

## Curriculum Vitae

### Dr. Kai-Lan Chang (as of January 2022)

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INFORMATION kai-lan.chang@noaa.gov
- APPOINTMENTS **Research Scientist II**, Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado Boulder & NOAA Chemical Sciences Laboratory (CSL), 2021-present  
**Research Scientist I**, CIRES & NOAA CSL, 2018-2021  
**National Research Council Fellow**, NOAA CSL, 2017-2018  
**National Research Council Fellow**, NOAA Global Monitoring Laboratory, 2016-2018  
**Associate**, Department of Statistical Science, University College London, UK, 2016  
**Officer**, Directorate-General of Budget, Accounting and Statistics, Taiwan, 2007-2010
- EDUCATION **University College London**, UK  
Ph.D., Statistics, 2011-2015  
M.S., Statistics, 2010-2011  
**National Taiwan University**, Taiwan  
B.S., Public Health, minor in Mathematics, 2002-2006
- AWARDS CIRES outstanding performance award, 2020  
US National Research Council research associateship award, 2015  
Costas Goutis [dissertation] prize, Department of Statistical Science, UCL, 2013  
Taiwanese government sponsorship for Ph.D. overseas study, 2009
- SERVICE Group lead, Tropospheric Ozone Assessment Report (TOAR-II) statistics focus working group, 2020-present  
Contributor to the 2018 World Meteorological Organization/United Nations Environment Programme (WMO/UNEP) Scientific Assessment of Ozone Depletion  
Grant reviewer for the Dutch Research Council  
Journal reviewer for *Computational Statistics & Data Analysis*; *Atmospheric Chemistry & Physics*; *Atmospheric Science Letters*, *Mathematics Magazine*; *Atmospheric Environment*; *Atmospheric Measurement Techniques*; *Elementa: Science of the Anthropocene*; *Journal of Geophysical Research: Atmospheres*; *Journal of Environmental Sciences*; *Geoscientific Model Development*; *Earth and Space Science*; *Urban Climate*; *Earth System Science Data*; *Environmental Science & Technology*; *Scientific Reports*; *Atmospheric Pollution Research*
- GRANTS Co-Investigator/Institutional PI, NASA Research Opportunities in Space and Earth Sciences: Atmospheric Composition Campaign Data Analysis and Modeling, *Solving the mystery of the disappearing low ozone values: attributing ozone trends over the Eastern Pacific Ocean and Western North America*, 2021  
Research grant supported by University of North Carolina at Chapel Hill & NASA Health and Air Quality Applied Sciences Team, *Using sciences to inform management* [under the supervision of Prof J. Jason West], 2017  
Co-Applicant, ReCoVER (Research on Changes of Variability and Environmental Risk) pilot study, UK, *Accelerated climate model emulation to capture uncertainties in modelling of future climate*, 2015
- REFERRED ARTICLES - **Chang, K.-L.**, Cooper, O.R., Gaudel, A., Allaart, M., Ancellet, G., Clark, H., Godin-Beekmann, S., Leblanc, T., Van Malderen, R., Nédélec, P., Petropavlovskikh, I., Steinbrecht, W., Stübi, R.,

- Tarasick, D.W. and Torres, C. (2021) Impact of the COVID-19 economic downturn on tropospheric ozone trends: an uncertainty weighted data synthesis for quantifying regional anomalies above western North America and Europe, *AGU Advances*, doi:10.1029/2021AV000542
- **Chang, K.-L.**, Schultz, M.G., Lan, X., McClure-Begley, A., Petropavlovskikh, I., Xu, X. and Ziemke, J.R. (2021) Trend detection of atmospheric time series: Incorporating appropriate uncertainty estimates and handling extreme events, *Elementa: Science of the Anthropocene*, doi:10.1525/elementa.2021.00035
  - Asher, E., Thornberry, T., Fahey, D.W., McComiskey, A., Carslaw, K., Grunau, S., **Chang, K.-L.**, Telg, H., Chen, P. and Gao, R.-S. (2021) A novel network-based approach to determining measurement representation error for model evaluation of aerosol microphysical properties, *Journal of Geophysical Research: Atmospheres*, doi:10.1029/2021JD035485
  - DeLang, M., Becker, J., **Chang, K.-L.**, Serre, M.L., Cooper, O.R., Schultz, M.G., Schroder, S., Lu, X., Zhang, L., Deushi, M., Josse, B., Keller, C.A., Lamarque, J.-F., Lin, M., Liu, J., Marécal, V., Strode, S.A., Sudo, K., Tilmes, S., Zhang, L., Cleland, S., Collins, E., Brauer, M. and West, J.J. (2021) Mapping yearly fine resolution global surface ozone through the Bayesian Maximum Entropy data fusion of observations and model output for 1990–2017, *Environmental Science & Technology*, doi:10.1021/acs.est.0c07742
  - Steinbrecht, W., Kubistin, D., Plass-Dülmer, C., Davies, J., Tarasick, D.W., von der Gathen, P., Deckelmann, H., Jepsen, N., Kivi, R., Lyall, N., Palm, M., Notholt, J., Kois, B., Oelsner, P., Allaart, M., PETERS, A., Gill, M., Van Malderen, R., Delcloo, A.W., Sussmann, R., Mahieu, E., Servais, C., Romanens, G., Stübi, R., Ancellet, G., Godin-Beekmann, S., Yamanouchi, S., Strong, K., Johnson, B., Cullis, P., Petropavlovskikh, I., Hannigan, J.W., Hernandez, J.L., Rodriguez, A.D., Nakano, T., Chouza, F., Leblanc, T., Torres, C., Garcia, O., Röhlings, A.N., Schneider, M., Blumenstock, T., Tully, M., Paton-Walsh, C., Jones, N., Querel, R., Strahan, S., Stauffer, R.M., Thompson, A.M., Inness, A., Engelen, R., **Chang, K.-L.** and Cooper, O.R. (2021) COVID-19 crisis reduces free tropospheric ozone across the Northern Hemisphere, *Geophysical Research Letters*, doi:10.1029/2020GL091987
  - Zhang, Y., West, J.J., Emmons, L.K., Flemming, J., Jonson, J.E., Lund, M.T., Sekiya, T., Sudo, K., Gaudel, A., **Chang, K.-L.**, Nédélec, P. and Thouret, V. (2021) Contributions of world regions to the global tropospheric ozone burden change from 1980 to 2010, *Geophysical Research Letters*, doi:10.1029/2020GL089184
  - GBD 2019 Risk Factor Collaborators (2020) Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019, *The Lancet*, doi:10.1016/S0140-6736(20)30752-2
  - **Chang, K.-L.**, Cooper, O.R., Gaudel, A., Petropavlovskikh, I. and Thouret, V. (2020) Statistical regularization for trend detection: an integrated approach for detecting long-term trends from sparse tropospheric ozone profiles, *Atmospheric Chemistry & Physics*, doi:10.5194/acp-20-9915-2020
  - Gaudel, A., Cooper, O.R., **Chang, K.-L.**, Bourgeois, I., Ziemke, J.R., Strode, S.A., Omen, L., Sellitto, P., Nédélec, P., Blot, R., Thouret, V. and Granier, C. (2020) Aircraft observations since the 1990s reveal increases of tropospheric ozone at multiple locations across the Northern Hemisphere, *Science Advances*, doi:10.1126/sciadv.aba8272
  - Cooper, O.R., Schultz, M.G., Schröder, S., **Chang, K.-L.**, Gaudel, A., Benitez, G.C., Cuevas, E., Fröhlich, M., Galbally, I. E., Molloy, S., Kubistin, D., Lu, X., McClure-Begley, A., Nédélec, P., O'Brien, J., Oltmans, S.J., Petropavlovskikh, I., Ries, L., Senik, I., Sjöberg, K., Solberg, S., Spain, G.T., Spangl, W., Steinbacher, M., Tarasick, D., Thouret, V. and Xu, X. (2020) Multi-decadal surface ozone trends at globally distributed remote locations, *Elementa: Science of the Anthropocene*, doi:10.1525/elementa.420
  - Banerjee, A., Fyfe, J.C., Polvani, L.M., Waugh, D. and **Chang, K.-L.** (2020) A pause in Southern Hemisphere circulation trends due to the Montreal Protocol, *Nature*, doi:10.1038/s41586-020-2120-4
  - Tarasick, D., Galbally, I.E., Cooper, O.R., Schultz, M.G., Ancellet, G., Leblanc, T., Wallington, T.J., Ziemke, J.R., Liu, X., Steinbacher, M., Staehelin, J., Vigouroux, C., Hannigan, J.W.,

García, O., Foret, G., Zanis, P., Weatherhead, E.C., Petropavlovskikh, I., Worden, H., Osman, M., Liu, J., **Chang, K.-L.**, Gaudel, A., Lin, M., Granados-Muñoz, M., Thompson, A.M., Oltmans, S.J., Cuesta, J., Dufour, G., Thouret, V., Hassler, B., Trickl, T. and Neu, J.L. (2019) Tropospheric Ozone Assessment Report: Tropospheric ozone from 1877 to 2016, observed levels, trends and uncertainties, *Elementa: Science of the Anthropocene*, doi:10.1525/elementa.376

- **Chang, K.-L.**, Cooper, O.R., West, J.J., Serre, M.L., Schultz, M.G., Lin, M., Marécal, V., Josse, B., Deushi, M., Suto, K., Liu, J. and Keller, C.A. (2019) A new method (M<sup>3</sup>Fusion v1) for combining observations and multiple models for an improved estimate of the global surface ozone distribution, *Geoscientific Model Development*, doi:10.5194/gmd-12-955-2019
- **Chang, K.-L.** and Guillas, S. (2019) Computer model calibration with large non-stationary spatial outputs: application to the calibration of a climate model, *Journal of the Royal Statistical Society: Series C*, doi:10.1111/rssc.12309
- GBD 2017 Risk Factor Collaborators (2018) Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017, *The Lancet*, doi:10.1016/S0140-6736(18)32225-6
- Weatherhead, E.C., Bodeker, G.E., Fassò, A., **Chang, K.-L.**, Lazo, L.K., Clack, C.T.M., Hurst, D.F., Hassler, B., English, J.M. and Yorgun, S. (2017) Spatial coverage of finite monitoring stations: A climate observing system simulation experiment, *Journal of Applied Meteorology and Climatology*, doi:10.1175/JAMC-D-17-0040.1
- **Chang, K.-L.**, Petropavlovskikh, I., Cooper, O.R., Schultz, M.G. and Wang, T. (2017) Regional trend analysis of surface ozone observations from monitoring networks in eastern North America, Europe and East Asia, *Elementa: Science of the Anthropocene*, doi:10.1525/elementa.243
- **Chang, K.-L.**, Guillas, S. and Fioletov, V.E. (2015) Spatial mapping of ground-based observations of total ozone, *Atmospheric Measurement Techniques*, doi:10.5194/amt-8-4487-2015

BOOK  
CHAPTERS

- Petropavlovskikh, I., Sofieva, V., Firth, S.M., Tourpali, K., Vigouroux, C., Wild, J.D., Ball, W.T., **Chang, K.-L.**, Davis, S.M., Degenstein, D.A., Froidevaux, L., Godin-Beekmann, S., Hubert, D., Laeng, A., Leblanc, T., Maillard Barras, E., Smit, H.G.J. and Steinbrecht, W. (2019) Observations and model data [in: “SPARC/IO3C/GAW report on Long-term Ozone Trends and Uncertainties in the Stratosphere”]
- Damadeo, R., Hassler, B., Zawada, D.J., Firth, S.M., Ball, W.T., **Chang, K.-L.**, Degenstein, D.A., Hubert, D., Misios, S. Petropavlovskikh, I., Roth, C.Z., Sofieva, V., Steinbrecht, W., Tourpali, K. and Zefefos, C.S., (2019) The LOTUS regression model [in: “SPARC/IO3C/GAW report on Long-term Ozone Trends and Uncertainties in the Stratosphere”]
- Hassler, B., Damadeo, R., **Chang, K.-L.**, Sofieva, V., Tourpali, K., Firth, S.M., Ball, W.T., Degenstein, D.A., Godin-Beekmann, S., Hubert, D., Maillard Barras, E., Misios, S., Petropavlovskikh, I., Roth, C.Z., Steinbrecht, W., Vigouroux, C., von Clarmann, T., Zawada, D.J. and Zefefos, C.S. (2019) Time series and trend results [in: “SPARC/IO3C/GAW report on Long-term Ozone Trends and Uncertainties in the Stratosphere”]  
[available at <https://www.sparc-climate.org/publications/sparc-reports>]

OTHER  
PUBLICATIONS

- Frost, G., Brewer, A., Granier, C. and **Chang, K.-L.** (2021) StoryMap presentations on “Atmospheric Composition, Chemistry, and Dynamics”  
[available at <https://storymaps.arcgis.com/stories/51ee218dec9c421c8476a81e4d71f22d>]
- Thompson, C., Cooper, O., Doherty, S. and **Chang, K.-L.** (2021) StoryMap presentations on “CSL Leadership and Contributions to the Scientific Community”  
[available at <https://storymaps.arcgis.com/stories/ce8654fa22e946be8401406aa009ae74>]

PRESENTATIONS

- AGU fall meeting, New Orleans, LA, USA 12/2021
- International Global Atmospheric Chemistry conference (virtual) 09/2021
- HEGIFTOM (Harmonization and Evaluation of Ground Based Instruments for Free Tropospheric Ozone Measurements) kick-off workshop (virtual) 03/2021

- TOAR-II kick-off workshop (virtual) 01/2021
- NOAA ESRL global monitoring annual conference (virtual) 07/2020
- AMS annual meeting, Boston, MA, USA 01/2020
- CIRES rendez-vous, Boulder, CO, USA 05/2019
- NOAA ESRL global monitoring annual conference, Boulder, CO, USA 05/2018
- NOAA ESRL global monitoring annual conference, Boulder, CO, USA 05/2017
- LOTUS workshop, Paris, France 03/2017
- AGU fall meeting, San Francisco, CA, USA 12/2016
- CliMathNet conference, Exeter, UK 07/2016
- SIAM conference on uncertainty quantification, Lausanne, Switzerland 04/2016
- Computational and data challenges in environmental modelling, Cambridge, UK 02/2016
- International conference on uncertainty quantification in  
computational sciences and engineering, Crete Island, Greece 05/2015
- Calculating and communicating uncertainty, London, UK 01/2015
- Latsis symposium on atmosphere and climate dynamics, Zurich, Switzerland 06/2014
- CCMI workshop, Lancaster, UK 05/2014
- SIAM conference on uncertainty quantification, Savannah, GA, USA 04/2014
- Seminar, University College London, UK 10/2013