

Michael K. Tippett

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A. Field of specialization

Variability and predictability of weather and climate, with a focus on extremes.

B. Education

Ph.D. Mathematics, New York University, New York, NY, 1992.

Dissertation title: Tokamak transport based in the 13-moment model, Advisor: Harold Weitzner.

M.S. Mathematics, New York University, New York, NY, 1990.

B.S. Mathematics, North Carolina State University, Raleigh, NC, 1987.

B.S. Electrical Engineering, North Carolina State University, NC, Raleigh, 1987.

C. Professional experience

Department of Applied Physics and Applied Mathematics, Columbia University.

Associate Professor, July 2016 – present.

Lecturer in the Discipline of Applied Mathematics, July 2013 – June 2016.

Chief Data Scientist, Initiative on Extreme Weather and Climate, Feb 2015 – present.

Center of Excellence for Climate Change Research, King Abdulaziz University, Jeddah, Saudi Arabia.

Adjunct Professor, Dec 2011 – 2017.

International Research Institute for Climate and Society, Columbia University.

Senior Research Scientist, 2013.

Leader global forecast development, 2008–2013.

Research Scientist, 2003–2013.

Associate Research Scientist, 1999–2003.

Center for Weather Prediction and Climate Studies (CPTEC), Cachoeira Paulista, Brazil.

Visiting Scientist, 1996–1999.

Max Planck Institute for Plasma Physics, Garching, Germany.

Postdoctoral Researcher, 1992–1995.

D. Teaching experience

Courses taught

APMA 2101 Intro. to Applied Math.

Year taught	2014	2015	2016	2017	2018
Students	126	103	105	129	133
Course: overall quality	2.86	3.86	3.39	3.30	lost in CourseWorks
Instructor: overall quality	2.78	3.58	3.11	3.15	lost in CourseWorks

APMA 3101 Linear Algebra

Year taught	2013	2014	2015	2016	2017	2018
Students	20	18	47	42	41	48
Course: overall quality	3.30	4.33	4.27	4.36	4.87	4 (median)
Instructor: overall quality	3.83	4.10	4.27	4.5	4.77	5 (median)

(Prior to 2018 interpolated median evaluation with 1-Poor, 2-Fair, 3-Good, 4-Very Good, 5-Excellent)

APMA 3900 Undergraduate Research in Applied Mathematics
 Spring 2019 [Brigid Lynch, Qidong Yang] Fall 2017 [Peiying Yu, Sara Edelman-Munoz]
 Spring 2016 [Maya Chandrasekaran]
 Fall 2016 [Alek Anichowski, Sara Edelman-Munoz]

APAM E6650 Research project
 Fall 2016 [Saurabh Kumar, Julien Maudet, Aditya Garg]

APMA E6901 2019 Special Topics in Applied Math. (Uncertainty quantification)
Graduate thesis experience
 Oral exam committee: Jessie Oehrlein (APAM). November 2018.
 Oral exam committee: Zane Martin (APAM). June 2017.
 Ph.D. thesis committee: Mark England (APAM). Proposal, May 2017.
 Ph.D. thesis committee: Aditi Dandapani (APAM). “Enlargement of filtration and the strict local Martingale property in stochastic differential equations.” Defense, May 2016.
 Ph.D. thesis committee: Chen Chen (DEES). “El Niño Southern Oscillation diversity in a changing climate.” Defense, December 2015.
 Oral exam committee: Mark England (APAM). June 2015.
 Ph.D. thesis committee: Usama Anber (APAM). “Idealized Cloud Resolving Modeling for Tropical Climate Studies.” Defense, June 2015.
 Ph.D. thesis committee (chair): William Martin (APAM). “Advancements for three-dimensional remote sensing of the atmosphere.” Defense, June 2014.
 External examiner for Mr. Kamil Shahzad M.Sc thesis “Eastern Mediterranean cyclone Tracks and their relationship with Saudi Arabian rainfall.” King Abdulaziz University, Jeddah, Saudi Arabia. Sep 2014.
PhD students supervised 0.
Postdoctoral researchers supervised Total 3. Currently 0.
 John T. Allen, Feb 2013 – Feb 2016. Promoted to Associate Research Scientist. Assistant Professor at Central Michigan University.
 Chi-Ying Lee, Oct 2013 – Sep 2016. Promoted to Associate Research Scientist.
 Mengqian Lu, Sep 2014 – Jan 2016. Assistant Professor at Hong Kong University of Science & Technology.
Associate Research Scientist supervised Currently 1. Chiara Lepore.

E. Publications [postdocs and students, senior author is listed first]

Papers in refereed journals (Google Scholar 5/16/19: 4364 citations, H-index = 31)

1. M. Bieli, A. H. Sobel, S. J. Camargo, and M. K. Tippett. A statistical model to predict the extratropical transition of tropical cyclones. *Wea. Forecasting*, 2019. Submitted.
2. S. Wang, M. K. Tippett, A. H. Sobel, Z. Martin, and F. Vitart. Impact of the QBO on prediction and predictability of the MJO convection. *J. Geophys. Res. Atmos.*, 2019. Submitted.
3. E. Koch, J. Koh, A. C. Davison, C. Lepore, and M. K. Tippett. Trends in the extremes of environments associated with severe US thunderstorms. *J. Climate*, 2019. Submitted.
4. K. Pegion, B. P. Kirtman, D. C. Collins, E. LaJoie, R. Burgman, R. Bell, T. DelSole, D. Min, Y. Zhu, W. Li, E. Sinsky, H. Guan, E. Becker, J. Gottschalck, J. Metzger, N. P. Baron, D. Achuthavarier, J. Marshak, R. D. Koster, H. Lin, N. Gagnon, M. Bell, M. K. Tippett, A. W. Robertson, S. Sun, S. G. Benjamin, B. W. Green, R. Bleck, and H. Kim. The Subseasonal Experiment (SubX): A multi-model subseasonal prediction experiment. *Bull. Amer. Meteor. Soc.*, 2018. Submitted.

5. M. A. Ehsan, F. Kucharski, M. Almazroui, M. Ismail, and M. K. Tippett. Potential predictability of Arabian Peninsula summer surface air-temperature (AP-SAT) in the North American Multimodel Ensemble. *Clim. Dyn.*, 2018. Submitted.
6. L. Trenary, T. DelSole, S. J. Camargo, and M. K. Tippett. Are midtwentieth century forced changes in North Atlantic hurricane potential intensity detectable? *Geophys. Res. Lett.*, 46, 3378–3386, 2019. doi:10.1029/2018GL081725.
18. M. K. Tippett, C. Lepore, W. J. Koshak, T. Chronis, and B. Vant-Hull. Performance of a simple proxy for U.S. cloud-to-ground lightning. *Int. J. Climatol.*, 2019. doi:10.1002/joc.6049.
8. V. A. Gensini and M. K. Tippett. Global ensemble forecast system (GEFS) predictions of days 1–15 U.S. tornado and hail frequencies. *Geophys. Res. Lett.*, 46, 2922–2930, 2019. doi:10.1029/2018GL081724.
9. M. K. Tippett. Comment on ”on the relationship between probabilistic and deterministic skills in dynamical seasonal climate prediction. *J. Geophys. Res. Atmos.*, 2019. doi:10.1029/2018JD029345.
10. T. DelSole, L. Trenary, X. Yan, and M. K. Tippett. Confidence intervals in optimal fingerprinting. *Clim. Dyn.*, 52, 4111–412, 2019. doi:10.1007/s00382-018-4356-3.
11. M. K. Tippett and W. J. Koshak. A baseline for the predictability of U.S. cloud-to-ground lightning. *Geophys. Res. Lett.*, 45, 10,719–10,728, 2018. doi:10.1029/2018GL079750.
12. M. L. LHeureux, M. K. Tippett, K. Takahashi, A. Barnston, E. J. Becker, G. D. Bell, T. E. Di Liberto, J. Gottschalck, M. S. Halpert, Z.-Z. Hu, N. C. Johnson, Y. Xue, and W. Wan. Strength outlooks for the El Niño-Southern Oscillation. *Wea. Forecasting*, 34, 165–175, 2018. doi:10.1175/WAF-D-18-0126.1.
13. M. K. Tippett. Robustness of relations between the MJO and U.S. tornado occurrence. *Mon. Wea. Rev.*, 146, 3873–3884, 2018. doi:10.1175/MWR-D-18-0207.1.
14. S. Wang, A. Sobel, M. K. Tippett, and F. Vitart. Prediction and predictability of tropical intraseasonal convection: seasonal dependence and the Maritime Continent prediction barrier. *Clim. Dyn.*, 2018. doi:10.1007/s00382-018-4492-9.
15. S. Wang, M. K. Tippett, A. Sobel, and F. Vitart. Propagation characteristics of BSISO indices. *Geophys. Res. Lett.*, 45, 9934–9943, 2018. doi:10.1029/2018GL078321.
16. N. Vigaud, M. K. Tippett, and A. W. Robertson. Probabilistic skill of subseasonal precipitation forecasts for the East Africa–West Asia sector during September–May. *Wea. Forecasting*, 33, 1513–1532, 2018. doi:10.1175/WAF-D-18-0074.1.
17. C. Lepore, M. K. Tippett, and J. T. Allen. CFSv2 monthly forecasts of tornado and hail activity. *Wea. Forecasting*, 33, 1283–1297, 2018. doi:10.1175/WAF-D-18-0054.1.
18. M. K. Tippett, C. Lepore, W. J. Koshak, T. Chronis, and B. Vant-Hull. Performance of a simple proxy for U.S. cloud-to-ground lightning. *Int. J. Climatol.*, 2018. Submitted.
19. N. Vigaud, A. W. Robertson, and M. K. Tippett. Predictability of recurrent weather regimes over North America during winter from submonthly reforecasts. *Mon. Wea. Rev.*, 146, 2559–2577, 2018. doi:10.1175/MWR-D-18-0058.1.
20. C.-Y. Lee, S. J. Camargo, F. Vitart, A. H. Sobel, and M. K. Tippett. Sub-seasonal tropical cyclone

- genesis prediction and MJO in the S2S dataset. *Wea. Forecasting*, 33, 967–988, 2018. doi:10.1175/WAF-D-17-0165.1.
21. M. K. Tippett, L. Trenary, T. DelSole, K. Pegion, and M. L. L’Heureux. Sources of bias in the monthly CFSv2 forecast climatology. *J. Appl. Meteor. Climatol.*, 57, 1111–1122, 2018. doi:10.1175/JAMC-D-17-0299.1.
 22. C.-Y. Lee, M. K. Tippett, A. H. Sobel, and S. J. Camargo. An environmentally forced tropical cyclone hazard model. *J. Adv. Model. Earth Syst.*, 10, 223–241, 2018. doi:10.1002/2017MS001186.
 23. T. DelSole and M. K. Tippett. Predictability in a changing climate. *Clim. Dyn.*, 51, 531–545, 2018. doi:10.1007/s00382-017-3939-8.
 24. L. Trenary, T. DelSole, M. K. Tippett, and K. Pegion. Monthly ENSO forecast skill and lagged ensemble size. *J. Adv. Model. Earth Syst.*, 10, 1074–1086, 2018. doi:10.1002/2017MS001204.
 25. M. L’Heureux, M. K. Tippett, A. Kumar, A. H. Butler, L. M. Ciasto, Q. D. K. J. Harnos, and N. C. Johnson. Strong relations between ENSO and the Arctic Oscillation in the North American Multi-Model Ensemble. *Geophys. Res. Lett.*, 44, 11654–11662, 2017. doi:10.1002/2017GL074854.
 26. T. DelSole, L. Trenary, and M. K. Tippett. The weighted-average lagged ensemble. *J. Adv. Model. Earth Syst.*, 9, 2739–2752, 2017. doi:10.1002/2017GL074854.
 27. N. Vigaud, A. W. Robertson, M. K. Tippett, and N. Acharya. Subseasonal predictability of boreal summer monsoon rainfall from ensemble forecasts. *Front. Environ. Sci.*, 2017. doi:10.3389/fenvs.2017.00067.
 28. S. Wang, A. Anichowski, M. K. Tippett, and A. H. Sobel. Seasonal noise vs. subseasonal signal: forecasts of California precipitation during the unusual winters of 2015-16 and 2016-17. *Geophys. Res. Lett.*, 44, 9513–9520, 2017. doi:10.1002/2017GL075052.
 29. D. Shawki, R. D. Field, M. K. Tippett, B. H. Saharjo, I. Albar, D. Atmoko, and A. Voulgarakis. Long-lead prediction of the 2015 fire and haze episode in Indonesia. *Geophys. Res. Lett.*, 44, 9996–10,005, 2017. doi:10.1002/2017GL073660.
 30. J. T. Allen, M. K. Tippett, A. H. Sobel, S. Nong, Y. Kaheil, A. Muehlbauer, and C. Lepore. An extreme value model for United States hail size. *Mon. Wea. Rev.*, 145, 4501–4519, 2017. doi:10.1175/MWR-D-17-0119.1.
 31. C. Lepore, M. K. Tippett, and J. T. Allen. ENSO-based probabilistic forecasts of March-May U.S. tornado and hail activity. *Geophys. Res. Lett.*, 44, 9093–9101, 2017. doi:10.1002/2017GL074781.
 32. M. Almazroui, O. Tayeb, A. S. Mashat, A. Yousef, Y. A. Al-Turki, M. A. Abid, A. O. Bafail, M. A. Ehsan, A. Zahed, M. A. Rahman, A. M. Mohorji, I.-S. Kang, A. Noaman, M. Omar, A. M. Al-roqi, K. Ammar, A. S. Al-Ghamdi, M. A. Hussein, I. Katib, E. O’Brien, N. R. Aljohani, M. N. Islam, A. Alsaedi, Y.-M. Yang, A. K. Alkhalaf, M. Ismail, A. Mashat, F. Kucharski, M. Assiri, S. Ibrahim, M. K. Tippett, I. U. Rashid, S. Kamil, A. Alahmadi, R. M. Atif, M. A. Bajunaid, and A. S. Hantoush. Saudi-KAU coupled global climate model: Description and performance. *Earth Syst. Environ.*, 1:7, 2017. doi:10.1007/s41748-017-0009-7.
 33. N. Vigaud, A. W. Robertson, and M. K. Tippett. Multi-model ensembling of subseasonal precipitation

- forecasts over North America. *Mon. Wea. Rev.*, 145, 3913-3928, 2017. doi:10.1175/MWR-D-17-0092.1.
34. A. G. Barnston and M. K. Tippett. Do statistical pattern corrections improve seasonal climate predictions in NMME models? *J. Climate*, 30, 8335-8355, 2017. doi:10.1175/JCLI-D-17-0054.1.
 35. M. K. Tippett, M. Ranganathan, M. L'Heureux, A. G. Barnston, and T. DelSole. Assessing probabilistic predictions of ENSO phase and intensity from the North American Multimodel Ensemble. *Clim. Dyn.*, 2017. doi:10.1007/s00382-017-3721-y.
 36. M. A. Ehsan, M. Almazroui, A. Yousef, O. Enda, M. K. Tippett, F. Kucharski, I.-S. Kang, and A. A. Alkhalaf. Sensitivity of AGCM simulated regional summer precipitation to different convective parameterizations. *Int. J. Climatol.*, 37, 4594-4609, 2017. doi:10.1002/joc.5108.
 37. A. G. Barnston, M. K. Tippett, M. Ranganathan, and M. L. L'Heureux. Deterministic skill of ENSO predictions from the North American Multimodel Ensemble. *Clim. Dyn.*, 2017. doi:10.1007/s00382-017-3603-3
 38. T. DelSole, L. Trenary, M. K. Tippett, and K. Pegion. Predictability of week 3-4 average temperature and precipitation over the contiguous United States. *J. Climate*, 30, 3499-3512, 2017. doi:10.1175/JCLI-D-16-0567.1.
 39. L. Trenary, T. DelSole, M. K. Tippett, and K. Pegion. A new method for determining the optimal lagged ensemble. *J. Adv. Model. Earth Syst.*, 9, 291-306, 2017. doi:10.1002/2016MS000838
 40. T. Hall and M. K. Tippett. Pacific hurricane landfalls on Mexico and SST. *J. Appl. Meteor. Climatol.*, 56, 667-676, 2017. doi:10.1175/JAMC-D-16-0194.1
 41. M. L'Heureux, M. K. Tippett, and A. G. Barnston. Reply to "Comment on 'Characterizing ENSO coupled variability and its impact on North American seasonal precipitation and temperature'". *J. Climate*, 30, 437-441, 2017. doi:10.1175/JCLI-D-16-0080.1.
 42. M. A. Ehsan, M. K. Tippett, M. Almazroui, M. Ismail, A. Yousef, F. Kucharski, M. Omar, M. Hussein, and A. A. Alkhalaf. Skill and predictability in multimodel ensemble forecasts for northern hemisphere regions with dominant winter precipitation. *Clim. Dyn.*, 48, 3309-3324, 2017. doi:10.1007/s00382-016-3267-4.
 43. L. Trenary, T. DelSole, M. K. Tippett, and B. Doty. Extreme eastern US winter of 2015 not symptomatic of climate change [in "Explaining Extremes of 2015 from a Climate Perspective"]. *Bull. Amer. Meteor. Soc.*, 97, S31-S35, 2016. doi:10.1175/BAMS-D-16-0156.1.
 44. M. K. Tippett, C. Lepore, and J. E. Cohen. More tornadoes in the most extreme U.S. tornado outbreaks. *Science*, 354, 1419-1423, 2016. doi:10.1126/science.aah7393. Reported by: [\[NPR\]](#) [\[The Christian Science Monitor\]](#) [\[Climate Central\]](#) [\[Bloomberg\]](#) [\[Altmetric score\]](#)
 45. C.-Y. Lee, M. K. Tippett, A. H. Sobel, and S. J. Camargo. Autoregressive modeling for tropical cyclone intensity climatology. *J. Climate*, 29, 7815-7830, 2016. doi:10.1175/JCLI-D-15-0909.1.
 46. A. H. Sobel, S. J. Camargo, T. M. Hall, C.-Y. Lee, M. K. Tippett, and A. A. Wing. Human influence on tropical cyclone intensity. *Science*, 353, 242-246, 2016. doi:10.1126/science.aaf6574. [\[Altmetric score\]](#)

47. T. DelSole, X. Yan, and M. K. Tippett. Inferring aerosol cooling from hydrological sensitivity. *J. Climate*, 29, 6167–6178, 2016. doi:10.1175/JCLI-D-15-0364.1.
48. A. H. Sobel, S. J. Camargo, A. G. Barnston, and M. K. Tippett. Northern hemisphere tropical cyclones during the quasi-El Niño of late 2014. *Nat. Hazards*, 83, 1717–1729, 2016. doi:10.1007/s11069-016-2389-7.
49. G. W. Carbin, M. K. Tippett, S. P. Lillo, and H. E. Brooks. Visualizing long-range severe thunderstorm environment guidance from CFSv2. *Bull. Amer. Meteor. Soc.*, 97, 1021–1031, 2016. doi:10.1175/BAMS-D-14-00136.1.
50. S. D. Ditchek, W. R. Boos, S. J. Camargo, and M. K. Tippett. A genesis index for monsoon disturbances. *J. Climate*, 29, 5189–5203, 2016. doi:10.1175/JCLI-D-15-0704.1.
51. X. Yan, T. DelSole, and M. K. Tippett. What surface observations are important for separating the influences of anthropogenic aerosols from other forcings? *J. Climate*, 29, 4165–4184, 2016. doi:10.1175/JCLI-D-15-0667.1.
52. C. Lepore, J. T. Allen, and M. K. Tippett. Relationships between extreme precipitation and atmospheric variables over the contiguous United States. *J. Climate*, 29, 3181–3197, 2016. doi:10.1175/JCLI-D-15-0331.1.
53. M. K. Tippett and J. E. Cohen. Tornado outbreak variability follows Taylor’s power law of fluctuation scaling and increases dramatically with severity. *Nat. Commun.*, 7, 10668, 2016. doi:10.1038/ncomms10668. Reported by: [[time.com](#)] [[slate.com](#)] [[Columbia Spectator](#)] [[Altmetric score](#)]
54. C.-Y. Lee, M. K. Tippett, A. H. Sobel, and S. J. Camargo. Rapid intensification and the bimodal distribution of tropical cyclone intensity. *Nat. Commun.*, 7, 10625, 2016. doi:10.1038/ncomms10625.
55. T. DelSole and M. K. Tippett. Forecast comparison based on random walks. *Mon. Wea. Rev.*, 144, 615–626, 2016. doi:10.1175/MWR-D-15-0218.1.
56. J. T. Allen, M. K. Tippett, and A. H. Sobel. Influence of the El Niño/Southern Oscillation on tornado and hail frequency in the United States. *Nat. Geosci.*, 8, 278–283, 2015. doi:10.1038/ngeo2385. Reported by: [[USA Today](#)] [[Insurance Journal](#)] [[Bloomberg](#)] [[Scientific American](#)] [[Altmetric score](#)]
57. J. T. Allen and M. K. Tippett. The characteristics of United States hail reports: 1955–2014. *Electronic J. Severe Storms Meteor.*, 10, 1–31, 2015.
58. L. Trenary, T. DelSole, M. K. Tippett, and B. Doty. Are eastern US winter temperatures becoming more variable? [in “Explaining Extremes of 2014 from a Climate Perspective”]. *Bull. Amer. Meteor. Soc.*, 96, S10–S15, 2015. doi:10.1175/BAMS-D-15-00138.1. Reported by [[Climate Central](#)]
59. J. T. Allen, M. K. Tippett, and A. H. Sobel. An empirical model relating U.S. monthly hail occurrence to large-scale meteorological environment. *J. Adv. Model. Earth Syst.*, 7, 226–243, 2015. doi:10.1002/2014MS000397.
60. A. G. Barnston, M. K. Tippett, H. M. van den Dool, and D. A. Unger. Toward an improved multi-model ENSO prediction. *J. Appl. Meteor. Climatol.*, 54, 1579–1595, 2015. doi:10.1175/JAMC-D-14-0188.1.
61. A. G. Barnston, N. Vigaud, L. N. Long, M. K. Tippett, and J.-K. E. Schemm. Atlantic tropical cyclone

- activity in response to the MJO in NOAA's CFS model. *Mon. Wea. Rev.*, 143, 4905–4927, 2015. doi:10.1175/MWR-D-15-0127.1.
62. T. DelSole and M. K. Tippett. Laplacian eigenfunctions for climate analysis. *J. Climate*, 28, 7420–7436, 2015. doi:10.1175/JCLI-D-15-0049.1.
 63. J. G. Dwyer, S. J. Camargo, A. H. Sobel, M. Biasutti, K. A. Emanuel, G. A. Vecchi, M. Zhao, and M. K. Tippett. Projected 21st century changes in the length of the tropical cyclone season. *J. Climate*, 28, 6181–6192, 2015. doi:10.1175/JCLI-D-14-00686.1.
 64. C.-Y. Lee, M. K. Tippett, S. J. Camargo, and A. H. Sobel. Probabilistic prediction of tropical cyclone intensity from a multiple-linear regression model. *Mon. Wea. Rev.*, 143, 933–954, 2015. doi:10.1175/MWR-D-14-00171.1.
 65. M. L'Heureux, M. K. Tippett, and A. G. Barnston. Characterizing ENSO coupled variability and its impact on North American seasonal precipitation and temperature. *J. Climate*, 28, 4231–4245, 2015. doi:10.1175/JCLI-D-14-00508.1.
 66. M. Lu, M. Tippett, and U. Lall. Changes in the seasonality of tornado and favorable genesis conditions in the Central United States. *Geophys. Res. Lett.*, 42, 4224–423, 2015. doi:10.1002/2015GL063968.
 67. M. K. Tippett, J. T. Allen, V. A. Gensini, and H. E. Brooks. Climate and hazardous convective weather. *Curr. Clim. Change Rep.*, 1, 60–73, 2015. doi:10.1007/s40641-015-0006-6.
 68. M. K. Tippett, M. Almazroui, and I.-S. Kang. Extended-range forecasts of areal-averaged Saudi Arabia rainfall. *Wea. Forecasting*, 30, 1090–1105, 2015. doi:10.1175/WAF-D-15-0011.1.
 69. A. Barnston and M. K. Tippett. Climate information, outlooks, and understanding—where does the IRI stand? *Earth Perspectives*, 1, 1–17, 2014. doi:10.1186/2194-6434-1-20.
 70. S. J. Camargo, M. K. Tippett, A. H. Sobel, G. A. Vecchi, and M. Zhao. Testing the performance of tropical cyclone genesis indices in future climates using the HIRAM model. *J. Climate*, 27, 9171–9196, 2014. doi:10.1175/JCLI-D-13-00505.1.
 71. T. DelSole, J. Nattala, and M. K. Tippett. Skill improvement from increased ensemble size and model diversity. *Geophys. Res. Lett.*, 41, 7331–7342, 2014. doi:10.1002/2014GL060133.
 72. T. DelSole and M. K. Tippett. Comparing forecast skill. *Mon. Wea. Rev.*, 142, 4658–4678, 2014. doi:10.1175/MWR-D-14-00045.1.
 73. L. Jia, T. DelSole, and M. K. Tippett. Can optimal projection improve dynamical model forecasts? *J. Climate*, 27, 2643–2655, 2014. doi:10.1175/JCLI-D-13-00232.1.
 74. M. K. Tippett. Changing volatility of U.S. annual tornado reports. *Geophys. Res. Lett.*, 41, 6956–6961, 2014. doi:10.1002/2014GL061347. Reported by: [[Washington Post](#)] [[Climate Central](#)] [[Weather.com](#)]
 75. B. Kirtman, P. Dughong Min, J. M. Infanti, J. L. K. III, D. A. Paolino, Q. Zhang, H. van den Dool, S. Saha, M. P. Mendez, E. Becker, P. Peng, P. Tripp, J. Huang, D. G. DeWitt, M. K. Tippett, A. G. Barnston, S. Li, A. Rosati, S. D. Schubert, M. Rienecker, M. Suarez, Z. E. Li, J. Marshak, Y.-K. Lim, J. Tribbia, K. Pegion, W. J. Merryfield, B. Denis, and E. F. Wood. The North American Multi-Model Ensemble (NMME): Phase-1 seasonal to interannual prediction, Phase-2 toward developing intra-Seasonal

- prediction. *Bull. Amer. Meteor. Soc.*, 95, 585–601, 2014. doi:10.1175/BAMS-D-12-00050.1.
76. M. K. Tippett, T. DelSole, and A. G. Barnston. Reliability of regression-corrected climate forecasts. *J. Climate*, 27, 3393–3404, 2014. doi:10.1175/JCLI-D-13-00565.1.
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 78. A. G. Barnston and M. K. Tippett. Predictions of Nino3.4 SST in CFSv1 and CFSv2: A diagnostic comparison. *Clim. Dyn.*, 41, 1–19, 2013. doi:10.1007/s00382-013-1845-2.
 79. T. DelSole, L. Jia, and M. K. Tippett. Decadal prediction of observed and simulated sea surface temperatures. *Geophys. Res. Lett.*, 40, 2773–2778, 2013. doi:10.1002/grl.50185.
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 81. T. DelSole, X. Yang, and M. K. Tippett. Is unequal weighting significantly better than equal weighting for multi-model forecasting? *Quart. J. Roy. Meteor. Soc.*, 139, 176–183, 2013. doi:10.1002/qj.1961.
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 88. P. Sinha, U. C. Mohanty, S. C. Kar, S. K. Dash, A. W. Robertson, and M. K. Tippett. Seasonal prediction of the Indian summer monsoon rainfall using canonical correlation analysis of the NCMRWF global model products. *Int. J. Climatol.*, 33, 1601–1614, 2012. doi:10.1002/joc.3536.
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105. T. DelSole and M. K. Tippett. Predictability: Recent insights from information theory. *Rev. Geophys.*, 45, RG4002, 2007. doi:10.1029/2006RG000202.
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117. M. K. Tippett and P. Chang. Some theoretical considerations on predictability of linear stochastic dynamics. *Tellus*, 55, 148–157, 2003.
118. M. K. Tippett and S. E. Cohn. Adjoint and low-rank covariance representation. *Nonlinear Proc. in Geoph.*, 8, 331–340, 2001.
119. S. J. Camargo, M. K. Tippett, and I. L. Caldas. Nonmodal energetics of electromagnetic drift waves. *Phys. Plasmas*, 7, 2849–2865, 2000.
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122. M. K. Tippett. Transient moist baroclinic instability. *Tellus*, 51A, 273–288, 1999.
123. M. K. Tippett and D. Marchesin. Bounds for solutions of the discrete algebraic Lyapunov equation. *IEEE Trans. Automat. Contr.*, 44, 214–218, 1999.
124. M. K. Tippett and D. Marchesin. Upper bounds for the solution of the discrete algebraic Lyapunov equation. *Automatica*, 35, 1485–1489, 1999.
125. S. J. Camargo, M. K. Tippett, and I. L. Caldas. Nonmodal linear analysis of drift-wave turbulence models. *Czech. J. Phys.*, 48, 189–194, 1998. Suppl. 2.

126. S. J. Camargo, M. K. Tippett, and I. L. Caldas. Nonmodal energetics of resistive drift waves. *Phys. Rev. E*, 58, 3693–3704, 1998. doi:10.1103/PhysRevE.58.3693.
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129. M. K. Tippett. Tokamak transport based on the 13-moment model. *J. Plasma Phys.*, 54, 77–104, 1995.
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131. G. M. Zaslavsky and M. K. Tippett. Connection between recurrence time statistics and anomalous transport. *Phys. Rev. Lett.*, 67, 3251–3254, 1991.
132. R. Ziolkowski and M. K. Tippett. Collective effect in an electron plasma system catalyzed by a localized electromagnetic wave. *Phys. Rev. A*, 43, 3066–3072, 1991.

Books and book chapters

1. F. Vitart, C. Cunningham, M. DeFlorio, E. Dutra, L. Ferranti, B. Golding, D. Hudson, C. Jones, C. Lavaysse, J. Robbins, and M. K. Tippett. Sub-seasonal to seasonal prediction of weather extremes. In F. Vitart and A. W. Robertson, editors, *Sub-seasonal to Seasonal Prediction: Bridging the gap between weather and climate forecasts*. Elsevier, 2018.
2. A. H. Sobel and M. K. Tippett. Extreme events: trends and risk assessment methodologies. In *Resilience: The Science of Adaptation to Climate Change*. Keith Alverson and Zinta Zommers, Editors, Elsevier, 2017. In press.
3. T. DelSole and M. K. Tippett. *Statistical Methods for Climate Scientists*. Cambridge University Press, 2017. Contract for 2020 delivery.
4. T. DelSole, M. K. Tippett, and L. Jia. Multi-year prediction and predictability. In C.-P. Chang, M. Ghil, M. Latif, and J. M. Wallace, editors, *Climate Change: Multidecadal and Beyond*, volume 6 of *World Scientific Series on Asia-Pacific Weather and Climate*, chapter 14, pages 219–233. World Scientific Publishing, 2015.
5. C. Monteleoni, G. Schmidt, F. Alexander, A. Niculescu-Mizil, K. Steinhäuser, M. Tippett, A. Banerjee, M. Blumenthal, A. Ganguly, J. Smerdon, and M. Tedesco. Climate informatics. In T. Yu, N. V. Chawla, and S. Simoff, editors, *Computational Intelligent Data Analysis for Sustainable Development*, Chapter 4, 81–126. CRC Press, Boca Raton, FL, 2013.
6. M. K. Tippett, S. J. Camargo, and I. L. Caldas. Modal and nonmodal linear stability of electromagnetic drift waves. In *Festschrift for Abraham Zimmerman*, volume 2 of *Topics in Theoretical Physics*. Instituto de Física Teórica, São Paulo, SP, Brazil, 1998.

Proceedings of Refereed Conferences

1. T. DelSole, C. Monteleoni, S. McQuade, M. K. Tippett, K. Pegion, and J. Shukla. Tracking seasonal prediction models. In *In Machine Learning and Data Mining Approaches to Climate Science: Proceedings of the 5th International Workshop on Climate Informatics*. 2015. (reviewed).

Technical reports and conference summaries

1. P. Gunturi and M. K. Tippett. Managing severe thunderstorm risk: Impact of ENSO on U.S. tornado and hail frequencies. Technical report, WillisRe, 2017. [Link](#).
2. J. T. Allen, M. K. Tippett, A. H. Sobel, and C. Lepore. Understanding the drivers of variability in severe convection: Bringing together the scientific and insurance communities. *Bull. Amer. Meteor. Soc.*, 97, ES221–ES223, 2016. doi:10.1175/BAMS-D-16-0208.1.
3. A. Sobel, S. Camargo, W. D. G. Deodatis, M. Gerrard, T. Hall, R. Hallman, J. Keenan, U. Lall, M. Levy, B. Orlove, C. Rosenzweig, R. Seager, J. Shaman, and M. Tippett. Extreme weather and climate: Workshop report. *J. Extr. Even.*, 3, 1671001, 2016. doi:10.1142/S2345737616710019.
4. P. N. Ceccato, I. N. S. Jaya, J. Qian, M. K. Tippett, A. W. Robertson, and S. Someshwar. Early warning and response to fires in Kalimantan, Indonesia. Technical report, IRI, Columbia University, 2010. <http://hdl.handle.net/10022/AC:P:10137>.
5. J. W. Hansen, M. K. Tippett, M. A. Bell, and A. V. M. Ines. Linking seasonal forecasts into RiskView to enhance food security contingency planning. Technical report, IRI, Columbia University, 2010. <http://hdl.handle.net/10022/AC:P:10136>.

F. Grants and contracts

1. NOAA #16283. \$272,026 9/1/19 - 8/31/22 0.75/YR Assessment and calibration of extreme precipitation probabilities in S2S forecast models (Lepore, C., PI; Tippett, M., Co-PI). Pending.
2. NOAA. \$598,051 9/1/19 - 8/31/22 0.5/YR Improving multi-model subseasonal probabilistic forecasts products using pattern-based calibration methods (Robertson, A., PI; Tippett, M., Co-PI). Pending.
3. NOAA. \$555,596 9/1/19 - 8/31/22 0.5/YR Subseasonal prediction and bias diagnosis of precipitation extremes in low latitudes (Wang, S., PI; Tippett, M., Sobel, A., Co-PIS). Pending.
4. NOAA. \$101,246 9/1/19 - 8/31/22 1/YR Advancing Subseasonal Predictions Through New Skill Comparison Methods (Tippett, M., PI). Pending.
5. NOAA. \$95,434 9/1/19 - 8/31/22 1/YR Advancing Decadal Predictions by Optimally Detecting Differences in Causal Relations (Tippett, M., PI). Pending.
6. NOAA. - #16248 \$197, 152 9/1/19 - 8/31/21 .25/YR Integrated assessment of United States hurricane hazards in the 21st century (Lee, C.Y., PI; de Camargo, S., Tippett, M., Mandli, K., Co-PIS, w/ Liu, H.) . Pending.
7. *Do Climate Models Capture the Relation Between Extreme Climate Events and the Large-Scale Environment?*. DelSole, T. PI; Tippett, M, Co-PI. DOE. Pending. (School of Engineering and Applied Sciences).
8. NOAA - NA180AR4310295. \$120,000 8/1/18 - 7/31/19 0.5 Testing, refinement and demonstration of probabilistic multi-model, calibrated subseasonal global forecast products (Robertson, A., PI; Tippett, M., Vigaud, N., Co-PIs).
9. *Collaborative Proposal: EarthCube Integration: Pangeo: An Open Source Big Data Climate Science Platform*. Abernathy, R., PI; Henderson, N., Lepore, C., Seager, R., Tippett, M., Co-PIs. NSF. Award Period: 11/1/17 -10/31/19. \$736,713. (Lamont-Doherty Earth Observatory/School of Engineering and Applied Sciences).

10. SWISS RE MGMT LTD. \$120,225 10/1/18 - 9/30/19 0.5/YR SWISSR CU18-3118 The Climate Change Signal in Hurricanes Today (Sobel, A., PI; de Camargo, S., Tippett, M., Lee, C.-Y., Co-PIs)
11. *Madden Julian Oscillation - The Maritime Continent Barrier and Seamless Verification*. Wang, S., PI; Tippett, M., Sobel, A., Co-PIs. National Oceanic and Atmospheric Administration. NA16OAR4310076. Award Period: 7/1/16 -6/30/19. \$509,456. (School of Engineering and Applied Sciences).
12. *Open Source Tropical Cyclone Risk Modeling for New York State*. Lee, C.-Y., PI; Camargo, S., Sobel, A., Tippett, M., Co-PIs. New York State. NYSERDA 103862. Award Period: 12/1/16- 3/1/20. \$299,873. (Lamont-Doherty Earth Observatory/School of Engineering and Applied Sciences).
13. *Weather Regime Diagnostic Tools for Sub-monthly Ensemble Forecasts*. Robertson, A., PI; Tippett, M., Vigaud, N., Co-Is. National Oceanic and Atmospheric Administration. NA16NWS4680014. Award Period 1/1/17-12/31/17. \$377,534. (Lamont-Doherty Earth Observatory/School of Engineering and Applied Sciences).
14. *Development a real-time multi-model sub-seasonal predictive capability*. Robertson, A., PI; Tippett, M., Co-PI. National Oceanic and Atmospheric Administration. NA16OAR4310145. Award Period: 08/01/2016 - 07/31/2018. \$367,250 Lamont. \$42,750. (School of Engineering and Applied Sciences).
15. *Severe weather activity prediction*. Tippett, M., PI; Sobel, A., Co-PI. Willis Re CU15-2366. Award period 7/1/15 - 6/30/19. \$406,000. (School of Engineering and Applied Sciences).
16. *Development and testing of a multi-model ensemble prediction system for sub-monthly forecasts*. Robertson, A., PI; Tippett, M., Co-PI. National Oceanic and Atmospheric Administration. NA15NWS4680014. Award Period: 05/01/2015 - 04/30/2017. \$26,982. (School of Engineering and Applied Sciences).
17. *Assessment of CFS predictions of severe weather activity*. Tippett, M., PI. National Oceanic and Atmospheric Administration. NA14OAR4310185. Award Period: 08/01/2014 - 07/31/2016. \$130K. (School of Engineering and Applied Sciences).
18. *Subseasonal NMME Forecasts: Skill, Predictability, and Multi-model Combinations*. Tippett, M., PI. National Oceanic and Atmospheric Administration. NA14OAR4310184. Award Period: 08/01/2014 - 07/31/2016. \$80K. (School of Engineering and Applied Sciences).
19. *Improved Probabilistic Forecast Products for the NMME Seasonal Forecast System*. Barnston, A., PI; Tippett, M., Li, S., Co-PIs. National Oceanic and Atmospheric Administration. NA14OAR4310188. Award Period: 8/1/14 - 7/31/16. \$246K. (Lamont-Doherty Earth Observatory).
20. *Development and analysis of environmental indices for the spatial distribution of hail occurrence and size*. Tippett, M., PI; Sobel, A., Co-PI. FM Global. Award Period: 05/22/2014 - 05/21/2018. \$147,767.00. (School of Engineering and Applied Sciences).
21. *AXA Award research project*. Sobel, A., PI; Biasutti, M., Wang, S., De Camargo, S., Tippett, M., Co-PIs. Award Period: 10/15/13-10/14/15. \$332,500. (Lamont-Doherty Earth Observatory/School of Engineering and Applied Sciences).
22. *Predictability of Atlantic hurricane activity by the NMME coupled models*. Barnston, A., PI; Tippett, M., Co-PI. National Oceanic and Atmospheric Administration. NA12OAR4310076. Award Period: 8/1/12-7/31/16. \$220K. (Lamont-Doherty Earth Observatory).
23. *Developing an optimum multi-model ENSO prediction*. NA12OAR4310082. Barnston, A., PI; Tippett, M, co-PI. w/ National Oceanic and Atmospheric Administration. Award Period: 8/1/12-7/31/15. \$275K. (Lamont-Doherty Earth Observatory).

24. *U.S. National Multi-Model Ensemble ISI Prediction System*. Tippett, M., PI. National Oceanic and Atmospheric Administration. Award Period: 08/01/2012 - 07/31/2015. \$174,925. (Lamont-Doherty Earth Observatory).
25. *Towards long-range prediction of tornado activity*. Tippett, M., PI; De Camargo, S., Sobel, A., Co-PIs. Columbia Research Initiatives for Science and Engineering (RISE). \$160K. 7/1/12. (Lamont-Doherty Earth Observatory).
26. *Extended-Range Prediction with Low-Dimensional, Stochastic-Dynamic Models: A Data-driven Approach*. Tippett, M., PI; Co-PIs: de Camargo, S., Sobel, A., Cane, M., Chen, D., Kaplan, A., Kushnir, Y., Henderson, N., Robertson, A., Ting, M., Yuan, X. Office of Naval Research. Award Period: 06/01/2012 - 05/31/2017. \$4,800,000. (Lamont-Doherty Earth Observatory).
27. *Incorporating scale and predictability information in multi-model ensemble climate predications*. Tippett, M., PI. National Oceanic and Atmospheric Administration. NA10OAR4310249. Award Period: 8/1/10 - 7/31/13. \$53K. (Lamont-Doherty Earth Observatory).
28. *Separating forced and unforced decadal predictability in models and observations*. Tippett, M., PI. Department of Energy. DE-SC0005109. Award Period: 7/1/10 - 6/30/13. \$96K. (Lamont-Doherty Earth Observatory).
29. *Recalibrating and Combining Ensemble Predictions*. Goddard, L., PI; Mason, S., Tippett, M Co-PIs. National Oceanic and Atmospheric Administration. NA08OAR4320912. Award Period: 08/01/09 - 07/31/11. \$285K. (Lamont-Doherty Earth Observatory).
30. *Linking seasonal forecasts into Riskview to enhance food security contingency planning*. Hansen, J., PI; Tippett, M., co-PI. UN World Food Program. Award Period: 11/23/09 - 8/31/10. \$14K. (Lamont-Doherty Earth Observatory).
31. *Collaborative Research: Hydrology of Central and Southwest Asia: Connections between regional atmospheric circulation and large-scale climate variability*. Kaplan, A., PI; M. Tippett, co-PI. NSF. Award Period: 2003-2006. \$56K. (Lamont-Doherty Earth Observatory).

G. Patents

N/A

H. Honors, prizes and fellowships

2016 Editors' Citation for Excellence in Refereeing for Geophysical Research Letters.

I. Invited talks

1. *Understanding skill scores*, 43rd Annual Climate Diagnostics and Prediction Workshop, Santa Barbara, California, 23–25 October, 2018. Invited.
2. *Severe Convective Storms: Impact of El Niño-Southern Oscillation (ENSO)*, Willis Research Network Autumn Seminar, London, November 1, 2017. Invited.
3. *Changes in the statistics of U.S. tornado reports*, 42nd Annual Climate Diagnostics and Prediction Workshop, Norman, Oklahoma, October 23-26, 2017. Invited.
4. *Climate and severe convective storms*, Board Meeting Educational Session, Hastings Mutual Insurance Company, Hastings, MI, August 10, 2017. Invited.
5. *Climate and severe thunderstorms: Progress since 2011*, CATLAB, Karen Clark & Company, Boston, MA, July 19, 2017. Invited.

6. *Changes in the statistics of U.S. tornado reports*, Programs in Atmospheres, Oceans and Climate (PAOC) Colloquium, MIT, Cambridge, MA, March 13, 2017. Invited.
7. *Changing tornado statistics*. Fourth Santa Fe Conference on Global & Regional Climate Change. Santa Fe, NM. February 8-9, 2017. Invited.
8. *Monthly predictions of severe weather indices in CFSv2*. Workshop on Sub-Seasonal to Seasonal Predictability of Extreme Weather and Climate. International Research Institute for Climate and Society, Dec 6-7, 2016. Invited.
9. *Characterizing hazardous convective weather risk*, Extreme events in the Earth and planetary sciences Workshop, Mathematics Institute, Warwick University, UK, July 4 - 8, 2016. Invited.
10. *Comparing forecast skill*, 13th International Meeting on Statistical Climatology, Canmore, Canada, June 6-10, 2016. Invited.
11. *Variability in US tornado reports and environments*, Workshop on Extreme Environmental Risks: Statistical Modeling and Insurability, ETH, Zurich, Switzerland. March 14-15, 2016. Invited.
12. *Changing tornado statistics*, Workshop in Severe Convection and Climate, Columbia University, New York, NY. March 9-10, 2016. Invited.
13. *Characterizing hazardous convective weather risk*, Atmosphere, Oceans, Climate Dynamics Seminar Series, Department of Geology & Geophysics, Yale University November 20, 2015. Invited.
14. *Hazardous convective weather risk: Big and small data problems*, 5th International Workshop on Climate Informatics, NCAR, Boulder, CO. September 24-25, 2015. Invited.
15. *Modeling Hazardous Convective Weather Risk*, RiskLab, ETH, Zurich, Switzerland. August 25, 2015. Invited.
16. *Modeling Hazardous Convective Weather Risk*, Extreme Weather and Climate: Hazards, Impacts, Actions, Columbia University, New York, NY. May 6, 2015. Invited.
17. *Assessment of CFS Predictions of U.S. Severe Weather Activity*, Climate and Severe Weather Workshop, NCWCP Conference Center, College Park, MD, March 11-12, 2015. Invited.
18. *Seasonal Prediction – Statistical Aspects I, II*, The First Seasonal Climatic Prediction Workshop, Center of Excellence for Climate Change Research, King Abdulaziz University, Jeddah, Kingdom of Saudi Arabia. Dec 29, 2014 - Jan 1, 2015. Invited.
19. *Modeling Hazardous Convective Weather Risk*, Climate, Risk and Statistics Workshop, Columbia University, New York, NY, Dec 11-12, 2014. Invited.
20. *Toward seamless prediction of severe weather activity*, Climate Prediction Center NOAA / National Centers for Environmental Prediction. College Park, MD. Jul 23, 2014. Invited.
21. *Association of Tornado Occurrence with Environmental Parameters*, School of Marine and Atmospheric Sciences, Stony Brook University, September 12, 2012. Invited.
22. *Association of Tornado Occurrence with Environmental Parameters*, NASA Goddard Institute for Space Studies, New York, NY. May 4, 2012. Invited.
23. *Association of Tornado Occurrence with Environmental Parameters*, Center for Ocean-Land-Atmosphere Studies, Fairfax, Virginia. May 3, 2012. Invited.
24. Invited Lecturer. *Targeted Training Activity: Statistical Methods in Seasonal Prediction*, Abdus Salam

International Centre for Theoretical Physics, Trieste, Italy. 2 August 2010 - 13 August 2010.

25. *Regression-based methods for finding coupled patterns*, 19th Conference on Probability and Statistics, 88th American Meteorological Society Annual Meeting, 20-24 January 2008.
26. *Potential predictability, ensemble forecasts and tercile probabilities*, Center for Ocean-Land-Atmosphere Studies, Fairfax, Virginia. June 30, 2005. Invited.

J. Conferences or workshops organized

The First International Workshop on Climate Informatics, August 26, 2011

The New York Academy of Sciences, [Information Web site](#)

Workshop on Severe Convection and Climate, March 14-15, 2013

Columbia University, Palisades, NY, [\[Agenda\]](#) [\[Description\]](#)

2nd Workshop on Severe Convection and Climate, March 9-10, 2016

Columbia University, New York, NY [\[Web site\]](#)

K. Service

University service

1. Applied Physics and Applied Mathematics Graduate Admissions Fall 2017–present.
2. Applied Mathematics Program Committee.
3. Class of 2019 AM Undergraduate Advisor (M-Z).
4. Class of 2016 AM Undergraduate Advisor (A-L).
5. Research Conference coordinator. Fall 2015.

Professional service

Journal reviewer: Journal of Climate, Monthly Weather Review, Geophysical Research Letters, Climate Dynamics, Science, Journal of Applied Meteorology and Climatology, IEEE Transactions on Automatic Control, Journal of Geophysical Research, Tellus, Weather and Forecasting, Journal of Hydrology, Ocean Modelling, Quarterly Journal of the Royal Meteorological Society, Climatic Change, Physica D: Nonlinear Phenomena, Journal of Atmospheric and Oceanic Technology, Journal of the Atmospheric Sciences, International Journal of Climatology, Theoretical and Applied Climatology, Proceedings of the National Academy of Science (USA).

Associate Editor, npj Climate and Atmospheric Science, 2016–present.

Associate Editor, Earth Systems and Environment, 2016-2018.

Associate Editor, Monthly Weather Review, 2003-2006.

Invited participant, Extreme Weather Events and Climate Change Attribution Workshop, National Academy of Sciences, Oct 22-23, Washington DC, 2015.

Review Panels: NOAA Modeling, Analysis, Predictions, and Projections, NOAA CLIVAR Pacific, Research Opportunities and Approaches to Data Science (ROADS) Review Committee.

NOAA Climate Prediction Task Force 2012-2014. NOAA S2S Task Force 2016-2018.

Data and tools distributed

Designed and developed the statistical methods and software used to correct the output of physics-based numerical models and produce monthly seasonal climate forecasts at the International Research Institute for Climate and Society. These forecasts are disseminated and used around the world. [\[IRI Climate Forecasts\]](#)

Statistical routines used in the [Climate Predictability Tool](#), which is “designed to assist National Meteor-

logical Services to produce their own tailored, downscaled seasonal climate forecasts.”

Our approach of associating tornado and hail activity with favorable atmospheric environments was the basis of an [experimental seasonal tornado forecast](#) issued in 2015.

Managed installation of the first [climate data portal](#) in Arabic serving the Middle East/North Africa region.

Laplacian eigenfunction [codes](#) and precomputed for various geographical domains and [grids](#).

[Codes](#) for the comparison of forecast skill.

Public outreach

1. A seasonal outlook for tornadoes? Feb 22, 2012. [earthsky.org](#)
2. What if we could predict tornadoes a month out? Jan 27, 2012. [csmonitor.com](#)
3. Scientists a step closer to predicting tornadoes, Feb 14, 2012. [usatoday.com](#)
4. Forecasting is a challenge as tornado season looms, February 23, 2012. [foxnews.com](#)
5. U.S. Tornado Chasers Prepare for High Season, Feb 24, 2012. [claimsjournal.com](#)
6. Tornado Clusters on the Rise in the U.S., Oct 20 2014. [weather.com](#)
7. Tornado seasons peaking earlier, becoming more volatile, Sep 17, 2014. [washingtonpost.com](#)
8. Tornado Days Decreasing, but Number Per Day Rising, October 16th, 2014. [climatecentral.org](#)
9. Experimental Forecast Projects Tornado Season, March 16th, 2015. [climatecentral.org](#)
10. El Niño Can Predict Tornado Season’s Severity, March 16, 2015. [livescience.com](#)
11. Is El Niño behind our record-slow start to tornado season?, March 24, 2015. [washingtonpost.com](#)
12. Tornadoes: El Niño may give Canada’s twister season a boost, Aug 4, 2015. [cbc.ca](#)
13. Is climate change behind the rise in extreme tornado outbreaks? Dec 2, 2016.. [csmonitor.com](#)
14. Thunderstorms Just as Costly to Insurers as Hurricanes: Study. March 22, 2017.. <http://www.insurancejournal.com>
15. ENSO and tornadoes. April 27. 2017. [NOAA](#)
16. Everything you need to know about the tornadoes (and blizzards) that struck this weekend. May 1, 2017. [Popular Science](#)
17. Tornadoes on the East Coast May Be a Sign of Things to Come. August 8, 2018. [NY Times](#)
18. Is climate change making U.S. tornadoes worse? March 5, 2019. [PBS News Hour](#)
19. What we know about tornadoes and climate. March 5, 2019. [change. CBS News](#).