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Wind erosion forces and their direction distribution for assessing efficiency of shelterbelts in northern China

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The prevailing wind erosion direction (PWED) and wind direction distribution (WDD) exert a significant impact on the protection efficiency of shelterbelts in soil wind erosion regions. In this paper, wind erosion forces, PWED, preponderance of wind erosion forces (Rm) in the PWED, and the contrast of wind erosion forces between PWED and its opposite direction (λ) were calculated based on the wind data of 204 weather stations in northern China from 1980 to 2016. The dominance of the PWED reflected by the combination of Rm and λ was defined as the WDD. The WDD was divided into four structural Patterns: Strong dominance of PWED (Pattern I), strong dominance of both PWED and its opposite direction (Pattern II), medium dominance of PWED (Pattern III) and weak dominance of PWED (Pattern IV). The western region mostly belongs to Pattern I, primary shelterbelts which are perpendicular to the PWED should be strengthened. Local areas of the mountain passes in the northwest of Junggar Basin, the north of Qaidam Basin and the northwest of Hexi Corridor, and the southern part of the plain area in northeast China belong to the Pattern II, it is necessary to set up multi-row shelterbelts and the orientation of the shelterbelts should be perpendicular to the PWED. The east region mainly belongs to Pattern III or Pattern IV, it is necessary to set up different levels of shelterbelts, and strengthen the construction of both the primary shelterbelts and the secondary shelterbelts.