REGIOEXAKT: REGIONAL CLASSIFICATION OF THE WIND CONDITIONS FOR GERMANY IN PRESENT AND FUTURE; CARTOGRAPHICAL VIEW OF TRENDS FOR EXTREME WIND CONDITIONS

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I. INTRODUCTION

Research programs for Climatic Change have found significantly increases for wind speed in storm events. Inside the RegioExAKT program the Ruhr-Universität Bochum has found time dependent trends for wind loads according to the structural engineering regulatory system. Significant trends have been found for more than 170 monitoring stations of the German Weather Service (DWD). As these stations are irregular distributed over Germany, a regional extrapolation has to be performed to identify "wind speed regions" according to the appropriate technical guideline (DIN 1055-4, 2005).

II. PRESENTATION OF RESEARCH

To perform a regional extrapolation for wind speed and wind loads the geostatistical Kriging method has been used inside the Geographical Information System ArcGIS. While using Kriging an unbiased linear estimation can be made for all unknown locations using weighted values of the known neighbour stations. These weighted values are optimized in a way that the overall error of the estimation will be nearly zero. As a basic principle for the estimation the geostatistical semivariogram is used to describe the regional correlation.

In a first approach a simple Kriging estimation with a spherical semivariogram and variable search radius has been used to perform an extrapolation for 12 trend scenarios depending on three different start dates of exposition (2009, 2019, 2029) and four different exposition periods (10, 20, 50, 80 years).

In the DIN 1055-4 four different wind zones are provided depending on wind load values with a range of 2,5 m/s impacting building structures. Depending on the fixed class limits the wind zones are recalculated using the Kriging method. Figure 1 shows the scenario for 2009 as the start date for the wind load exposition of the building and 10 years for the exposition period.

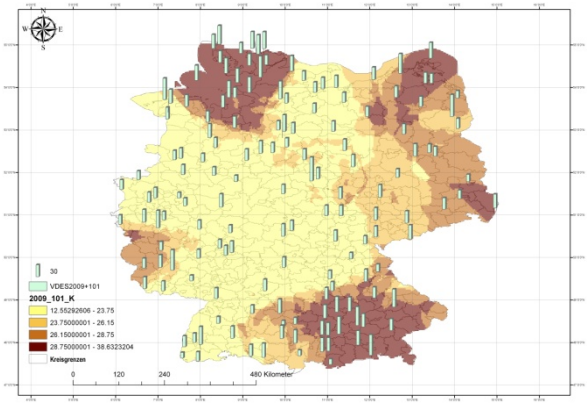

Fig. 1: Wind load classes for start date building of exposition in 2009 and exposition period of 10 years

To represent the other extent of the time scale Fig. 2 shows a more future scenario with 2029 as the start date and 80 years for the exposition period.

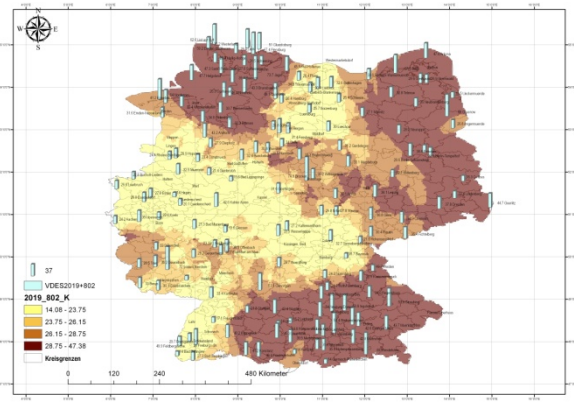

Fig. 2: Wind load classes for start date building of exposition in 2029 and exposition period of 80 years

It is also shown in Fig. 2 that the area of the new wind zone class 4 has significantly grown as it represents the consequences of an increasing trend for wind speed and wind loads in future climate conditions. Furthermore the wind zone class 4 includes more and much higher wind load values than the scenarios in the earlier time scale as the value distribution is shifting from normal to right skewed.

III. RESULTS AND CONCLUSIONS

Regarding these results the wind zones in the DIN 1055-4 are no longer valid for the estimated future storm conditions in Germany. Especially the wind zone class 4 needs to be updated regarding the higher wind load values that are now included in this class. Recommendations will be made for additional wind zone classes or the development of a new model for treating those higher wind load values in future wind conditions. Results are to be expected by the end of the RegioExAKT program.

V. REFERENCES

DIN 1055-4, 2005: Action on structures , Part 4: Wind loads