ASPECTS OF WIND POWER IN THE COMPLEX TERRAIN OF ICELAND

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Abstract: A study of observed winds in Iceland reveals large interannual fluctuations in wind power and also a large directional dependence of the wind power at individual locations. It is suggested that the temporal variability of wind power is related to variability in the direction of the large scale flow.

Keywords: *wind power, wind direction, trend, Iceland,mountains*

1. INTRODUCTION

In this study, the wind power in Iceland is assessed with the help of conventional wind observations at several synoptic weather stations. Time series are constructed, the sensitivity of wind power ad individual locations to wind direction and to the temporal resolution of the observations is investigated.

2. LONG-TERM EVOLUTION OF THE WIND POWER

Figure 1 and 2 show the evolution of the available wind power at several weather stations in Iceland together with the wind power of the geostrophic wind calculated from the ERA40 reanalysis of the European Centre for Medium Range Weather Forecasting. Figure 1 shows a slight positive trend in the geostrophic wind power, but this trend is very small compared to the interannual variability. Only one weather station (Stórhöfði) has power of a similar magnitude, but the wind power at Stórhöfði has a negative trend. The other weather stations (Fig.2) reveal only small long-term trends at most of the stations, but periods of relatively little and periods of relatively abundant available wind power. The most striking aspect of this is the fact that although Iceland is small, the curves do not oscillate in the same phase. Around 1980 Keflavik has a minimum, while Raufarhöfn, Hornbjargsviti and Stykkishólmur feature a maximum. This out-of-phase feature is most likely related to the variability in wind directions.

3. WIND DIRECTIONS AND WIND POWER

Figure 3 shows that some of the weather stations receive a relatively large part of their power from a narrow directional window. Thus, Galtarviti has a power peak in winds from the NE and SW, Dalatangi has peaks in southerly flows, Hornbjargsviti has distinct peaks in flows from the ENE and SE. The geostrophic wind direction is compared to the surface wind direction in Figure 4. At most directions, the angle between the surface wind and the geostophic wind is about 40° or even less.

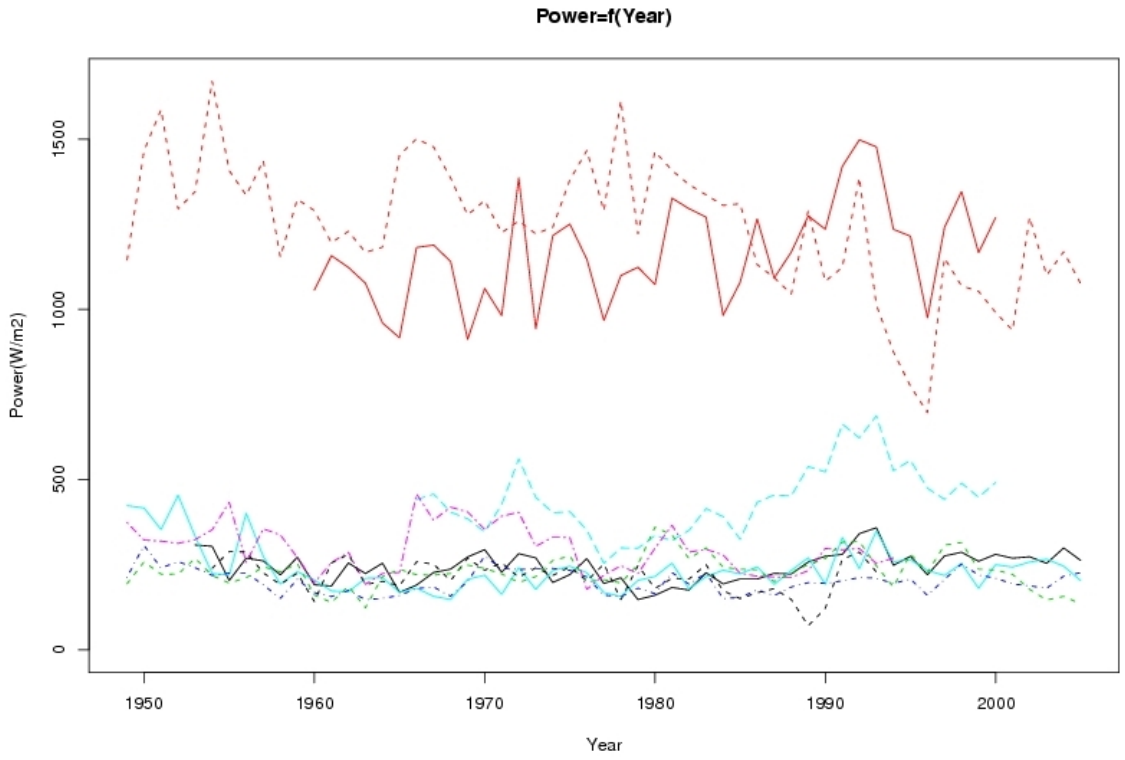

Figure 1: Temporal evolution of available wind power at several weather stations in Iceland

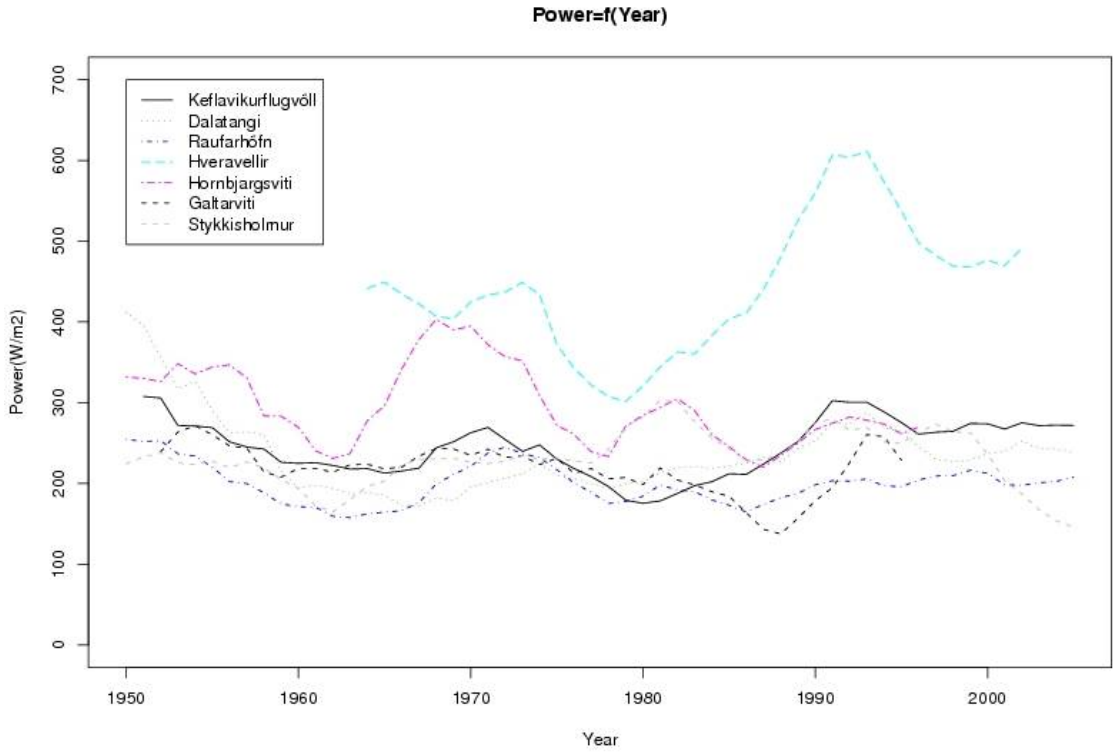

Figure 2: Wind power (zoom from Fig. 1, but with 5 years running mean)

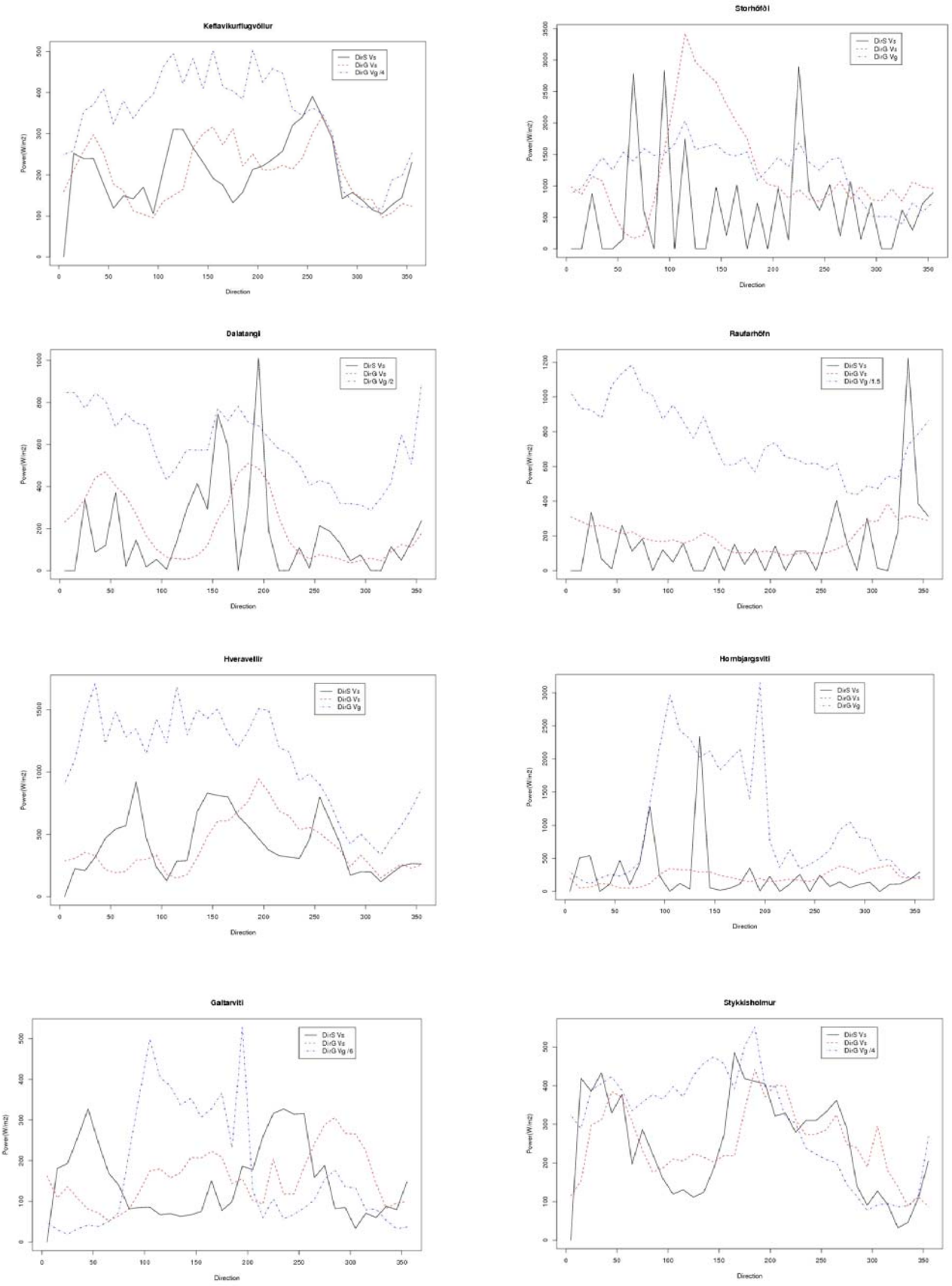

Figure 3: Wind power as a function of wind direction at several weather stations in Iceland. G is for geostrophic and S is for surface (10 m) winds.

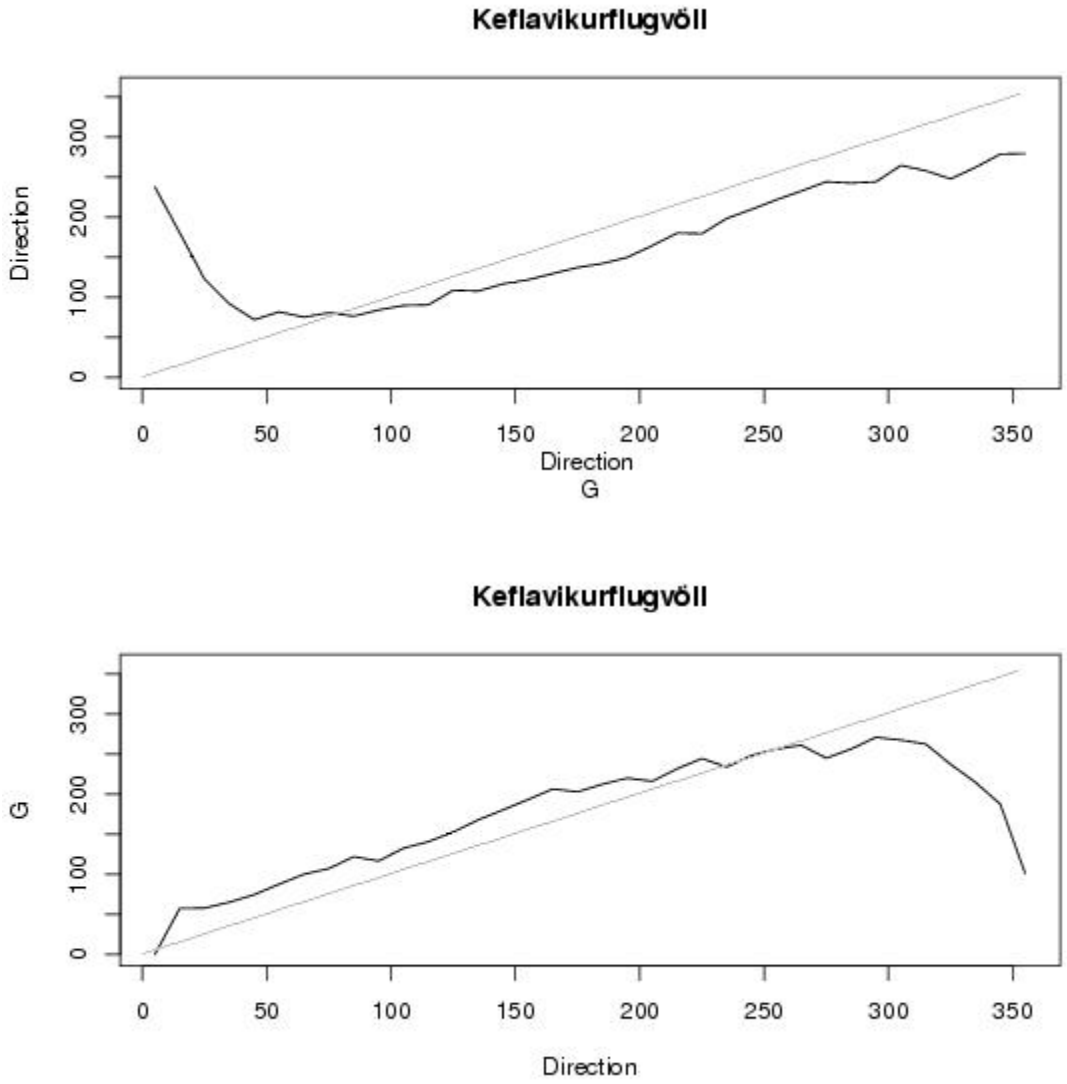

Figure 3 : Observed wind direction at 10 m height vs. the direction of the geostrophic wind at Keflavíkurflugvöllur