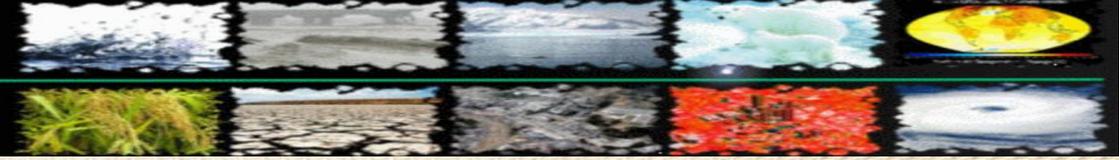




水文遙測實驗室  
Hydrology Remote Sensing Lab.



# Horizon 2020: Coordination of citizens' observatories initiatives

**Dr. Yuei-An Liou 劉說安**

Professor Academician, [yueian@csrsr.ncu.edu.tw](mailto:yueian@csrsr.ncu.edu.tw)

• **Hydrological Remote Sensing Laboratory (HRSL)**

• **Center for Space and Remote Sensing Research, National Central Univ.**

Foreign Member, Academy of Engineering Sciences, Russian Federation;

Member, International Academy of Astronautics

Honorary President, **Taiwan Group on Earth Observations**

President, Taiwan GIS Center (<http://www.tgic.org.tw/>)

• **Google Scholar:** <http://scholar.google.com.tw/citations?user=ejgPYzIAAAAJ&hl=zh-TW>

• **ResearchGate:** [https://www.researchgate.net/profile/Yuei-An\\_Liou](https://www.researchgate.net/profile/Yuei-An_Liou)

• **Wiki/維基百科:** <https://zh.wikipedia.org/wiki/劉說安> [https://en.wikipedia.org/wiki/Yuei-An\\_Liou](https://en.wikipedia.org/wiki/Yuei-An_Liou)

Call number: H2020-SC5-2016-2017

## Record for Continental United States

Professor Ricky Rood shares his expertise with the media



<h3>Upcoming Events</h3> <p>February 19th 3:30 pm - 4:30 pm Weekly Seminar</p> <p>February 19th 5:30 pm - 6:30 pm AOSS Open House</p> <p>February 21st 3:30 pm - 4:30 pm Weekly Seminar</p> <p>February 26th 3:30 pm - 4:30 pm Weekly Seminar</p> <p><a href="#">More Events</a></p>	<h3>In the News</h3> <p><b>AOSS SPOTLIGHT</b> <b>Dr. Yuei-An Liou: Alumnus Spotlight</b></p>  <p>Alumnus Dr. Yuei-An Liou is a professor at the National Central University in Taiwan and is President of the Taiwan Group on Earth Observations.</p> <p>Liou is recognized internationally for his work in leading remote sensing research.</p> <p>Liou says his favorite memory from AOSS is the kindness of the community.</p> <p><a href="#">Full Spotlight</a></p>	<h3>AOSS on the Web</h3> <p><a href="#">f</a> <a href="#">t</a> <a href="#">in</a> <a href="#">p</a> <a href="#">v</a> <a href="#">y</a></p> <p><b>Daily Planet</b> Get the latest on AOSS and SPRL activities</p> <p><b>Jobs for Grads</b> Find out who's hiring in the industry</p>
<h3>Popular Pages</h3> <ul style="list-style-type: none"> <li>Graduate Studies</li> <li>Research Experience for Undergraduates (REU) at the U-M Department of Atmospheric, Oceanic and Space Sciences</li> <li>Graduate MEng Program - Space Engineering</li> <li>Undergraduate Studies</li> <li>Atmospheric Sciences</li> </ul>	<h3>2013 Leaders and Honors Award Recipients</h3> <p>Congratulations to the following students who earned Leaders and Honors Awards from the College:</p> <p>Alex Bryan, Distinguished Leadership Award Guangxing Lin, Towner Prize for Distinguished Academic... (more)</p> <p><b>Alumnus Kevin Reed receives honorable mention for dissertation</b></p>	<h3>AOSS Blogroll</h3> <p><b>Climate Science</b></p> <ul style="list-style-type: none"> <li>Rick Rood Climate Change</li> <li>Ricky Rood Climate Policy</li> </ul> <p><b>Space Science</b></p> <ul style="list-style-type: none"> <li>Mark Moldwin "From the Field" Science Blog (Encyclopedia Britannica)</li> </ul> <p><b>General Interest</b></p> <ul style="list-style-type: none"> <li>Aaron Ridley Personal Blog</li> </ul>

# WHERE ARE WE FROM?

Madrid

✓ 延遲抵達：下午12:35  
抵達：MAD - 航廈：2

上午12:20 → 下午12:15  
出發 (台北) 抵達 (GMT+1)

Taiwan Taoyuan Int'l Airport  
航廈：2，登機門：D6

KLM 808  
上午12:20 TPE → 上午6:55 AMS  
提早 13 分鐘抵達

路線 6JQPQN





**Hydrology Remote Sensing Laboratory**  
**Center for Space and Remote Sensing Research**  
**National Central University, Taiwan**



Head: <https://www.researchgate.net/profile/Yue-An-Liou>

Results of recent 5-year research: <https://scholar.google.com.tw/citations?user=ejgPz1AAAAAJ&hl=zh-TW>

Prof. Academician Yue-An Liou was awarded double PhD in Electrical Engineering and Atmospheric, Oceanic and Space Sciences at University of Michigan. In 1996, he established Hydrology Remote Sensing Laboratory at CSRSP, NCU. His main research is to apply aerospace science and remote sensing technology to environmental issues, including urban heat island, hydrological cycles, natural hazards, eco-environment, etc. For the purpose of improving environmental sustainability by means of remote sensing technology, it is required to integrate multiple sensors to receive multi-scale remoted data. Based on the imagery data, further information can be extracted with data processing and image analyses with other observation data and geographical information systems. To elaborate effectiveness of remote sensing, by combining with respective physical models like atmospheric, land-use, hydrologic or statistical models, environmental sustainability, impacts and trends can be further analyzed and estimated.



Academician & Distinguished Professor  
 Yue-An Liou

Research: <https://www.researchgate.net/profile/Yue-An-Liou>

- Applications of advanced airborne and spaceborne remote sensing to key environmental issues such as carbon sequestration in urban area, heat island, hydrological cycles, as well as natural hazards.
- Integration of multiple sensors to take data with multiple scales and multiple physical measures, such as multispectral, hyperspectral, microwave, thermal, as well as LIDAR sensors.
- Development of various approaches of data processing and image analysis to extract information for subsequent entry to statistical or physical models to monitor the properties and trends of the environmental issues.
- Applications of GNSS radio occultation (RO) remote sensing data to study earth's atmosphere and ionosphere research for improving weather forecast and space weather prediction, and improvements of their data processing schemes.

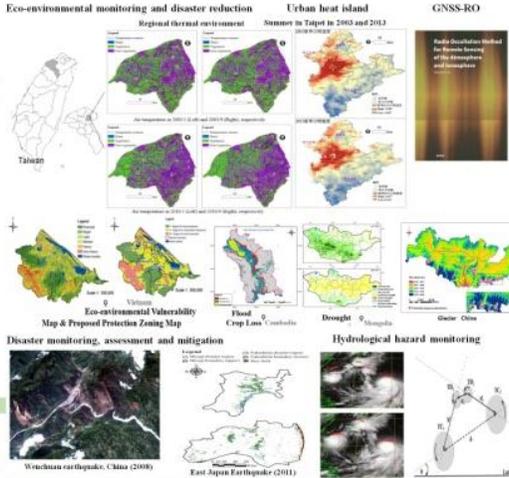
Members:



Graduate Students:



Equipment:



Publications: <https://scholar.google.com.tw/citations?user=ejgPz1AAAAAJ&hl=zh-TW>

- Liou, Y.-A., J.-C. Liu, et al. 2016. Generalized empirical formulas of threshold distance to characterize cyclone-cyclone interactions. *IEEE Transactions on Geoscience and Remote Sensing*, Volume 54, Issue 6, pp. 3502-3512.
- Nguyen, A. K., Y.-A. Liou\*, M.-H. Li, and T. A. Tran. 2016. Zoning eco-environmental vulnerability for environmental management and protection. *Ecological Indicators*, 69: 149-117.
- Cheng, C.-H., F. Nishii, Y.-A. Liou\*. 2015. A regional land use drought index for Florida. *Remote Sensing*, 7(12), 17140-17167.
- Dao, Phuong D. and Y.-A. Liou\*. 2015. Object-based flood mapping and affected rice field estimation with Landsat 8 OLI and ALOS-2 data. *Remote Sensing*, 7(5), 5077-5097.
- Paredy, A.G., Y.-A. Liou\*, et al. 2015. Application of the locality principle to radio occultation studies of the Earth's atmosphere and ionosphere. *Atmospheric Measurement Techniques*, 8, 2885-2899.
- Liou, Y.-A.\* and S. K. Kim. 2014. Evapotranspiration estimation with remote sensing and various surface energy balance algorithms - a review. *Energy*, 2014, 7(35), 2821-2849, doi: 10.1016/j.energy.2014.05.021.

International Activities and Collaborations: <http://www.iceo-sl.org.tw/>



Address: No. 300, Zhongda Rd., Zhongli District, Taoyuan City 32001, Taiwan  
 TEL: +886-3-4227111 ext. 57689 <http://ncu.edu.tw>  
 Contact: Nguyen Kim Anh: [kimanh.nguyen2010@icloud.com](mailto:kimanh.nguyen2010@icloud.com); Le Mai Son: [liouan2603@gmail.com](mailto:liouan2603@gmail.com)

# WHO WE ARE?

## Hydrological Remote Sensing Laboratory (HRSL)



# SNOWFALL IN TAIWAN

---



An Unusual Snowfall Event in January 2016

# TASKS TO DO?

---

- **Collect and analyze historical snowfall events in Taiwan and relevant remote sensing data, especially for the 2016 snowfall case: mobile phone, camera, drone/UAV, airborne, satellite; citizens' views, preparedness.**
- **Establish a Web-GIS platform to share snowfall database for community users.**
- **Incorporate bio-physically based land surface model with snow model for characterizing land/snow-air interactions; implement data assimilation schemes.**
- **Use remote sensing data to monitor and detect snow properties, coverage, density, and water equivalent, ...etc, including active (satellite & airborne) and passive microwave, optical (Landsat, Sentinel 2 ...; Drones).**
- **Assess eco-environmental vulnerability (potential damage and loss in agriculture, fishery) especially associated with snowfall 2016, and propose recommendations to the authorities for further actions.**

THANKS

---

QUESTIONS?

# RESEARCH TOPICS & PLANS

- **Our recent research interests include:**
- **1.1 Applications of advanced airborne and spaceborne remote sensing** to key environmental issues, such as **carbon sequestration in urban area, heat island, hydrological cycles**, as well as **natural hazards**. It is required to have an integration of **multiple sensors** to take data with multiple scales and multiple physical measures, such as multispectral, hyperspectral, microwave, thermal, as well as LiDAR sensors.
- **1.2 Applications of GNSS radio occultation (RO)** remote sensing data to study **earth's atmosphere and ionosphere research** for improving weather forecast & space weather prediction; & improvements of their processing schemes.
- This requires handling of **geospatial information** by geographical information systems. Various approaches of **data processing and image analysis** are then adopted to extract information for subsequent entry to **statistical or physical models** to monitor the properties and trends of the environmental issues. Remote sensing technologies are new enabling technologies, which enable us to care for our living environment to achieve the sustainability.

# SPONSORS

**Hydrology Remote Sensing Laboratory (HRSL) has been continuously thriving and developing based on the solid support from:**

- ✓ **Ministry of Science and Technology,**
- ✓ **Hakka Affairs Council**
- ✓ **National Applied Research Laboratory (National Space Organization), Dept. of Land Administration (Ministry of Interior),**
- ✓ **Water Resources Agency (Ministry of Economic Affairs),**
- ✓ **Civil Aeronautics Administration (Ministry of Transportation and Communications), Ministry of Education, Academia Sinica,**
- ✓ **Office of Naval Research (USA), and National Science Foundation and other units.**

# RESEARCH CAPACITY & WORKFORCE

- MEMBERS, PROJECTS, SCHOLARSHIP,
  - EQUIPMENT
1. Satellite Payloads
  2. Airborne Sensors
  3. In-situ Instruments: Bowen Ratio Evaporation Measuring (Evapotranspiration, Surface heat flux ...); GNSS Receivers; ...



# RESEARCH DIRECTION

Recent 5-year publications

- Disaster (1/4)
- Hydrological process remote sensing (2/4)
- Damage assessment (3/4)
- GNSS radio occultation remote Sensing(4/4)

# (1/4) DISASTER

1.1 Use of high-resolution Formosat-2 satellite images for post-earthquake disaster assessment: A study following 12 May 2008 Wenchuan earthquake.

1.2 Analysis of interactions among two tropical depressions and typhoons Tembin and Bolaven (2012) in Pacific Ocean by using satellite cloud images.

1.3 Changes in glaciers and glacial lakes and the identification of dangerous glacial lakes in the Pumqu river basin, Xizang (Tibet).

1.4 Observing land subsidence and revealing the factors that influence it using a multi-sensor approach in Yunlin county, Taiwan.

# (2/4) HYDROLOGICAL PROCESS REMOTE SENSING

**2.1 Evapotranspiration estimation through remote sensing and various surface energy balance algorithms – a review**

**2.2 Energy budget on various land use areas using reanalysis data in Florida**

**2.3 Estimation of Root Zone Soil Moisture using Apparent Thermal Inertia with MODIS Imagery over the Tropical Catchment of Northern Thailand**

**2.4 Impacts of Pond Change on the Regional Sustainability of Water Resources in Taoyuan, Taiwan**

**2.5 Vanishing ponds and regional water resources in Taoyuan, Taiwan**

**2.6 Evaluation of surface heat fluxes in Chiayi plain of Taiwan by remotely sensed data**

**2.7 Terrain correction for increased estimation accuracy of evapotranspiration in a mountainous watershed**

**2.8 On the Relationship between LULC Changes and Regional Thermal Environment in Taoyuan, Taiwan**

## (3/4) ECO-ENVIRONMENT & DAMAGE ASSESSMENT

3.1 Assessment of disaster losses in rice field and yield after tsunami induced by the 2011 Great East Japan earthquake

3.2 Object-based flood mapping and affected rice field estimation with Landsat 8 OLI and MODIS data, central Taiwan

3.3 Zoning eco-environmental vulnerability for environmental management and protection

3.4 Eco-environmental vulnerabilities and influential factors by remote sensing data

# (4/4) GNSS radio occultation remote Sensing

**4.1 World Rank Top 5, most scientific products in radio occultation research by International Radio Occultation Working Group (IROWG)**

# REFERENCES - 1/4

2016 (5篇, 5 SCI / 4 correspondence) [(IF = 15.915 (2016))]

Munkhzul Dorjsuren, Y.-A. Liou\*, Chi-Han Cheng, 2016: Time series MODIS and in-situ data analysis for Mongolia drought, *Remote Sensing*. 2016; 8(6):509; doi:10.3390/rs8060509. (<http://www.mdpi.com/2072-4292/8/6/509>) [Miss Dorjsuren is a PhD student of Prof. Liou] **(SCI, IF=3.18)**

Nguyen, K. A., Y.-A. Liou\*, M.-H. Li, and A. T. Tran, 2016: Zoning eco-environmental vulnerability for environmental management and protection. *Ecological Indicators*, 69(2016), 100-117, <http://dx.doi.org/10.1016/j.ecolind.2016.03.026>. [Miss Nguyen is a PhD student of Prof. Liou] **(SCI, IF=3.444)**

Kuleshov, Y., S. Choy, E. F. Fu, F. Chane-Ming, Y.-A. Liou, and A. G. Pavelyev, 2016: Analysis of meteorological variables in the Australasian region using ground- and space-based GPS Techniques. *Atmospheric Research*, 147-148, 111–120, doi: <http://dx.doi.org/10.1016/j.atmosres.2016.02.021>. **(SCI, IF=2.844)**

(<http://www.sciencedirect.com/science/article/pii/S0169809516300382>)

Liou, Y.-A.\*, J.-C. Liu, Meng-Xi Wu, Chi-Han Cheng, Ching-Ping Kuei, and Rong-Moo Hong, 2016: Generalized empirical formulas of threshold distance to characterize cyclone-cyclone interactions. *IEEE Transactions on Geoscience and Remote Sensing*, 54(6), 3502-3512, doi:[10.1109/TGRS.2016.2519538](https://doi.org/10.1109/TGRS.2016.2519538). **(SCI, IF=2.933)**

(<http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7401024>)

Wang, Z. Y., T. Che, and Y.-A. Liou\*, 2016: Global Sensitivity Analysis of the L-MEB Model for Retrieving Soil Moisture. *IEEE Transactions on Geoscience and Remote Sensing*. PP, 1–14, doi:[10.1109/TGRS.2015.2509176](https://doi.org/10.1109/TGRS.2015.2509176). **(SCI, IF=3.514)**

(<http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7389400>)

# REFERENCES - 2/4

2015 (8篇,8 SCI /7 correspondence) [(IF = 20.088 (2015))]

- Cheng, C.-H., F. Nnadi, Y.-A. Liou\*, 2015: A Regional Land Use Drought Index for Florida, *Remote Sensing*, 7(12), 17149–17167, doi:10.3390/rs71215879. **(SCI, IF=3.18)** (<http://www.mdpi.com/2072-4292/7/12/15879/pdf>)
- Hsu, Wei-Chen, Hung-Cheng Chang, Kuan-Tsung Chang, En-Kai Lin, Jin-King Liu, and Y.-A. Liou\*, 2015: Observing Land Subsidence and Revealing the Factors That Influence It Using a Multi-Sensor Approach in Yunlin County, Taiwan, *Remote Sensing*, 7, 8202-8223, doi: 10.3390/rs70608202. **(SCI, IF=3.18)** (<http://www.mdpi.com/2072-4292/7/6/8202/htm>)
- Liou, Y.-A.\*, C. T. Lee, C. R. Ho, and M. H. Li, 2015: Preface to the special issue on “Earth Observations and Societal Impacts”. *Terrestrial, Atmospheric and Oceanic Sciences*, 26, I-II, doi: 10.3319/TAO.2014.10.07.01(EOSI). **(SCI, IF=0.703)** ([https://www.researchgate.net/profile/Yuei-An\\_Liou/publication/277022187\\_Preface\\_to\\_the\\_Special\\_Issue\\_on\\_\\_Earth\\_Observations\\_and\\_Societal\\_Impacts\\_/links/555ff91608ae9963a118b78b.pdf](https://www.researchgate.net/profile/Yuei-An_Liou/publication/277022187_Preface_to_the_Special_Issue_on__Earth_Observations_and_Societal_Impacts_/links/555ff91608ae9963a118b78b.pdf))
- Liou, Y.-A.\*, H. L. Liu, T. S. Wang, and C. H. Chou, 2015: Vanishing ponds and regional water resources in Taoyuan, Taiwan. *Terrestrial, Atmospheric and Oceanic Sciences*, 26(2), 161-168, doi: 10.3319/TAO.2014.12.02.01(EOSI). **(SCI, IF=0.703)** (<http://tao.cgu.org.tw/pdf/v262-IIp161.pdf>)
- Dao, Phuong D. and Y.-A. Liou\*, 2015: Object-based Flood Mapping and Affected Rice Field Estimation with Landsat 8 OLI and MODIS Data. *Remote Sensing*, 7(5), 5077-5097, doi: 10.3390/rs70505077. [Mr. Dao is a MS student of Prof. Liou.] **(SCI, IF=3.18)** (<http://www.mdpi.com/2072-4292/7/5/5077/pdf>)

# REFERENCES - 3/4

- Pavelyev, A.G., **Y.-A. Liou\***, S. S. Matyugov, A.A. Pavelyev, V. N. Gubenko, K. Zhang, and Y. Kuleshov, 2015: Application of the locality principle to radio occultation studies of the Earth's atmosphere and ionosphere, *Atmospheric Measurement Techniques*, 8, 2885–2899, doi: 10.5194/amtd-8-2885-2015. **(SCI, IF= 2.929)** (<http://www.atmos-meas-tech.net/8/2885/2015/amt-8-2885-2015.pdf>)
- Li, W., Y.-B. Yuan, J.-K. Ou, Y.-J. Chai, Z.-S. Li, **Y.-A. Liou**, and N.-B. Wang, 2015: New versions of the BDS/GNSS zenith tropospheric delay model IGGtrop, *Journal of Geodesy*, 89, 73–80, 2015, doi: 10.1007/s00190-014-0761-5. **(SCI, IF= 2.699)** (<http://link.springer.com/article/10.1007/s00190-014-0761-5>)
- Liu, Ji-Chyun, **Y.-A. Liou\***, Meng-Xi Wu, Yueh-Jyun Lee, Chi-Han Cheng, and Ching-Ping Kuei, 2015: Analysis of interactions among two tropical depressions and typhoons Tembin and Bolaven (2012) in Pacific Ocean by using satellite cloud images. *IEEE Transactions on Geoscience and Remote Sensing*, 53(3), 1394-1402, doi: 10.1109/TGRS.2014.2339220. **(SCI, IF=3.514, RF=15/249) 2014 (8篇, 8 SCI/6 correspondence)[3](IF = 15.583 (2014))**
- Yeh, W.-H., C.-Y. Huang, T.-C. Chiu, M.-Q. Chen, J.-Y. Liu, and **Y.-A. Liou**, 2014: Ray tracing simulation in nonspherically symmetric atmosphere for radio occultation, *Terrestrial, Atmospheric and Oceanic Sciences*, Vol. 25, No. 6, 801-812, December 2014. doi: 10.3319/TAO.2014.07.07.01(A). **(SCI, IF=0.703)** (<http://tao.cgu.org.tw/pdf/v256p801.pdf>)
- Kar, S. K. and **Y.-A. Liou\***, 2014: Analysis of cloud-to-ground lightning and its relation with surface pollutants over Taipei, *Taiwan. Annales Geophysicae*, 32, 1–8, 2014, doi: 10.5194/angeo-32-1-2014. **(SCI, IF=1.709)** (<http://ann-geophys.net/32/1085/2014/angeo-32-1085-2014.pdf>)
- Liou, Y.-A.\***, C.-R. Ho, Y. Kuleshov, and J.-P. Barriot, 2014: Editorial - Earth Observations and Societal Impacts. *Advances in Meteorology*, 2014, Article ID 619203, 3 pages, <http://dx.doi.org/10.1155/2014/619203>. **(SCI, IF=0.946)** (<http://www.hindawi.com/journals/amete/2014/619203/>)

# REFERENCES - 4/4

Kar, S.K. and **Y.-A. Liou\***, 2014: Enhancement of cloud-to-ground Lightning activity over Taipei, Taiwan in relation to urbanization. *Atmospheric Research*, 147-148, 111–120, doi: 10.1016/j.atmosres.2014.05.017 **(SCI, IF=2.844)** (<http://dx.doi.org/10.1016/j.atmosres.2014.05.017>)

**Liou, Y.-A.\*** and S. K. Kar, 2014: Evapotranspiration estimation with remote sensing and various surface energy balance algorithms – a review, *Energies*, 2014, 7 (5), 2821-2849; doi: 10.3390/en7052821. **(SCI, IF=2.436)** (<http://www.mdpi.com/1996-1073/7/5/2821>)

Cheng, C.-H., F. Nnadi, and **Y.-A. Liou\***, 2014: Energy budget on various land use areas using reanalysis data in Florida, *Advances in Meteorology*, 2014, Article ID 232457, 13 pages, <http://dx.doi.org/10.1155/2014/232457>. **(SCI, IF=0.946)** [Mr. Cheng is a former graduate student of Prof. Liou.] (<http://www.hindawi.com/journals/amete/2014/232457/>)

Che, Tao, Lin Xiao, and **Y.-A. Liou\***, 2014: Changes in glaciers and glacial lakes and the identification of dangerous glacial lakes in the Pumqu river basin, Xizang (Tibet), *Advances in Meteorology*, 2014, Article ID 903709, 8 pages, doi: 10.1155/2014/903709 **(SCI, IF=0.946)** (<http://www.hindawi.com/journals/amete/2014/903709/>)

Chan Ming, F., C. Ibrahim, C. Barthe, S. Jolivet, P. Keckhut, **Y.-A. Liou**, and Y. Kuleshov, 2014: Observation and a numerical study of gravity waves during tropical cyclone Ivan (2008), *Atmospheric Chemistry and Physics*, 14, 641-658, doi:10.5194/acp-14-641-2014. **(SCI, IF=5.053)** (<http://www.atmos-chem-phys.net/14/641/2014/acp-14-641-2014.pdf>)