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| **Recommendation ITU-R P.2148-0**  **(08/2022)** |
| **Digital maps related to surface  wind speed statistics** |
| **P Series**  **Radiowave propagation** |

Foreword

The role of the Radiocommunication Sector is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including satellite services, and carry out studies without limit of frequency range on the basis of which Recommendations are adopted.

The regulatory and policy functions of the Radiocommunication Sector are performed by World and Regional Radiocommunication Conferences and Radiocommunication Assemblies supported by Study Groups.

# Policy on Intellectual Property Right (IPR)

ITU-R policy on IPR is described in the Common Patent Policy for ITU-T/ITU-R/ISO/IEC referenced in Resolution ITU‑R 1. Forms to be used for the submission of patent statements and licensing declarations by patent holders are available from <http://www.itu.int/ITU-R/go/patents/en> where the Guidelines for Implementation of the Common Patent Policy for ITU‑T/ITU‑R/ISO/IEC and the ITU-R patent information database can also be found.

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| Series of ITU-R Recommendations  (Also available online at <http://www.itu.int/publ/R-REC/en>) | |
| **Series** | Title |
| **BO** | Satellite delivery |
| **BR** | Recording for production, archival and play-out; film for television |
| **BS** | Broadcasting service (sound) |
| **BT** | Broadcasting service (television) |
| **F** | Fixed service |
| **M** | Mobile, radiodetermination, amateur and related satellite services |
| P | Radiowave propagation |
| **RA** | Radio astronomy |
| **RS** | Remote sensing systems |
| **S** | Fixed-satellite service |
| **SA** | Space applications and meteorology |
| **SF** | Frequency sharing and coordination between fixed-satellite and fixed service systems |
| **SM** | Spectrum management |
| **SNG** | Satellite news gathering |
| **TF** | Time signals and frequency standards emissions |
| **V** | Vocabulary and related subjects |

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| ***Note***: *This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.* |

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RECOMMENDATION ITU-R P.2148-0

Digital maps related to surface wind speed statistics

(2022)

Scope

This Recommendation provides methods to predict wind speed statistics at any location on the surface of the Earth and at any exceedance probability within the range from 0.01% to 99%.

Keywords

Wind speed

Related ITU-R Recommendations

Recommendation ITU-R [P.2146](https://www.itu.int/rec/R-REC-P.2146/en)

NOTE – The latest revision/edition of the Recommendation should be used.

The ITU Radiocommunication Assembly,

considering

*a)* that surface wind speed statistics are needed to predict scattering from the sea surface;

*b)* that worldwide fifth generation reanalysis data from the European Centre for Medium-Range Weather Forecasts (ECMWF) are available;

*c)* that ten years of worldwide reanalysis data have been post-processed to provide wind speed statistics,

recommends

that the method in Annex 1 should be used to predict wind speed statistics at any location on the surface of the Earth and at any exceedance probability within the range from 0.01% to 99%, when more accurate local statistical data are not available.

Annex 1

List of symbols

wind speed (m/s)

exceedance probability (%)

# 1 Wind speed statistical maps

Digital maps of the worldwide average annual statistics of wind speed at a height of 10 m above the surface of the Earth are an integral part of this Recommendation with the characteristics shown in Table 1. The association between exceedance probability and the associated map file name is shown in Table 2.

The annual values of wind speed, , in m/s, exceeded for 0.01, 0.02, 0.03, 0.05, 0.1, 0.2, 0.3, 0.5, 1, 2, 3, 5, 10, 20, 50, 60, 70, 80, 90, 95 and 99% of an average year at a height of 10 m above the surface of the Earth are an integral part of this Recommendation and are available in the form of digital maps provided in the file R-REC-P.2148-0-202208-!!ZIP.

# 2 Spatial and statistical interpolation

The wind speed at any location on the surface of the Earth and at any exceedance probability within the range from 0.01% to 99% can be predicted by the following method:

a) determine the two probabilities, *pabove* and *pbelow*, above and below the desired exceedance probability, *p*, from the set: 0.01, 0.02, 0.03, 0.05, 0.1, 0.2, 0.3, 0.5, 1, 2, 3, 5, 10, 20, 50, 60, 70, 80, 90, 95 and 99%;

b) for the probability, determine the wind speed, , , , and at the four closest grid points;

c) for the probability, determine the wind speed, , , , and at the four closest grid points;

d) for the probability, , determine the wind speed at the location on the surface of the Earth by performing a bi-linear interpolation of the four values of wind speed , , , and as described in Annex 1 of Recommendation ITU-R [P.1144](https://www.itu.int/rec/R-REC-P.1144/en);

e) for the probability, , determine the wind speed at the location on the surface of the Earth by performing a bi-linear interpolation of the four values of wind speed , , , and as described in Annex 1 of Recommendation ITU-R [P.1144](https://www.itu.int/rec/R-REC-P.1144/en);

f) determine the wind speed, , at the desired location and exceedance probability, *p*, by interpolating and vs *pabove* and *pbelow* to exceedance probability, *p*, on a linear vs log10 *p* scale.

TABLE 1

Map file characteristics

|  |  |
| --- | --- |
| Parameter | Value |
| Format | ASCII |
| Upper left corner latitude | 90° N |
| Latitude increment | −0.25° |
| Upper left corner longitude | 0° E |
| Longitude increment | +0.25° |
| Number of rows | 721 |
| Number of columns | 1 440 |
| Column separator | Space |
| Row separator | Windows (CR LF) |

TABLE 2

Map file name vs. exceedance probability

|  |  |
| --- | --- |
| Exceedance probability | Map file name |
| 0.01% | W\_001.txt |
| 0.02% | W\_002.txt |
| 0.03% | W\_003.txt |
| 0.05% | W\_005.txt |
| 0.1% | W\_01.txt |
| 0.2% | W\_02.txt |
| 0.3% | W\_03.txt |
| 0.5% | W\_05.txt |
| 1.0% | W\_1.txt |
| 2.0% | W\_2.txt |
| 3.0% | W\_3.txt |
| 5.0% | W\_5.txt |
| 10.0% | W\_10.txt |
| 20.0% | W\_20.txt |
| 50.0% | W\_50.txt |
| 60.0% | W\_60.txt |
| 70.0% | W\_70.txt |
| 80.0% | W\_80.txt |
| 90.0% | W\_90.txt |
| 95.0% | W\_95.txt |
| 99.0% | W\_99.txt |