

A Study of Precipitation Forecasting for the Pre-summer Rainy Season in South China Based on a BP Neural Network

Bing-Zeng Wang^{1,2}, Si-Jie Liu^{1,2*}, Xin-Min Zeng^{1,2,3*}, Bo Lu⁴, Zeng-Xin Zhang¹, Jian Zhu¹, and Irfan Ullah¹

¹ College of Hydrology and Water Resources, Hohai University, Nanjing 210098, China;

² China Meteorological Administration Hydrometeorology Key Laboratory, Nanjing 210098, China;

³ College of Oceanography, Hohai University, Nanjing, China

⁴ China Meteorological Administration, Beijing, China

* Correspondence: Correspondence: xinmin.zeng@hhu.edu.cn (X.-M.Z.); liusijie@hhu.edu.cn (S.-J.L.)

130 monthly monitoring indices from China National Climate Centre

1 atmospheric circulation indices:

1. Northern Hemisphere Subtropical High Area Index
2. North African Subtropical High Area Index
3. North African-North Atlantic-North American Subtropical High Area Index
4. Indian Subtropical High Area Index
5. Western Pacific Subtropical High Area Index
6. Eastern Pacific Subtropical High Area Index
7. North American Subtropical High Area Index
8. Atlantic Subtropical High Area Index
9. South China Sea Subtropical High Area Index
10. North American-Atlantic Subtropical High Area Index
11. Pacific Subtropical High Area Index
12. Northern Hemisphere Subtropical High Intensity Index
13. North African Subtropical High Intensity Index
14. North African-North Atlantic-North American Subtropical High Intensity Index
15. Indian Subtropical High Intensity Index
16. Western Pacific Subtropical High Intensity Index

17. Eastern Pacific Subtropical High Intensity Index
18. North American Subtropical High Intensity Index
19. North Atlantic Subtropical High Intensity Index
20. South China Sea Subtropical High Intensity Index
21. North American-North Atlantic Subtropical High Intensity Index
22. Pacific Subtropical High Intensity Index
23. Northern Hemisphere Subtropical High Ridge Position Index
24. North African Subtropical High Ridge Position Index
25. North African-North Atlantic-North American Subtropical High Ridge Position Index
26. Indian Subtropical High Ridge Position Index
27. Western Pacific Subtropical High Ridge Position Index
28. Eastern Pacific Subtropical High Ridge Position Index
29. North American Subtropical High Ridge Position Index
30. Atlantic Sub Tropical High Ridge Position Index
31. South China Sea Subtropical High Ridge Position Index
32. North American-North Atlantic Subtropical High Ridge Position Index
33. Pacific Subtropical High Ridge Position Index
34. Northern Hemisphere Subtropical High Northern Boundary Position Index
35. North African Subtropical High Northern Boundary Position Index
36. North African-North Atlantic-North American Subtropical High Northern Boundary Position Index
37. Indian Subtropical High Northern Boundary Position Index
38. Western Pacific Subtropical High Northern Boundary Position Index
39. Eastern Pacific Subtropical High Northern Boundary Position Index
40. North American Subtropical High Northern Boundary Position Index
41. Atlantic Subtropical High Northern Boundary Position Index
42. South China Sea Subtropical High Northern Boundary Position Index
43. North American-Atlantic Subtropical High Northern Boundary Position Index
44. Pacific Subtropical High Northern Boundary Position Index

45. Western Pacific Sub Tropical High Western Ridge Point Index
46. Asia Polar Vortex Area Index
47. Pacific Polar Vortex Area Index
48. North American Polar Vortex Area Index
49. Atlantic-European Polar Vortex Area Index
50. Northern Hemisphere Polar Vortex Area Index
51. Asia Polar Vortex Intensity Index
52. Pacific Polar Vortex Intensity Index
53. North American Polar Vortex Intensity Index
54. Atlantic-European Polar Vortex Intensity Index
55. Northern Hemisphere Polar Vortex Intensity Index
56. Northern Hemisphere Polar Vortex Central Longitude Index
57. Northern Hemisphere Polar Vortex Central Latitude Index
58. Northern Hemisphere Polar Vortex Central Intensity Index
59. Eurasian Zonal Circulation Index
60. Eurasian Meridional Circulation Index
61. Asian Zonal Circulation Index
62. Asian Meridional Circulation Index
63. East Asian Trough Position Index
64. East Asian Trough Intensity Index
65. Tibet Plateau Region 1 Index
66. Tibet Plateau Region 2 Index
67. India-Burma Trough Intensity Index
68. Arctic Oscillation, AO
69. Antarctic Oscillation, AAO
70. North Atlantic Oscillation , NAO
71. Pacific/ North American Pattern , PNA
72. East Atlantic Pattern, EA

73. West Pacific Pattern , WP
74. North Pacific Pattern , NP
75. East Atlantic-West Russia Pattern , EA/WR
76. Tropical-Northern Hemisphere Pattern, TNH
77. Polar-Eurasia Pattern , POL
78. Scandinavia Pattern , SCA
79. Pacific Transition Pattern, PT
80. 30hPa zonal wind Index
81. 50 hPa zonal wind Index
82. Mid-Eastern Pacific 200mb Zonal Wind Index
83. West Pacific 850mb Trade Wind Index
84. Central Pacific 850mb Trade Wind Index
85. East Pacific 850mb Trade Wind Index
86. Atlantic-European Circulation W Pattern Index
87. Atlantic-European Circulation C Pattern Index
88. Atlantic-European Circulation E Pattern Index

2 sea surface temperature indices

1. NINO 1+2 SSTA Index
2. NINO 3 SSTA Index
3. NINO 4 SSTA Index
4. NINO 3.4 SSTA Index
5. NINO W SSTA Index
6. NINO C SSTA Index
7. NINO A SSTA Index
8. NINO B SSTA Index
9. NINO Z SSTA Index
10. Tropical Northern Atlantic SST Index
11. Tropical Southern Atlantic SST Index

12. Western Hemisphere Warm Pool Index
13. Indian Ocean Warm Pool Area Index
14. Indian Ocean Warm Pool Strength Index
15. Western Pacific Warm Pool Area Index
16. Western Pacific Warm Pool Strength index
17. Atlantic Multi-decadal Oscillation Index
18. Oyashio Current SST Index
19. West Wind Drift Current SST Index
20. Kuroshio Current SST Index
21. ENSO Modoki Index
22. Warm-pool ENSO Index
23. Cold-tongue ENSO Index
24. Indian Ocean Basin-Wide Index
25. Tropic Indian Ocean Dipole Index
26. South Indian Ocean Dipole Index

3 other indices

1. Cold Air Activity Index
2. Western North Pacific Typhoon number
3. Number of Landing Typhoon on China
4. Total Sunspot Number Index
5. Southern Oscillation Index
6. Tropical Pacific Outgoing Long Wave Radiation Index
7. Multivariate ENSO Index
8. Pacific Decadal Oscillation Index
9. Atlantic Meridional Mode SST Index
10. Quasi-Biennial Oscillation Index
11. Globally Integrated Angular Momentum Index
12. Solar Flux Index

13. Equatorial Pacific 130E-80W Upper 300m temperature averaged anomaly index
14. Equatorial Pacific 160E-80W Upper 300m temperature Average anomaly index
15. Equatorial Pacific 180-100W Upper 300m temperature Average anomaly index
16. North Atlantic Triple index