Hao-Chih Lin (林浩之)

R3034, No. 128, Sec. 2, Academia Rd., Nangang Dist., Taipei City, Research Center for Environmental Changes, Academia Sinica 115201, Taiwan.
Office Tel: +886-2-2787-5834
Mobile: +886-965-071-760
Email: yuki781117@gate.sinica.edu.tw
Lab website link: https://rcec.sinica.edu.tw/index.php?action=member&id=125

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EDUCATION

2019/04 – 2022/03 Ph.D. Graduate School of Engineering, Kobe University, Japan
2012/07 – 2014/08 M.S. Depart. of Natural Resources and Environmental Studies, National Dong-Hwa University, Taiwan
2008/09 – 2012/06 B.A. Depart. of Life Science, Tunghai University, Taiwan

EMPLOYMENT

2022/04 - 2023/04 Postdoctoral Fellow Depart. of Geography, National Taiwan University, Taiwan
2015/09 - 2018/01 Research Assistant Biodiversity Research Center, Academia Sinica, Taiwan

HONORS & AWARDS

2021 Outstanding Discussion Award, Japan Society of Civil Engineers 66th Hydraulic Engineering Conference. https://committees.jsce.or.jp/hydraulic/node/210
2022 Belmont Soils 2020 International Scholars Program, Belmont Forum. https://www.czen.org/content/awards

RESEARCH INTEREST

My research is centered within the fields of limnology, ecohydrology, and biogeochemistry, with a longstanding focus on understanding the effects of extreme climate events, such as typhoons, on the dynamics of carbon (C) and nitrogen (N) fluxes within ecosystems. Specifically, I'm particularly interested in examining how these events impact the horizontal transfer of C and N from terrestrial environments to aquatic ecosystems. My work is currently divided into three main areas of study: (1) The Influence of Typhoon disturbances on primary production in freshwater ecosystems: In this research, I employ a 3D hydraulic model to estimate the distribution of C and N within water bodies. By considering factors like hydraulic retention and thermal stratification, I aim to understand how

typhoon disturbances affect primary production in freshwater ecosystems. This study sheds light on the resilience of these ecosystems in the face of extreme weather events. (2) Next, my work involves investigating soil quality and resilience in constructed wetlands across subtropical and tropical regions in Taiwan. This research is compared the soil quality between younger and older constructed wetlands, helping us more understand the benefits of ecosystem services and C and N cycling in constructed wetlands. (3) I'm focusing on the greenhouse gases (GHGs) emission by using chamber method in paddy and cabbage farms, considering the physical, hydrological, bacteria compositions and biogeochemical processes. These studies contribute to a clearer understanding of how C and N fluxes are influenced by extreme climate events and their implications for ecosystem services in aquatic ecosystems.

我的研究領域涵蓋湖沼學、生態水文學和生物地球化學，長期以來我一直對颱風和其他極端氣候事件對碳、氮通量在生態系統中的影響深感興趣，特別是從陸地到水生態系統水平可溶性碳、氮的輸入。目前我主要專注於兩個研究領域：（1）颱風干擾對淡水生態系統初級生產的影響。我使用三維水力模型來估計水體內碳的垂直分佈和滯留時間(residence time)，以考慮颱風期間水體內的混合(vertical mixing)、分層(thermal stratification)、及更新(water renewal)，從而獲得初級生產的估算值。（2）另外我也調查人工溼地的土壤品質 (soil quality)，並從調查資料中比較台灣亞熱帶到熱帶地區人工濕地的恢復力(resilience)。（3）目前正在使用氣室量測法(chamber method)調查霧峰稻米和甘藍田的溫室氣體排放量與土壤微生物菌相。這些研究有助於我們澄清物理、水文和生物地球化學過程對溼地生態系之碳、氮通量及生態系服務的影響。

RESEARCH HIGHLIGHTS

1. **Typhoon disturbances impact on primary production in aquatic ecosystems**

   My work involves using a 3D hydraulic model (Fantom) alongside data on water quality, climate, and bathymetry to simulate how typhoon disturbances affect primary production in small lakes and coastal lagoons [1,2]. Through this research, I've achieved two main goals. (1) I've developed a conceptual model that considers both physical and biogeochemical processes, giving us a better understanding and prediction of primary production. (2) I've used this model to estimate carbon fluxes over multiple years, comparing typhoon and non-typhoon years in a small mountain lake [3]. These findings help us understand how typhoon disturbances impact primary production in aquatic ecosystems.

   Reference: [1] Lin et al, 2021 and 2022. [2] Nakayama et al.2020 and 2022. [3] Lin et al, 2023.

2. **The resilience of soil quality in constructed wetlands**

   Constructed wetlands, an ecological engineering technique widely used in recent decades to treat anthropogenic wastewater. These wetlands use aquatic plants to absorb nutrients such as nitrogen and phosphorus from water. However, there's a lack of information about soil carbon dynamics in

constructed wetlands, especially in subtropical regions where data is rare. To bridge this knowledge gap, my current research involves comparing older (~20 years old) and younger (~5-10 years old) constructed wetlands in terms of carbon fluxes, soil quality, and soil degradation. This study aims to provide a better understanding of the additional ecological benefits and values that constructed wetlands might offer aside from wastewater treatment.

3. The regimes of greenhouse gases (GHGs) emission, soil chemical, and microorganism compositions in agriculture ecosystems

According to Taiwan's greenhouse gas emissions inventory, agriculture emits around 3,200 kilotons-CO_2 equivalent, with rice cultivation, farming practices, and fertilization contributing about half of the total agricultural greenhouse gas emissions. To reduce greenhouse gas emissions from agriculture, we use an automated closed chamber system to monitor gas emissions from rice paddy. We also investigate soil chemical and microbial changes in farmlands soil to clarify emission regimes and further provide effective nature-based solutions (NbS).

1. 颱風擾動對水生態系統初級生產量之影響

我的研究涉及使用三維水體模型（Fantom）以及水質、氣候和水底地形數據，模擬颱風擾動對小湖泊及沿海潟湖的初級生產的影響[1,2]。通過這項研究，我實現了兩個主要目標。 (1) 我建立了一個綜合模型，考慮了物理和生物地球化學過程，使我們更好地理解和預測初級生產。 (2) 我使用這個模型估算多年來高山湖泊(鴛鴦湖)的碳通量，從中比較了颱風年和非颱風年[3]。這些研究結果有助於我們了解颱風干擾如何影響水生態系統的初級生產量。參考文獻：[1] Lin et al, 2021 and 2022. [2] Nakayama et al.2020 and 2022. [3] Lin et al, 2023.

2. 人工濕地土壤的恢復能力

人工濕地是近幾十年來廣泛使用的生態工程技術，用於處理人為污水。這些濕地水生植物吸收水體中的氮和磷等養分。然而，在全球的人工濕地文獻及數據庫中，亞熱帶地區的資料相對不足，其中台灣濕地土壤碳的動態監測資料更是稀缺。欲理解人工濕地年齡對土壤品質之影響，我的當前研究涉及比較年輕（完工約 2 至 5 年）和年老（完工約 20 年）人工濕地的碳通量與土壤品質情況。從中讓我們理解人工濕地在污水處理以外可能提供的額外生態效益與價值。

3. 農地溫室氣體與土壤微生物的關係

台灣溫室排放清冊表示，農業約釋放 3,200 千公噸二氧化碳當量，其中稻田種植、農耕與施肥約占農業溫室氣體總排放的一半。欲降低農業釋放的溫室氣體排放，我們利用自動化密閉氣室系統(automatic closed chamber)監測稻作的氣體排放與調查農田土讓化學、菌相變化，以利釐清農田的排放機制與進一步提供有效地自然為底的解決方案(Nature-based solutions, Nbs)。

REPRESENTATIVE PUBLICATIONS (*: corresponding author)

1. Peng, Y., Nakayama, K.*, Sakaguchi, J., Komai, K., Shimizu, T., Omori, J., Uno, K., Fuji, T., **Lin, H. C.**, Tsai, J. W., Carbon capture and storage in a eutrophic reservoir, *Journal of Geophysical Research: Biogeosciences*, 2024. (Submitted)
2. **Lin, H. C.**, Chang, E. H., Chen, T. K. Shiau, Y. J.*, Influences of age and seasonal changing on soil quality in subtropical constructed wetlands, *Environmental Research*, 2024. (Submitted)
3. **Lin, H. C.**, Nakayama, K. *, Tsai, J. W., Chiu, C. Y., Conceptual models of dissolved carbon fluxes in a two-layer stratified lake: interannual typhoon responses under extreme climates, *Biogeosciences*, October, 2023. https://doi.org/10.5194/bg-20-4359-2023
4. Nakamoto, K., Nakayama. *, K., Komai, K., Matsumoto, H., Watanabe, K., Kubo, A., Tada, K., Maruya, Y., Yano., S., Tsai, J. W., **Lin, H. C.**, Vilas, M., Hipsey, M., A spatially integrated dissolved inorganic carbon (SiDIC) model for aquatic ecosystems considering submerged vegetation, *Journal of Geophysical Research: Biogeosciences*, e2022JG007032, February, 2023. https://doi.org/10.1029/2022JG007032
5. Nakayama, K. *, Kawahara, Y., Kurimoto, Y., Tada, K., **Lin, H. C.**, Hung, M. C., Tsai, J. W. * Effects of oyster aquaculture on carbon capture and removal in a tropical mangrove lagoon in southwestern Taiwan. *Science of The Total Environment*, 838, 156460, September, 2022. https://doi.org/10.1016/j.scitotenv.2022.156460
6. **Lin, H. C.**, Chiu, C. Y. *, Tsai, J. W., Tada, K., Matsumoto, H., Nakayama, K*, Hydraulic retention effect and typhoon disturbance impact carbon flux in shallow subtropical mountain lakes. *Science of the Total Environment*, Vol 803, No. 10, January, 2022. https://doi.org/10.1016/j.scitotenv.2021.150044
7. **Lin, H. C.**, Chiu, C. Y., Tsai, J. W., Liu, W. C., Tada, K., Nakayama, K. *, Influence of thermal stratification on seasonal net ecosystem production and dissolved inorganic carbon in a shallow subtropical lake, *Journal of Geophysical Research: Biogeosciences*. Vol. 126, No. 4, e2020JG005907, March, 2021. https://doi.org/10.1029/2020JG005907
8. **Lin, H. C. ***, Nakayama, K., Effect of typhoon on carbon flux in a shallow stratified lake, Journal of *Japan Society of Civil Engineers Ser B1 (Hydraulic Engineering)*, Vol. 77, No. 2, August, 2021. https://doi.org/10.2208/jscejhe.77.2_I_1051
9. Nakayama, K. *, Komai, K., Tada, K., **Lin, H. C.**, Yajima, H., Yano, S., Tsai, J. W., Modeling dissolved inorganic carbon considering submerged aquatic vegetation. *Ecological Modelling*, Vol. 431, 109188, June, 2020. https://doi.org/10.1016/j.ecolmodel.2020.109188
10. Chiu, C. Y., Jones, J. R., Rusak, J. A., **Lin, H. C.**, Nakayama, K., Kratz, T. K., Tsai, J. W.*, Terrestrial loads of dissolved organic matter drive inter-annual carbon flux in subtropical lakes during times of drought. *Science of the Total Environment*, Vol.717, 137052, February, 2020. https://doi.org/10.1016/j.scitotenv.2020.137052

Others (Conferences)

H. C. Lin, Y. J. Shiau, Taiwan's mangrove blue carbon: Assessing its role for a sustainable environment. *NTU and UTokyo Joint Conference*, Taipei, TW, Dec. 2023. (Oral)

H. C. Lin, K. Nakayama, C. Y. Chiu, J. W. Tsai. Developing a Two-Layer Conceptual Model for Monthly DIC and DOC Concentrations Considering Interannual Typhoon Responses in a Small Subtropical Lake in Taiwan. *American Geophysical Union (AGU) Fall Meeting*, Chicago. Dec. 2022. (Oral)

A. S. Wymore, H. Fazekas, J. C. Huang, **H. C. Lin**, M. Maerker, W. H. McDowell, Y. Onda, E. M. Parker. Stoichiometry-discharge relationships reveal the balance of energy and nutrient availability across watersheds. *American Geophysical Union (AGU) Fall Meeting*, Chicago. Dec. 2022. (co-author)