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Education and professional experience

Education:

Ph. D. in Resources, Environment and Sustainability, University of British Columbia, Canada. [2022]
Dissertation title: Interactions between the land surface and the near-surface atmosphere: implications for evaporative demand and evapotranspiration under a changing climate

BSc. in Rural Systems Engineering, Seoul National University, South Korea. [2016]

Professional experience:

Graduate Research Assistant, University of British Columbia (PI: Dr. Mark S. Johnson) [2017 – 2022]
Research Associate, National Center for Agro-Meteorology, South Korea [2016]
Undergraduate Research Assistant, Seoul National University (PI: Dr. Joon Kim) [2014 – 2015]

Teaching experiences

Mentor of Research Experience program (REX) for UBC undergraduate students [2022]
Module developer and delivery. Course: Ecohydrology of Watersheds and Water Systems (ENVR 420, UBC), Guest lecture topic: Evapotranspiration theory and applications [2019 – 2022]
Mentor of a graduate student project. Course: Artificial Intelligence for Social Impact (CPSC 532L) [2020]
Teaching Assistant. Course: Ecohydrology of Watersheds and Water Systems (ENVR 420, UBC) [2018]
Teaching Assistant. Course: Land, Food and Community 1 (LFS 250, UBC) [2017 – 2018]

Research interests

Land-atmosphere interactions, water-carbon-energy nexus, ecohydrology, biometeorology, land surface modeling, satellite remote sensing, climate change adaptation and mitigation, machine learning and bigdata

Brief Bio

Kim graduated Seoul National University (SNU). He was awarded numerous merit-based scholarships along the way to earning the Grand Prize for undergraduate research from SNU. As an undergraduate, Kim led a biometeorological study resulting in a publication in *Agriculture, Ecosystems & Environment*. He worked at the National Centre for Agro-Meteorology in Korea, where he managed eddy-covariance systems.

Upon joining the University of British Columbia (UBC) MSc program, Kim assumed the day-to-day operation of an eddy-covariance flux tower system in Burns Bog near Vancouver, meeting regularly with researchers and technicians from three separate departments. In the process, he developed several new approaches (e.g., applying machine learning algorithms for gap-filling) to working with methane flux data. He then convened an international effort to apply these approaches to flux data from other sites, resulting in a paper that he led that was published in *Global Change Biology*.

After transfer from MSc to PhD program, Kim has been working on evapotranspiration theory, modelling, and impacts of climate change. In this process, he was awarded a Mitacs Globalink internship, spending three months in Dr. Monica Garcia's lab in the Technical University of Denmark (DTU), where he studied remote sensing technologies. He was also an invited participant to the 2019 AmeriFlux Early Career Workshop and 2022 SMAP Canada workshop, and was selected to participate in the US National Center for Atmospheric Research (NCAR) training course on the Community Land Model. Kim's policy brief on water management in Korea presenting strategies to reduce water use for rice field irrigation won an idea contest for sustainable water management (awarded by president of Korea Water Resources Corporation).

Along with these professional experiences, Kim developed a novel theoretical expression of evapotranspiration and evaluated it using site scale to global scale datasets by collaborating with an international team. This study was published in *Hydrology and Earth System Sciences*, and was selected as a highlight by European Geosciences Union. Kim wrote a draft of a research project proposal which suggested how his novel theory can be applied to satellite remote sensing. The project proposal was accepted by the Canadian Space Agency (CSA), and Kim has been leading the research project as a Co-Investigator.

Honors and awards

Graduate program

2020 – 2022. President's Academic Excellence Initiative PhD Award. UBC
2018 – 2022. Four Years Doctoral Fellowships. UBC
2017 – 2022. International Tuition Award. UBC
2017 – 2018. Faculty of Science Graduate Award. UBC
2019. Mitacs Globallink Research Award. Mitacs
2018. Award by President of Korea Water Resources Corporation. Idea contest for sustainable water management in South Korea

Undergraduate program

2017. Excellent Degree Thesis Award. College of Agriculture and Life Science, SNU
2016. Graduation with *Cum laude*, SNU
2015. Grand Prize (Award by President of SNU). SNU Undergraduate Research Program, SNU
2015. Evergreen Scholarship. SNU Evergreen Scholarship Foundation
2014 – 2015. Agricultural Engineering Scholarship. SNU Alumni Association of Agricultural Engineering
2011, 2014-2015. Merit Based Scholarship (Scholarship of Superior Academic Performance). SNU
2009. National Scholarship for Science and Engineering. Korea Student Aid Foundation

Research projects

Current projects

Improving Estimates of Evapotranspiration and Land Surface Relative Humidity Using Satellite-Derived Soil Moisture and Vegetation Optical Depth from SMAP-SMOS and Land Surface Temperature from Sentinel-3, C$ 250,000 from *Canadian Space Agency*. **Co-Investigator** [2021 – present]

Previous projects

Agricultural Water Innovation in the Tropics (AgWIT) project funded by the EU Joint Call for the Water Joint Programming Initiative 2016, *Natural Sciences and Engineering Research Council of Canada.* **Graduate Research Assistant** [2017 – 2020]

Constructing the foundation of core technologies for custom-made agricultural & forest meteorological services, *Korea Meteorological Administration.* **Research Associate** [2016]

Constructing the terrestrial ecosystem carbon database for the Carbon- Tracker-Asia improvement, *Korea Meteorological Administration.* **Undergraduate Research Assistant** [2015]

Development of time series database for CO_2 fluxes and investigation of ecosystem carbon dynamics, *Korea Meteorological Administration.* **Undergraduate Research Assistant** [2014 – 2015]

Publications

1. **Kim, Y.**, Morillas, L., Garcia, M., Weber, U., Black, T. A. & Johnson, M. S. (2021). Relative humidity gradients as a key constraint on terrestrial water and energy fluxes. *Hydrology and Earth System Sciences.* 25 (9), 5175-5191. doi: 10.5194/hess-25-5175-2021

   ※ SCI. 2020 IF=5.748, Rank=7/98 (Water Resources). Time Cited: 2.

   ※ This article was selected as EGU highlights by European Geosciences Union.

2. **Kim, Y.**, Johnson, M. S., Knox, S., Black, T. A., Dalmagro, H. J., Kang, M., Kim, J. & Baldocchi, D. (2020). Gap-filling approaches for eddy covariance methane flux: a comparison of three machine learning algorithms and a traditional method with and without principal component analysis. *Global Change Biology.* 26 (3), 1499-1518. doi:10.1111/gcb.14845.

   ※ SCI. 2020 IF=10.863, Rank=9/274 (Environmental Sciences). Time Cited: 70.

3. **Kim, Y.**, Talucder, M. S. A., Kang, M., Shim, K. -M., Kang, N. & Kim, J. (2016). Interannual variations in methane emission from an irrigated rice paddy caused by rainfall during the aeration period. *Agriculture, Ecosystems & Environment.* 223, 67-75. doi: 10.1016/j.agee.2016.02.032

   ※ SCI. 2020 IF=5.567, Rank=1/57 (Agriculture, Multidisciplinary). Time Cited: 36.

Korean journal

4. Choi, S.W., Kim, H., **Kim, Y.**, Kang, M. & Kim, J. (2016). Estimation and mapping of methane emission from rice paddies in Gyunggi-do using the modified water management scaling factor. *Korean Journal of Agricultural and Forest Meteorology*. 18(4), 320-326

Under review

1. **Kim, Y.**, García, M., & Johnson, M. S. (under review in *Earth's Future*). Land-atmosphere feedbacks reduce evaporative demand in a warming climate: implications at local and global scales. *Preprint available in: Earth and Space Science Open Archive*. doi:10.1002/essoar.10511797.1
2. **Kim, Y.**, García, M., Black, T. A. & Johnson, M. S. (under review in *Journal of Advances in Modeling Earth Systems*). Assessing the complementary role of Surface Flux Equilibrium (SFE) theory and Maximum Entropy Production (MEP) principle in the estimation of actual evapotranspiration. *Preprint available in: Earth and Space Science Open Archive.* doi:10.1002/essoar.10511856.1

Presentation and posters

1. **Kim, Y.** (2022). Improving Estimates of Evapotranspiration Using Satellite-Derived Soil Moisture. *Canadian Space Agency.* online (Invited)
2. **Kim, Y.** & Johnson, M. S. (2022). The sensitivity of evaporation to soil moisture: the role of relative humidity gradient. *2022 SMAP Canada Workshop.* online (Invited)
3. **Kim, Y.**, Johnson, M. S., Knox, S., Black, T. A., Dalmagro, H. J., Kang, M., Kim, J., Ryu, Y., Baldocchi, D. (2019). CH4 flux gap-filling approaches for eddy covariance data: a comparison of three machine learning algorithms and marginal distribution sampling method with and without principal component analysis. *2019 EGU General Assembly.* Vienna, Austria (Poster)
4. **Kim, Y.** & Johnson, M. S. (2017). Spectral entropy as a mean to quantify water stress history for natural vegetation and irrigated agriculture in a water-stressed tropical environment. *2017 AGU Fall Meeting.* New Orleans, Louisiana, USA (Poster)
5. Johnson, M. S., Lathuilliere, M. J., Morillas, L., Dalmagro, H. J., D'Acunha, B., **Kim, Y.**, Suarez, A. & Couto, E. G. (2017). Carbon and water fluxes and footprints in tropical agricultural systems under rainfed and irrigated conditions. *2017 AGU Fall Meeting*. New Orleans, Louisiana, USA (invited)
6. Choi, S.W., Kang, M., Indrawati, Y.M., Kim, H., **Kim, Y.** & Kim, J. (2016). Carbon footprint estimation using long-term flux measurement in Haenam, Korea: Implication for climate-smart agriculture. *EcoSummit 2016*. Le Corum, Montpellier, France (Poster)
7. **Kim, Y.**, Talucder, M. S. A., Kang, M., Kang, N., Shim, K. -M. & Kim, J. (2015). Changes in methane emission from rice paddy triggered by rainfall during the mid-season Drainage (in Korean). *The 2015 Korean Meteorological Society Fall Conf.* Jeju, Korea (Oral)

Journal referee

Earth's Future; *Hydrology and Earth System Sciences*; *Journal of Hydrology*; *Remote Sensing of Environment*

Workshop and other activities

2019. Visiting PhD student (three months). Dr. Monica García's group at Department of Environmental Engineering, Technical University of Denmark
2019. Invited workshop participant. 2019 AmeriFlux Early Career Workshop, Boulder, CO, USA
2019. Workshop participant. CLM (Community Land Model) / CTSM (Community Terrestrial Systems Model) tutorial, National Center for Atmospheric Research (NCAR) Mesa Lab, Boulder, CO, USA
2016. Workshop participant. The International Workshop on Agromet and GIS Applications for Agricultural Decision Making (AgMP, WMO), Jeju, South Korea

PhD committee members

PhD supervisor:

Dr. Mark S. Johnson (Institute for Resources, Environment & Sustainability/ Department of Earth, Ocean, & Atmospheric Sciences, UBC)

PhD supervisory committee:

Dr. T. Andrew Black (Faculty of Land and Food Systems, UBC)
Dr. Sara H. Knox (Department of Geography, UBC)
Dr. Monica Garcia (Department of Environmental Engineering, Technical University of Denmark)
Dr. Paulo Brando (Earth System Science, University of California, Irvine)