Drivers of Extreme Wind Events in Mexico for Wind Power Applications

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In this talk, we investigate the causes of the strongest and weakest winds observed across Mexico and explore the consequences of these to current and future wind energy production in the country. Using 40 years of the ERA-5 atmospheric reanalysis data, we find that the strongest winds in this region are caused by cold surges, where an anticyclone moves South from the Central United States of America resulting in strong Northerly winds across the Gulf of Mexico which channel through the gap in the mountains to the South of Mexico. Other regions have different drivers for high and low wind speed events. The strongest winds across the East coast of Mexico originate from Easterly trade winds propagating across the Gulf of Mexico, whereas those in Baja California Sur are influenced by the proximity of the North Pacific High. These regions in Mexico have peak (and sustained low) wind speeds at different times of year which suggests that wind farms in different regions could compliment one another to optimise wind power generation. However, all stations but Baja California Sur see the same weather patterns associated with weak wind events, meaning that low wind power production may be unavoidable at these times. The conditions that proceed these sustained periods of strong and weak winds are explored to gain some predictability for wind power applications. The El Nino Southern Oscillation is found to influence wind speeds at some locations across Mexico at sub-seasonal time-scales.