PIERRE GENTINE
Maurice Ewing and J. Lamar Worzel Professor
Department of Earth and Environmental Engineering
Department of Earth and Environmental Sciences
Columbia University
500 West 120th Street, Mudd 842C, New York, NY 10027
Phone: (347) 401 0345, Fax: (212) 854 7081
Email: pg2328@columbia.edu
Orcid: https://orcid.org/0000-0002-0845-8345
https://scholar.google.com/citations?user=1KXRphAAAAAJ&hl=en

FIELDS OF SPECIALIZATION

- Continental hydrological and carbon cycles, with a focus on machine learning, remote sensing, and turbulence.

EDUCATION

2007-2010	Ph. D., Civil and Environmental Engineering, Massachusetts Institute of Technology Advisor: Dr. Dara Entekhabi Dissertation Title: Spectral behavior of the land-atmosphere system
2004-2006	M.Sc., Civil and Environmental Engineering, Massachusetts Institute of Technology
1997-2002	M.Eng. – "Ingénieur" degree SupAéro – French National Aeronautical and Space Engineering school, Applied Mathematics, Toulouse, France

PROFESSIONAL RECORD

2021-	Director, National Science Foundation Science and Technology Center (STC) Learning the Earth with Artificial intelligence and Physics (LEAP), Columbia University
2021-	Maurice Ewing and J. Lamar Worzel Professor of Geophysics, Columbia University
2021-	Full Professor, Columbia University
2018-	Faculty member, Earth Institute, Columbia University (by nomination)
2018-	Faculty member, Data Institute, Columbia University (by nomination)
2017-	Tenured Associate Professor, Earth and Environmental Engineering, Columbia University
2016-2017	Associate Professor, Earth and Environmental Engineering, Columbia University
2013-2017	Junior faculty, Earth Institute, Columbia University (by nomination)
2011-2016	Assistant Professor, Earth and Environmental Engineering, Columbia University

2009-2011	Instructor, Applied Physics and Applied Mathematics, Columbia University
2006-2007	Quantitative Engineer – Natixis equity derivatives
2002-2004	Engineer – French Space Agency (CNES)

HONORS AND AWARDS

- ISI Highly Cited Researcher (2023)
- Columbia Provost Leadership fellow (2023)
- American Geophysical Union (AGU) Macelwane medal (2022)
- Fellow, American Geophysical Union (AGU) (2022)
- Humboldt award (2021 – declined offer)
- National Science Foundation Science and Technology Center (STC) award (2021)
- Maurice Ewing and J. Lamar Worzel endowed professorship (2021)
- European Research Council Synergy Award (2019)
- Columbia University nominated candidate for the 2019 Blavatnik award
- American Geophysical Union (AGU)
  Global Environmental Change Early Career Award (2017)
- American Meteorological Society (AMS) Clarence Meisinger Award (2017)
- Invited scientist at ECMWF (European Centre for Medium range Weather Forecast - 2016)
- NSF CAREER award (2016)
- Department of Energy (DOE) Early Career award (2015)
- NASA New Investigator Program (early career) award (2014)
- Excellence in refereeing – Geophysical Research Letters (2013)
- Invited professorship award – Wageningen University (2013)
- Invited professorship award – Ecole Normale Superieure (2012)
- Shoettler fellowship MIT (2004-2006)

PUBLICATIONS: (H-index 62 - Google Scholar – 08/2023)

Students are in bold red, Post-Docs are <u>underlined</u>, co-advised students are in bold and italic

In press/published

1. Y Liu, S Le, Y Zou, M Sadgedhi, Y Chen, N Andela, **P Gentine**, 2023, A Simplified Machine Learning Based Wildfire Ignition Model from Insurance Perspective, ICLR 2023 Workshop on Tackling Climate Change with Machine Learning
2. Z Zeng, W Wu, Y Li, C Huang, X Zhang, J Peñuelas, Y Zhang, **P Gentine**, 2023, Increasing meteorological drought under climate change reduces terrestrial ecosystem productivity and carbon storage, One Earth 6 (10), 1326-1339
3. LR Vargas Zeppetello, KA McColl, JA Bernau, BB Bowen, LI Tang, **P Gentine**, 2023, Apparent surface conductance sensitivity to vapour pressure deficit in the absence of plants, Nature Water, 1-11
4. J Lin, S Yu, T Beucler, **P Gentine**, D Walling, M Pritchard, 2023, Systematic Sampling and Validation of Machine Learning-Parameterizations in Climate Models, arXiv preprint arXiv:2309.16177
5. ***F Immorlano***, V Eyring, TM de Gouville, G Accarino, D Elia, G Aloisio, **P Gentine**, 2023, Transferring climate change knowledge, arXiv preprint arXiv:2309.14780

6. MA Bhouri, L Peng, MS Pritchard, **P Gentine**, 2023, Multi-fidelity climate model parameterization for better generalization and extrapolation, arXiv preprint arXiv:2309.10231
7. W Li, J Pacheco-Labrador, M Migliavacca, D Miralles, A Hoek van Dijke, **P Gentine**, 2023, Widespread and complex drought effects on vegetation physiology inferred from space, Nature Communications 14 (1), 4640
8. ***X Li***, Y Ryu, J Xiao, B Dechant, J Liu, B Li, S Jeong, **P Gentine,** 2023, New-generation geostationary satellite reveals widespread midday depression in dryland photosynthesis during 2020 western US heatwave, Science Advances 9 (31), eadi0775
9. S Xu, **P Gentine**, L Li, L Wang, Q Ju, D Ningpeng, Z Yu, 2023, Response of Ecosystem Productivity to High Vapor Pressure Deficit and Low Soil Moisture: Lessons Learned From the Global Eddy-Covariance Observations, Earth's Future, 11 (8), e2022EF003252
10. ***F Giardina***, P Gentine, AG Konings, SI Seneviratne, BD Stocker, 2023, Diagnosing evapotranspiration responses to water deficit across biomes using deep learning, New Phytologist (in press)
11. W Li, J Pacheco-Labrador, M Migliavacca, D Miralles, A Hoek van Dijke, **P Gentine**, R Orth, 2023 Widespread and complex drought effects on vegetation physiology inferred from space Nature Communications 14 (1), 4640
12. X Li, Y Ryu, J Xiao, B Dechant, J Liu, B Li, S Jeong, **P Gentine,** 2023, New-generation geostationary satellite reveals widespread midday depression in dryland photosynthesis during 2020 western US heatwave, Science Advances 9 (31), eadi0775
13. RK Braghiere, Y Wang, A Gagné-Landmann, PG Brodrick, AA Bloom, **P Gentine**, et al., 2023, The importance of hyperspectral soil albedo information for improving Earth system model projections, AGU Advances 4 (4), e2023AV000910
14. Y Zou, M Sadeghi, Y Liu, A Puchko, S Le, Y Chen, N Andela, **P Gentine**, 2023, Attention-Based Wildland Fire Spread Modeling Using Fire-Tracking Satellite Observations, Fire 6 (8), 289
15. Y Qing, S Wang, ZL Yang**, P Gentine**, 2023, Soil moisture− atmosphere feedbacks have triggered the shifts from drought to pluvial conditions since 1980, Communications Earth & Environment 4 (1), 254
16. **J Nathaniel**, J Liu, **P Gentine**, 2023, MetaFlux: Meta-learning global carbon fluxes from sparse spatiotemporal observations, Scientific Data 10 (1), 440
17. C Shen, AP Appling, **P Gentine**, T Bandai, H Gupta, A Tartakovsky, 2023, Differentiable modelling to unify machine learning and physical models for geosciences, Nature Reviews Earth & Environment, 1-16
18. MA Bhouri, **P Gentine,** 2023, Memory-based parameterization with differentiable solver: Application to Lorenz'96, Chaos: An Interdisciplinary Journal of Nonlinear Science 33 (7)
19. J Buch, AP Williams, CS Juang, WD Hansen, **P Gentine**, 2023, SMLFire1. 0: a stochastic machine learning (SML) model for wildfire activity in the western United States, Geoscientific Model Development 16 (12), 3407-3433
20. S Yu, WM Hannah, L Peng, MA Bhouri, R Gupta, J Lin, B Lütjens, JC Will, **P Gentine**, et al. 2023, ClimSim: An open large-scale dataset for training high-resolution physics emulators in hybrid multi-scale climate simulators, NeurIPS datasets
21. L Gu, J Yin, **P Gentine**, HM Wang, LJ Slater, SC Sullivan, J Chen, 2023, Large anomalies in future extreme precipitation sensitivity driven by atmospheric dynamics, Nature Communications 14 (1), 31
22. Z Zhang, A Cescatti, YP Wang, **P Gentine**, J Xiao, L Guanter, AR Huete, 2023, Large diurnal compensatory effects mitigate the response of Amazonian forests to atmospheric warming and drying, Science Advances 9 (21), eabq4974
23. S Shamekh, KD Lamb, Y Huang, **P Gentine**, 2023, Implicit learning of convective organization explains precipitation stochasticity, Proceedings of the National Academy of Sciences 120 (20), e2216158120

24. **X Xi**, Q Zhuang, S Kim, **P Gentine**, 2023, Evaluating the effects of precipitation and evapotranspiration on soil moisture variability within CMIP5 using SMAP and ERA5 data, Water Resources Research, e2022WR034225
25. ***M Shehata***, **P Gentine**, N Nelson, C Sayde, 2023, Optimization of the number and locations of the calibration stations needed to monitor soil moisture using distributed temperature sensing systems: A proof-of-concept study, Journal of Hydrology 620, 129449
26. F Iglesias-Suarez, **P Gentine**, B Solino-Fernandez, T Beucler, M Pritchard, 2023, Causally-informed deep learning to improve climate models and projections, arXiv preprint arXiv:2304.12952
27. AF Feldman, Z Zhang, Y Yoshida, **P Gentine**, A Chatterjee, D Entekhabi, 2023, A multi-satellite framework to rapidly evaluate extreme biosphere cascades: the Western US 2021 drought and heatwave, Global Change Biology
28. ***A Grundner,*** T Beucler, **P Gentine**, V Eyring, , 2023, Data-Driven Equation Discovery of a Cloud Cover Parameterization, arXiv preprint arXiv:2304.08063
29. B Zhu, Z Deng, X Song, W Zhao, D Huo, T Sun, P Ke, D Cui, C Lu, **P Gentine**, 2023, CarbonMonitor-Power near-real-time monitoring of global power generation on hourly to daily scales, Scientific Data 10 (1), 217
30. **O Skulovich**, **P Gentine**, 2023, A Long-term Consistent Artificial Intelligence and Remote Sensing-based Soil Moisture Dataset, Scientific Data 10 (1), 154
31. Y Zhang, J Fang, WK Smith, X Wang, **P Gentine**, SL Russell, 2023, Satellite solar-induced chlorophyll fluorescence tracks physiological drought stress development during 2020 southwest US drought, Global Change Biology
32. ***RR ElGhawi***, B Kraft, C Reimers, M Reichstein, M Körner, **P Gentine**, 2023, Hybrid modeling of evapotranspiration: inferring stomatal and aerodynamic resistances using combined physics-based and machine learning, Environmental Research Letters 18 (3), 034039
33. ***A Kaps***, A Lauer, G Camps-Valls, **P Gentine**, L Gómez-Chova, V Eyring, , 2023, Machine-learned cloud classes from satellite data for process-oriented climate model evaluation, IEEE Transactions on Geoscience and Remote Sensing 61, 1-15
34. L Gloege, K Kornhuber, O Skulovich, I Pal, S Zhou, P Ciais, **P Gentine**, 2023, Land-Atmosphere Cascade Fueled the 2020 Siberian Heatwave, AGU Advances 3 (6), e2021AV000619
35. Y Li, W Zhang, CR Schwalm, **P Gentine**, WK Smith, P Ciais, JS Kimball, 2023, Widespread spring phenology effects on drought recovery of Northern Hemisphere ecosystems, Nature Climate Change, 1-7
36. X Lian, W Zhao, **P Gentine**, 2022 Recent global decline in rainfall interception loss due to altered rainfall regimes, Nature Communications 13 (1), 7642
37. K Fan, L Slater, Q Zhang, J Sheffield, **P Gentine**, S Sun, W Wu 2022, Climate warming accelerates surface soil moisture drying in the Yellow River Basin, China, Journal of Hydrology 615, 128735
38. KA Schiro, H Su, F Ahmed, N Dai, CE Singer, **P Gentine**, GS Elsaesser, 2022, Model spread in tropical low cloud feedback tied to overturning circulation response to warming, Nature Communications 13 (1), 7119
39. J Buch, AP Williams, CS Juang, WD Hansen, **P Gentine**, 2022, SMLFire1. 0: a stochastic machine learning (SML) model for wildfire activity in the western United States, EGUsphere, 1-39
40. Z Fu, P Ciais, AF Feldman, **P Gentine,** D Makowski, IC Prentice, PC Stoy, 2022, Critical soil moisture thresholds of plant water stress in terrestrial ecosystems, Science Advances 8 (44), eabq7827
41. J Yin, **P Gentine**, L Slater, L Gu, Y Pokhrel, N Hanasaki, S Guo, L Xiong, 2022, Compound drought-heatwave events threaten future socio-ecosystem productivity, Nature Sustainability
42. J Cui, X Lian, C Huntingford, L Gimeno, T Wang, J Ding, M He, H Xu, **P Gentine**, 2022, Global water availability boosted by vegetation-driven changes in atmospheric moisture transport, Nature Geoscience, 1-7
43. X He, S Liu, T Xu, K Yu, **P Gentine**, Z Zhang, Z Xu, D Jiao, D Wu, 2022, Improving predictions of evapotranspiration by integrating multi-source observations and land surface model, Agricultural Water Management 272, 107827

44. S Zhou, **P Gentine**, AP Williams, BR Lintner, KL Findell, TF Keenan, Y Zhang, 2022, Diminishing seasonality of subtropical water availability in a warmer world dominated by soil moisture–atmosphere feedbacks, Nature communications 13 (1), 5756
45. J Yin, L Slater, L Gu, Z Liao, S Guo, **P Gentine**, Global increases in lethal compound heat stress: Hydrological drought hazards under climate change, Geophysical Research Letters 49 (18), e2022GL100880
46. ***M Shehata*, P Gentine**, N Nelson, C Sayde, 2022, Characterizing soil water content variability across spatial scales from optimized high-resolution distributed temperature sensing technique, Journal of Hydrology 612, 128195
47. Y Zhang, **P Gentine**, X Luo, X Lian, Y Liu, S Zhou, AM Michalak, W Sun, 2022, Increasing sensitivity of dryland vegetation greenness to precipitation due to rising atmospheric CO_2, Nature communications 13 (1), 4875
48. G Behrens, T Beucler, **P Gentine**, F Iglesias-Suarez, M Pritchard, V Eyring, Non-Linear Dimensionality Reduction With a Variational Encoder Decoder to Understand Convective Processes in Climate Models, Journal of advances in modeling earth systems 14 (8), e2022MS003130
49. Liu, Z, Deng, Z, Zhu, B, Ciais, P, Davis, SJ, Tan, J, **Gentine, P**. & ... 2022, 'Global patterns of daily CO2 emissions reductions in the first year of COVID-19', *Nature Communications,* https://www.nature.com/articles/s41561-022-00965-8
50. Fu, Z, Ciais, P, Prentice, IC, **Gentine**, P, & ... 2022, 'Atmospheric dryness reduces photosynthesis along a large range of soil water deficits', *Nature Communications*, https://www.nature.com/articles/s41467-022-28652-7
51. Wang, K, Bastos, A, Ciais, P, Wang, X, & ... 2022, 'Regional and seasonal partitioning of water and temperature controls on global land carbon uptake variability', *Nature Communications*, https://www.nature.com/articles/s41467-022-31175-w
52. Liu, L, Chen, X, Ciais, P, Yuan, W, Maignan, F, **Gentine, P**. & ... 2022, 'Tropical tall forests are more sensitive and vulnerable to drought than short forests', *Global Change Biology*, https://doi.org/10.1111/gcb.16017
53. Lian, X, Jeong, S, Park, CE, Xu, H, Li, LZX, Wang, T, **Gentine, P** & ... 2022, 'Biophysical impacts of northern vegetation changes on seasonal warming patterns', *Nature Communications*, https://www.nature.com/articles/s41467-022-31671-z
54. Zhou, S, Keenan, TF, Williams, AP, Lintner, BR, & **Gentine, P** 2022, 'Large Divergence in Tropical Hydrological Projections Caused by Model Spread in Vegetation Responses to Elevated CO2', *Earth's Future,* https://doi.org/10.1029/2021EF002457
55. Zhang, Y, **Gentine, P**, Luo, X, Lian, X, Liu, Y, & ... 2022, 'Increasing sensitivity of dryland vegetation greenness to precipitation due to rising atmospheric CO2', *Nature Communications*, , https://www.nature.com/articles/s41467-022-32631-3
56. **Green, JK**, Ballantyne, A, Abramoff, R, **Gentine, P**, & ... 2022, 'Surface temperatures reveal the patterns of vegetation water stress and their environmental drivers across the tropical Americas', *Global Change Biology*,
57. He, X, Liu, S, Xu, T, Yu, K, **Gentine, P**, Zhang, Z, & ... 2022, 'Improving predictions of evapotranspiration by integrating multi-source observations and land surface model', *Agricultural Water Management*, https://www.sciencedirect.com/science/article/pii/S0378377422003742
58. Zhou, S, Williams, AP, Lintner, BR, Findell, KL, & **Gentine, P**, 2022, 'Diminishing seasonality of subtropical water availability in a warmer world dominated by soil moisture–atmosphere feedbacks', *Nature Communications*, https://www.nature.com/articles/s41467-022-33473-9
59. ***Shehata, M*, Gentine, P**, Nelson, N, & Sayde, C 2022, 'Characterizing soil water content variability across spatial scales from optimized high-resolution distributed temperature sensing technique', *Journal of Hydrology*, https://www.sciencedirect.com/science/article/pii/S0022169422007685
60. Fu, J, Kang, S, Zhang, L, Li, X, **Gentine, P**, & ... 2022, 'Amplified warming induced by large-scale application of water-saving techniques', *Environmental Research Letters,* https://doi.org/10.1088/1748-9326/ac4b52

61. Wang, R, Li, L, **Gentine, P**, Zhang, Y, Chen, J, & ... 2022, 'Recent increase in the observation-derived land evapotranspiration due to global warming', *Environmental Research Letters*, https://doi.org/10.1088/1748-9326/ac4291
62. Dou, X, Wang, Y, Ciais, P, Chevallier, F, Davis, SJ, **Gentine, P**, & ... 2022, 'Near-real-time global gridded daily CO2 emissions', *The Innovation*, https://www.sciencedirect.com/science/article/pii/S2666675821001077
63. Davis, SJ, Liu, Z, Deng, Z, Zhu, B, Ke, P, Sun, T, **Gentine, P**, & ... 2022, 'Emissions rebound from the COVID-19 pandemic', *Nature Climate Change,* https://www.nature.com/articles/s41558-022-01332-6
64. Reichstein, M, Ahrens, B, Kraft, B, **Gentine, P**, & ... 2022, 'Combining System Modeling and Machine Learning into Hybrid Ecosystem Modeling', *Knowledge-Guided Machine Learning,* https://doi.org/10.1201/9781003143376-14
65. Wu, X, Liu, H, Hartmann, H, Ciais, P, Kimball, JS, **Gentine, P**, & ... 2022, 'Timing and order of extreme drought and wetness determine bioclimatic sensitivity of tree growth', *Earth's Future*, https://doi.org/10.1029/2021EF002530
66. ***Yin, J***, Slater, L, Gu, L, Liao, Z, Guo, S, **Gentine, P**, & ... 2022, 'Global Increases in Lethal Compound Heat Stress-Hydrological Drought Hazards under Climate Change', *Geophysical Research Letters,* https://doi.org/10.1029/2022GL100880
67. **Zhan, W**, Yang, X, Ryu, Y, Dechant, B, **Huang, Y**, & **Gentine, P**, 2022, 'Two for one: Partitioning CO2 fluxes and understanding the relationship between solar-induced chlorophyll fluorescence and gross primary productivity using machine learning', *Agricultural and Forest Meteorology*, https://www.sciencedirect.com/science/article/pii/S0168192322001708
68. Su, Y, Yang, X, **Gentine, P**, Maignan, F, Shang, J, & ... 2022, 'Observed strong atmospheric water constraints on forest photosynthesis using eddy covariance and satellite-based data across the Northern Hemisphere', *International Journal of Remote Sensing,* https://www.sciencedirect.com/science/article/pii/S1569843222000103
69. Zhou, K, Zhang, Q, Xiong, L, & **Gentine, P** 2022, 'Estimating evapotranspiration using remotely sensed solar-induced fluorescence measurements', *Agricultural and Forest Meteorology*, https://www.sciencedirect.com/science/article/pii/S016819232100486X
70. ***Wang, R***, **Gentine, P**, Li, L, Chen, J, & ... 2022, 'Observational evidence of regional increasing hot extreme accelerated by surface energy partitioning', *Journal of the Atmospheric Science,* https://journals.ametsoc.org/view/journals/hydr/23/3/JHM-D-21-0114.1.xml
71. Prigent, C, Jimenez, C, Dinh, LA, **Gentine, P**, & ... 2022, 'Diurnal and Seasonal Variations of Passive and Active Microwave Satellite Observations Over Tropical Forests', *Journal of Geophysical Research*, https://doi.org/10.1029/2021JG006677
72. **Cheng, Y**, Giometto, MG, Kauffmann, P, & **Gentine, P**, 2022, 'Deep learning for subgrid-scale turbulence modeling in large-eddy simulations of the convective atmospheric boundary layer', *Journal of Advances* …, https://doi.org/10.1029/2021MS002847
73. Xi, X, Gentine, P, Zhuang, Q, & Kim, S 2022, 'Evaluating the variability of surface soil moisture simulated within CMIP5 using SMAP data', *Journal of Geophysical Research,* https://doi.org/10.1029/2021JD035363
74. Mooers, G, Pritchard, M, Beucler, T, Srivastava, P, & **Gentine, P**, 2022, 'Comparing Storm Resolving Models and Climates via Unsupervised Machine Learning', *arXiv,* https://arxiv.org/abs/2208.11843
75. Bu, J, Gan, G, Chen, J, Su, Y, Yuan, M, Gao, Y, **Gentine, P**, & ... 2022, 'Dryland evapotranspiration from remote sensing solar-induced chlorophyll fluorescence: constraining an optimal stomatal model within a two-source energy balance', *arXiv*, https://arxiv.org/abs/2206.14416
76. Zhu, B, Song, X, Deng, Z, Zhao, W, Huo, D, Sun, T, **Gentine, P**, & ... 2022, 'Carbon Monitor-Power: near-real-time monitoring of global power generation on hourly to daily scales', *arXiv* https://arxiv.org/abs/2209.06086

77. **Gentine P**, Eyring V, & Beucler T (2021). Deep Learning for the Parametrization of Subgrid Processes in Climate Models. *Deep Learning for the Earth Sciences*, 307-314, https://doi.org/10.1002/9781119646181.ch21
78. **Cheng Y**, Li Q, Li D, & **Gentine P** (2021). Logarithmic profile of temperature in sheared and unstably stratified atmospheric boundary layers. *Physical Review Fluids*, 6(3), https://doi.org/10.1103/physrevfluids.6.034606
79. Liu Y, Konings AG., Kennedy D, & **Gentine P** (2021). Global Coordination in Plant Physiological and Rooting Strategies in Response to Water Stress. *Global Biogeochemical Cycles*, 35(7), https://doi.org/10.1029/2020gb006758
80. Chen X, Su Z, Ma Y, Trigo I, & **Gentine P** (2021). Remote Sensing of Global Daily Evapotranspiration based on a Surface Energy Balance Method and Reanalysis Data. *Journal of Geophysical Research: Atmospheres,* 126(16), , https://doi.org/10.1029/2020jd032873
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82. Beucler T, Ebert-Uphoff I, Rasp S, Pritchard M, & **Gentine P** (2021). *Machine Learning for Clouds and Climate (Invited Chapter for the AGU Geophysical Monograph Series "Clouds and Climate").,* https://doi.org/10.1002/essoar.10506925.1
83. Feldman AF, Gianotti DJ, Konings AG, **Gentine P**, & Entekhabi D (2021). Patterns of plant rehydration and growth following pulses of soil moisture availability. *Biogeosciences*, 18(3), 831-847, https://doi.org/10.5194/bg-18-831-2021
84. Peters-Lidard CD., Mocko DM, Su L, Lettenmaier DP, **Gentine P,** & Barlage M (2021). Advances in Land Surface Models and Indicators for Drought Monitoring and Prediction. *Bulletin of the American Meteorological Society*, 1-68, https://doi.org/10.1175/bams-d-20-0087.1
85. Liu Y, Chen D, Mouatadid S, Lu X, Chen M, Cheng Y, Xie Z, Jia B, Wu H, & **Gentine P** (2021). Development of a Daily Multilayer Cropland Soil Moisture Dataset for China Using Machine Learning and Application to Cropping Patterns. *Journal of Hydrometeorology,* 22(2), 445-461, https://doi.org/10.1175/jhm-d-19-0301.1
86. He W, Ju W, Jiang F, Parazoo N, **Gentine P**, et al (2021). Peak growing season patterns and climate extremes-driven responses of gross primary production estimated by satellite and process based models over North America. *Agricultural and Forest Meteorology*, 298, 108292, https://doi.org/10.1016/j.agrformet.2020.108292
87. Tran H, Leonarduzzi E, Fuente L, Hull RB, Bansal V, Chennault C, **Gentine P**, Melchior P, Condon LE & Maxwell RM. (2021). Development of a Deep Learning Emulator for a Distributed Groundwater–Surface Water Model: ParFlow-ML. *Water*, 13(23), 3393, https://doi.org/10.3390/w13233393
88. Zhou S, Williams AP, Lintner BR, Berg AM, Zhang Y, Keenan TF, Cook BI, Hagemann S, Seneviratne SI, & **Gentine P** (2021). Soil moisture–atmosphere feedbacks mitigate declining water availability in drylands. *Nature Climate Change*, 11(1), 38-44, https://doi.org/10.1038/s41558-020-00945-z
89. Yang X, Wu J, … **Gentine P**, & Wright SJ (2021). A comprehensive framework for seasonal controls of leaf abscission and productivity in evergreen broadleaved tropical and subtropical forests. *The Innovation*, 2(4), 100154, https://doi.org/10.1016/j.xinn.2021.100154
90. Chen X, Ciais P, Maignan, …, **Gentine P**, et al. (2021). Vapor Pressure Deficit and Sunlight Explain Seasonality of Leaf Phenology and Photosynthesis Across Amazonian Evergreen Broadleaved Forest. *Global Biogeochemical Cycles*, 35(6), https://doi.org/10.1029/2020gb006893
91. Yazbeck ZT, Bohrer G, **Gentine P**, et al. (2021). Site Characteristics Mediate the Relationship Between Forest Productivity and Satellite Measured Solar Induced Fluorescence. *Frontiers in Forests and Global Change*, 4, https://doi.org/10.3389/ffgc.2021.695269
92. Liu L, Ciais P, …, **Gentine P,** et al. (2021). Tropical tall forests are more sensitive and vulnerable to drought than short forests. *Global Change Biology*, 28(4), 1583-1595, https://doi.org/10.1111/gcb.16017

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95. **Wang R**., Zhang Y., Zhou S., **Gentine P**, (2021). Long-term relative decline in evapotranspiration despite increased runoff, *Hydrology and Earth System Sciences*, *25*(7), 3805-3818,
96. **Massmann, A**., **Gentine, P.,** & Runge, J. (2021). Causal inference for process understanding in Earth sciences. *arXiv e-prints*, arXiv-2105.
97. Braghiere B., Wang; Y., Doughty R., Souza D., Magney T., Widlowski, J-L., Longo M., Bloom A., Worden J., **Gentine P.,** Frankenberg C., (2021), Accounting for canopy structure improves hyperspectral radiative transfer and sun-induced chlorophyll fluorescence representations in a new generation Earth System model, *Remote Sens Env.* 261 (2021): 112497.
98. Chen X. Ciais P., et al., **Gentine P.,** (2021), Vapor pressure deficits and sunlight explain seasonality of leaf phenology and photosynthesis across Amazonian evergreen broadleaved forest, *Global Biochemical Cycles*
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232. **Gentine**, P., D. Entekhabi, and J. Polcher (2011a), The Diurnal Behavior of Evaporative Fraction in the Soil-Vegetation-Atmospheric Boundary Layer Continuum, *J Hydrometeorol*, *12*(6), 1530–1546, doi:10.1175/2011JHM1261.1.
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237. **Gentine**, P., D. Entekhabi, A. Chehbouni, G. Boulet, and B. Duchemin (2007), Analysis of evaporative fraction diurnal behaviour, *Agr Forest Meteorol*, *143*, 13–29, doi:10.1016/j.agrformet.2006.11.002.

GRANTS AND CONTRACTS AWARDED

Total project funding received amounts to ~ $34,950,000

- **Zegar foundation** 2023-2026: "Optimizing the wheres and hows of cloud seeding using AI"
- **Department of Energy collaborative grant** 2021-2024 ($3,500,000 Lead: Rose Yu, share ~$850,000): "Discovering physically meaningful structures from climate extreme data"
- **NSF STC** 2021-2026 ($25,000,000 – Lead): "Learning the Earth with Artificial intelligence and Physics – LEAP"
- **NASA ROSES MAP** 2021-2024 ($849,495 – Lead Dr. Ensheng Wang, share ~$350,000): "Modeling forest physiological and structural responses to climate extremes and feedbacks in GISSModelE"
- **NASA ROSES Hydrology** 2020-2023 ($692,000 – Lead Dr. Elizabeth Tellman, share ~$50,000): "Mapping flood impacts using multi sensor satellite data fusion in urban areas"
- **NASA ROSES SMAP** 2020-2023 ($500,000): "Understanding memory effects and respiration with SMAP vegetation optical depth"
- **European Research Council Synergy Award** 2019-2025 ($2.1M euros): "Understanding and Modelling the Earth System with Machine Learning"
- **NSF Cyberinfrastructure for Sustained Scientific Innovation (CSSI) - Data and Software: Elements and Frameworks** 2018-2021 ($300,000): "Software for a new machine learning based parameterization of moist convection for improved climate and weather prediction using deep learning methods"
- **NASA ROSES Hydrology** 2018-2021 ($500,000): "Partitioning evapotranspiration towards transpiration"
- **NASA ROSES** 2017-2019 ($100,000): "Quantum computing with applications to the carbon cycle"
- **NOAA MAPP** 2017-2020 ($450,000): "Biosphere-atmosphere regulations of droughts assessed using microwave and solar-induced fluorescence observations and improved plant water stress representation"
- **National Science Foundation - Climate and large-scale dynamics** 2017-2020 ($450,000): "Cloud albedo feedback on tropical continents"

- **National Science Foundation - Climate and large-scale dynamics** 2017-2020 ($200,000): "Transition between shallow and deep convection"
- **National Science Foundation CAREER** 2016-2021 ($500,000): "Departure from Monin-Obukhov Similarity Theory (MOST) using high-resolution models
- **Department of Energy early career** 2015-2020 ($750,000): "Cross-Scale Land-Atmosphere Interactions (CSLAEX)"
- **NASA ROSES** 2014-2017 ($450,748): "Neural network retrieval of soil moisture from SMAP for use in NWP centers"
- **NASA New Investigator Program** 2014-2017 ($258,011): "A unified parameterization of dry and moist convection"
- **Department of Energy /GoAmazon** grant 2014-2017 (share as co-PI $316,817, total >$2M) with Jung-Eun Lee (Brown University-PI): "Ecophysiological control on Amazonian precipitation seasonality and variability"
- **NASA ROSES** grant 2013-2015 ($265,000): "Downscaling of flooded fraction derived from low-resolution microwave measurements"
- **Department of Energy /Atmospheric Science Research** grant 2012-2015 (share as co-PI $96,000, total $500,000) with Zhiming Kuang (Harvard-PI): "Probing the transition from shallow to deep convection using ASR data and large-eddy simulations"
- **National Science Foundation/Climate and Large-scale dynamics** grant 2011-2014 (share as co-PI $259,000, total $500,000): "Quantifying the impacts of atmospheric and land-surface heterogeneity and scale on soil moisture-precipitation feedbacks"

INVITED TALKS

2023: United Nations, Harvard, Berkeley, CUNY, US National Academies, University of British Columbia, General Electric/NSF, Simons Foundation
2022: Aspen institute, MIT, Artificial Intelligence for Good Group, University of Minnesota, Beijing Normal University
2021: Carnegie, IBM, University of Minnesota, LSCE-Paris, UCLA, AI4Good Microsoft, National academies
2020: AGU, NYU, NASA JPL, DOE, GFDL, MIT, Oxford University, CEA LSCE, Duke University
2019: Urbana Champaign (UIUC), Climate Informatics keynote, U Wisconsin – Madison, Harvard, ETH keynote on machine learning
2018: Princeton, Luxembourg Institute of Science and Technology, EPFL, CalTech, UC Irvine, Max Planck Institute Hamburg, ETH Zurich, UC Berkeley, Ghent University
2017: Max Planck Institute Jena, AGU meeting, ETH Zurich, EGU, Ghent University, Lamont Doherty, university of Washington, NASA GSFC
2016: Brown University, NASA, European Centre for Medium Weather Forecast, Colorado State University, AMS
2015: AGU, MIT
2014: DOE ASR meeting, DOE tropical meeting, University of Virginia
2013: Stony Brook, DOE ASR meeting, TU Delft, Wageningen University
2012: Ecole Normale Superieure, Boston University
2011: ETH Zurich, UC Berkeley, UC Irvine, Princeton University, Georgia Tech, Massachusetts Institute of Technology

SERVICE AND MEMBERSHIPS

Professional service:

- External Advisory Board member, AI for the Planet Advisory Board Boston Consulting Group – World Economic Forum (2022-now)
- AGU Global Environmental Change section canvassing committee member (to identify, encourage or lead nominations of scientists in underrepresented groups) (2019-now)
- World Climate Research Program (WCRP) - US CLIVAR Data Science group co-lead and co-founder (2019-now)
- Climate Data Guide Board of Advisors (2021-now)
- WCRP Working Group on Seasonal to Interannual Prediction - member
- Global Land/Atmosphere System Study (GLASS) Global Energy and Water Cycle Experiment (GEWEX) - member
- LoCo (Local Coupling) Global Energy and Water Cycle Experiment (GEWEX) - member
- CUAHSI (Consortium of Universities for the Advancement of Hydrologic Science, Inc.) Columbia University representative
- NOAA drought task force co-lead (2017-2020)
- Organizer of the Alpine summer school on land-atmosphere interactions (2015) – bringing 45 students from various fields (ecology to climate) to collaborate on and learn about biosphere-atmosphere interactions.
- NSF white paper panelist on the future of funding in hydrometeorology and hydroclimatology

Memberships:

- American Geophysical Union (AGU) member
- American Meteorological Society (AMS) member

Columbia University service:

- School
  - Committee on instruction (COI) - 2013-2019
  - Eagleston scholar supervision - current
  - BRIDGE under-represented student mentoring 2019-current
- Department
  - Head of graduate committee and program 2017-current
  - Department Diversity, Equity and Inclusion group member (2020-now)
  - Department undergraduate committee 2010-2017
  - Department undergraduate orientation 2010-current
  - Department seminar organization 2010-2015
- Institute
  - Earth Institute postdoctoral selection committee

EDITOR/REVIEWER

Associate Editor:

Remote Sensing
Frontiers in Artificial Intelligence - AI in Food, Agriculture and Water
Hydrology and Earth System Sciences
Journal of Hydrometeorology
Frontiers in hydrology (up to 2017)

Frontiers in atmospheric sciences (up to 2017)

Reviewer:

- **Journals:**
  Nature, Nature climate change,Water resources research, Advances in water resources, Journal of hydrology, Boundary-layer meteorology, Journal of hydrometeorology, Journal of climate, Journal of the atmospheric sciences, Atmospheric Chemistry and Physics, Hydrology and Earth system sciences, Biogeosciences.
- **Proposals:**
  National Science Foundation, National Science Foundation CAREER, Department of Energy, NASA, NERC, Dutch space agency, Swiss Foundation, Department of Energy Laboratory review.

TEACHING EXPERIENCE

University Courses

Sole Lecturer

- Linear algebra Fall 2009, Fall 2011, Columbia University
- Principle of Applied Mathematics Spring 2011, Columbia University
- Hydrology Fall 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 21
- Hydrosystems Spring 2013, 2014, 2015, 2016, 2017, 2019, 2020, 2021
- Management and development of water systems Spring 2014, 2015, 2017, 2019
- Machine Learning for Environmental Science and Engineering 2019, 2020, 2021, 2022, 2023

Evaluations and number of students:

Course number	Name	Number of students
EAEEE4000_001_2022_1	Machine learning for environmental engin	51
Course mean 4.12 Instructor mean 4.47		
EAEEE4000_001_2021_1	Machine learning for environmental engin	26
Course mean 3.94 Instructor mean 4.00		
CIEEE3250_001_2021_1	HYDROSYSTEMS ENGINEERING	34
Course mean 3.75 Instructor mean 3.83		
EAEEE4000_001_2020_1	Machine learning for environmental engin	10

Course mean 3.83
Instructor mean 4.17

CIEEE3250_001_2020_1	HYDROSYSTEMS ENGINEERING	34

Course mean 4.20
Instructor mean 4.00

CIEEE3250_001_2019_1	Physical hydrology	19

Course mean 3.63
Instructor mean 3.88

CIEEE3250_001_2019_1	HYDROSYSTEMS ENGINEERING	19

Course mean 3.27
Instructor mean 3.18

ECIAW4100_001_2019_1	MGMT & DEVPT OF WATER SYSTEMS	39

Course mean 3.50
Instructor mean 3.63

EAEE6240_001_2018_3	PHYSICAL HYDROLOGY	24

Course mean 3.95
Instructor mean 4.30

EAEE6240_001_2017_3	PHYSICAL HYDROLOGY	28

Course mean 4.50
Instructor mean 4.50

CIEEE3250_001_2017_1	HYDROSYSTEMS ENGINEERING	18

Course mean 3.83
Instructor mean 3.7

ECIAW4100_001_2017_1	MGMT & DEVPT OF WATER SYSTEMS	28

Course mean 4.10
Instructor mean 4.00

EAEE6240_001_2016_3	PHYSICAL HYDROLOGY	19

Course mean 4.50
Instructor mean 4.50

EAEE6240_001_2015_3	PHYSICAL HYDROLOGY	29

Course mean 4.43
Instructor mean 4.52

CIEEE3250_001_2015_1	(shared) HYDROSYSTEMS ENGINEERING	19

Course mean 3.00
Instructor mean 3.33

ECIAW4100_001_2015_1	(shared) MGMT & DEVPT OF WATER SYSTEMS	39

Course mean 3.57
Instructor mean 3.62

EAEEE6240_001_2014_3	PHYSICAL HYDROLOGY	14

Course mean 4.7
Instructor mean 4.88

ECIAW4100_001_2014_1	(shared) MGMT & DEVPT OF WATER SYSTEMS	29

Course mean 4.09
Instructor mean 4.27

CIEEE3250_001_2014_1	(shared) HYDROSYSTEMS ENGINEERING	24

Course mean 3
Instructor mean 3.22

EAEEE6240_001_2013_3	PHYSICAL HYDROLOGY	8

Course mean 4.75
Instructor mean 4.5

ECIAW4100_001_2013_1	(shared) MGMT & DEVPT OF WATER SYSTEMS	52

Course mean NA
Instructor mean NA

CIEEE3250_001_2013_1	(shared) HYDROSYSTEMS ENGINEERING	20

Course mean NA
Instructor mean NA

EAEEE6240_001_2012_3	PHYSICAL HYDROLOGY	8

Course mean NA
Instructor mean NA

Guest Lecturer

- Woods Hole Geophysical Fluid Dynamics summer school – Summer 2014

RESEARCH SUPERVISED AS SPONSOR

Research scientist

- Dr. Kara Lamb (2020 –2022) – Microphysics
- Dr. Yaling Liu (2018 –2020) – Vegetation Optical Depth for stress monitoring

Post-doctoral

- Dr. Jiangong Lian (2022 –) – Eddy-covariance measurements
- Dr. Xu Lian (2022 –) – Carbon cycle
- Dr. Sara Shamekh (2021 –) – Machine learning for turbulence and convection, now professor at NYU
- Dr. Wenli Zhao (2018 –2020) – Machine learning for land-atmosphere feedback
- Dr. Sha Zhou (2018 –2021) – Biosphere-atmosphere feedbacks and compound events
- Dr. Sylvia Sullivan (2018 –2019) now Postdoctoral scholar at KIT – Organized convection

- Dr. Yao Zhang (2018 –2019) now Postdoctoral scholar at UC Berkeley – Solar-induced fluorescence
- Dr. Qi Li (2016 – 2018) now Assistant Professor at Cornell - Departure from Monin Obukhov
- Dr. Seyed Hamed Alemohammad (2016 – 2018) now Research Scientist at Radiant – Soil moisture retrieval using machine learning techniques
- Dr. Alexandra Konings (2015 – 2016) now Assistant Professor at Stanford – Retrieving vegetation water stress from remote sensing
- Dr. Bin Fang (2015 – 2016) now working in the private sector – Soil moisture retrieval using machine learning techniques
- Dr. Seung-Bu Park (2014 – 2017) now Research Scientist in South Korea – Large-eddy simulations and implementation of unified convection parameterization in the NASA GISS climate model
- Dr. Jana Kolassa (2014–2015) now Research Scientist at NASA – Soil moisture retrieval from multiple satellite product
- Dr. Alexis Berg (2012 –2013) now Research Scientist at Princeton University – Soil moisture and precipitation feedbacks
- Dr. Nicolas Rochetin (2012 –2013) now Research Scientist at Météo France – Radiative Convective Equilibrium over land

Doctor of Philosophy (Earth & Environmental Engineering)

- Aya Lahlou (2022-) Phenology
- Yongquan Qu (2022-) Low-cloud turbulence
- Rong-Yu Gu (2021-) Windthrow
- Jianing Fang (2021-) Hybrid machine learning
- Jisu Huan (2019-) Turbulence in the canopy and surface layers
- Weiwei Zhan (2019-) Machine learning for terrestrial carbon cycle
- Olya Skulovich (2018 –) Machine learning of soil moisture
- Yu Huang (2017 –) Amazon cloud feedback on water and carbon cycles
- Adam Massmann (2016 –2022) Land-atmosphere feedback on mesoscale storms
- Yu Cheng (2014 – 2019) now Postdoctoral researcher at Harvard - Heterogeneity in turbulence
- Daniel Kennedy (2013 – 2019) now Postdoctoral researcher at NCAR - Vegetation water content and plant hydraulics
- Julia Green (2013 – 2019) now Postdoctoral researcher at LSCE - Ecophysiological control of plants on convection over the Amazon
- Léo Lemordant (2012 – 2017) now CEO Enerfip - Carbon feedbacks on the surface hydrologic cycle and land-atmosphere interactions
- Marceau Guérin (2011 – 2018) now Freelance Consultant - Survival strategies to droughts

Master Students

- Violette Launeau (Summer 2022) Machine learning for climate
- Thomas de Gouville (Summer 2020) Machine learning for climate
- Kenza Amara (Summer 2019) Machine learning for fire prediction
- Francesco Giardina (Summer 2016) Amazon trait regulation of climate variability
- Anais Chhang (summer 2014) Estimating evaporation using weather station data
- Alix Garelli (summer 2015) Interaction between cold pools and surface fluxes
- Felix Camus (summer 2016) Drought in the Amazon and El Niño

- Brahim Khalid (summer 2016) Organization of Mesoscale Convective Systems globally

EXTERNAL EXAMINER FOR PHD DISSERATIONS

PhD examination committees in Columbia SEAS Departments:

Earth and Environmental Engineering

- John Feighery (2013)
- Mengquian Lu (2014)

Civil and Environmental Engineering

- Daniel Marasco (2014)
- Raha Hakimdavar (2016)

PhD examination committee – Oxford university

- Tom Bolton (2020)