, T., Friedl, MA. 2023 Land Surface Phenology, Eddy Covariance Tower Sites, North America, 2017-2021. ORNL DAAC, <https://doi.org/10.3334/ORN LDAAC/2033>

## **CONFERENCE PRESENTATIONS**

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### **Oral presentations**

- [9] **Moon, M.** 2023. Observing and modeling vegetation phenology using remote sensing and data-driven model. 1st Annual Eastern Regional Dynamic Global Vegetation Conference, Woods Hole MA, USA, **Keynote Speaker**
- [8] **Moon, M.**, Richardson, AD., Milliman, T., Friedl, MA. 2022 A high spatial resolution land surface phenology dataset for AmeriFlux and NEON sites. *2022 AmeriFlux Annual Meeting*, Virtual
- [7] **Moon, M.**, Seyednasrollah, B., Richardson, AD., Gray, JM., Friedl, MA. 2020. Photoperiod compensates for decreased temperature sensitivity in deciduous forest greenup. *American Geophysical Union 2020 Fall Meeting*, Virtual, **Invited**
- [6] **Moon, M.**, Li, D., Liao, W., Rigden, A., Friedl, MA. 2018. Attribution of surface energy balance changes induced by springtime phenology. American Geophysical Union 2018 Fall Meeting, Washington DC, USA
- [5] **Moon, M.**, Kang, M., Thakuri, BM., Lee, J. 2015. Errors in net ecosystem exchanges of CO<sub>2</sub>, water vapor, and heat caused by storage fluxes calculated by single-level scalar measurements over a rice paddy. *Korean Society of Agricultural and Forest Meteorology*, Jeon-ju, Korea
- [4] **Moon, M.**, Kim, T., Kim, H. 2014. Effects leaf nitrogen allocation on photosynthetic nitrogen-use efficiency of seedling of three tropical species in Indonesia. *2014 ESA annual meeting*, Sacramento, CA USA
- [3] **Moon, M.**, Kim, H. 2014. Effects of nitrogen allocation on photosynthetic nitrogen-use efficiency of three tropical species seedlings in Indonesia. *Spring Academic Conference of Korean Forest Society*, Seoul, Korea
- [2] **Moon, M.** and Kim, H. 2014 Effects of nitrogen allocation on photosynthetic nitrogen- and water-use efficiency of three tropical species seedlings in Indonesia. *Academic Conference of Ecological Society of Korea*, Seoul, Korea
- [1] **Moon, M.**, Park, J., Cho, S., Ryu, D, Kim, H. 2013. Azimuthal, radial, and tree-to-tree variations of 50-year-old *Pinus Koraiensis* sap flux density. *Fall Academic Conference of Korean Forest Society*, Cheongju, Korea

### **Poster presentations**

- [11] **Moon, M.**, Richardson, AD., O'Keefe, J., Friedl, MA. 2021. Modeling leaf senescence in temperate deciduous tree species. *American Geophysical Union 2021 Fall Meeting*, New Orleans, LA USA
- [10] **Moon, M.**, Seyednasrollah, B., Richardson, AD., Gray, JM., Friedl, MA. 2019. Climate controls on springtime phenology in Eastern Temperate Forests of North America. *American Geophysical Union 2019 Fall Meeting*, San Francisco, CA USA
- [9] **Moon, M.**, Melaas, E., Gray, JM., Friedl, MA. 2018 Inter-annual variation in springtime phenology of North American temperate and boreal forests. *ForestSat 2018*, College Park, MD USA

- [8] **Moon, M.**, Melaas, E., Damien, S., Friedl, MA. 2017 Multi-Scale Analysis of Trends in Northeastern Temperate Forest Springtime Phenology. *American Geophysical Union 2017 Fall Meeting*, New Orleans, LA USA
- [7] **Moon, M.**, Kang, M., Thakuri, B., Kim, J. 2015. Bias in storage flux estimated from a single-level CO<sub>2</sub> concentration over a rice paddy. *Korean Meteorological Society Spring Meeting*, Gyeongju, Korea
- [6] **Moon, M.**, Park, J., Cho, S., Ryu, D., Kim, T., Kim, H. 2013. Azimuthal, radial, and tree-to-tree variation of sap flux density of 50-year-old *Pinus koraiensis* trees. *International Joint Conference of 11<sup>th</sup> Asia flux International Workshop, 3<sup>rd</sup> HESSS, and 14<sup>th</sup> Annual Meeting of KSAFM*, Seoul, Korea
- [5] **Moon, M.**, Park, J., Cho, S., Ryu, D., Kim, T., Kim, H. 2013. Interspecies differences in radial distribution of sap flux density. *9<sup>th</sup> International Workshop on Sap flow*, Ghent, Belgium
- [4] **Moon, M.**, Park, J., Cho, S., Ryu, D., Kim, H. 2013. Water use and photosynthetic characteristics of tropical species in Indonesia. *Spring Academic Conference of Korean Forest Society*, Seoul, Korea
- [3] **Moon, M.**, Park, J., Cho, S., Ryu, D., Kim, H. 2012. Response of sap flux radial distribution of 50-year-old *Pinus koraiensis* trees to various environmental factors. *AOGS-AGU (WPGM) joint assembly*, Singapore
- [2] **Moon, M.**, Kim, J., Park, J., Cho, S., Ryu, D., Kim, H. 2012. Analysis of foliage defoliation on stand water availability using carbon stable isotope. *Spring Academic Conference of Korean Forest Society*, Seoul, Korea
- [1] **Moon, M.**, Kim, T., Lee, H., Ryu, D., Kim, S., Suh, S., Kim, H. 2011. Response of sap flux radial distribution of 40-year-old *Pinus koraiensis* trees to various environmental factors. *International Conference on Forest Technologies for Mitigating Climate Change*, Seoul, Korea

## INVITED TALKS

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- [5] Moon, M. 2023 Assessing damage and recovery in forest ecosystem after fire using high-resolution satellite imagery: Conifer versus deciduous forests. Seoul National University, Seoul, Korea.
- [4] Moon, M. 2022. *Observing and modeling vegetation phenology using satellite imagery and Bayesian statistics*. Seoul National University, Seoul, Korea.
- [3] *The AmeriFlux Management Project (AMP) webinar series: How to use AmeriFlux data*. April 27, 2021. Guest panelist. <https://ameriflux.lbl.gov/community/amp-webinar-series/>
- [2] Moon, M. 2019. *Modification of surface energy balance during springtime: The important role of atmospheric controls*. Seoul National University, Seoul, Korea.
- [1] Moon, M. 2019. *Tracking a rhythm of the Earth: Long-term record in land surface phenology*. National Institute of Environmental Research, Incheon; National Institute of Forest Science, Seoul; Kyungpook National University, Daegu; Chungnam National University, Daejeon; Yonsei University, Seoul; Kangwon National University, Chuncheon; Seoul National University, Seoul, Korea.

## TEACHING EXPERIENCES

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- 2017 - 2021     **Teaching Assistant**, Boston University (Graduate)  
Course: Multivariate Analysis for Geographers
- 2020/2022     **Teaching Assistant**, Boston University (Graduate)  
Course: Micrometeorology: Energy & Mass Transfer at the Earth's Surface

## **PROFESSIONAL SERVICES**

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### **Journal Referee**

Remote Sensing of Environment; Agricultural and Forest Meteorology; Remote Sensing; International Journal of Biometeorology; Sensors; Science of the Total Environment; ISPRS Journal of Photogrammetry and Remote Sensing; Journal of Geophysical Research-Biogeosciences; Forests; GIScience & Remote Sensing; Journal of Ecology; Scientific Data; Earth System Dynamics; International Journal of Digital Earth; Biogeosciences; Trees; Sustainability; Ecological Indicators; Nature Communications; Nature Ecology & Evolution; Nature Climate Change

### **Grant Review**

German Research Foundation (Deutsche Forschungsgemeinschaft)

## **RELEVANT SKILLS**

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### **Computing skills**

- Programming languages: R, Python, and Linux Bash shell
- GIS application: QGIS

### **Experimental facilities and sampling**

- Eddy covariance system
  - Gas analyzers (LI-7700/7500A/7500/7200, EC150, CPEC200)
  - Sonic anemometer (CSAT3) / Profile system (AP200)
  - Data loggers with various meteorological sensors
- Portable Gas exchange measurements: LI-6400XT
- Plant Canopy Analysis: LAI-2200C
- Spectrometer: ASD HandHeld 2
- Sap flux density sensor: Granier's type heat dissipation sensor (Homemade)
- Pressure Chambers: Water potential/Cavitation chamber (PMS)