A large field of white wind turbines under a cloudy sky. The turbines are arranged in rows, stretching into the distance. The sky is filled with soft, white clouds, and the overall scene is bright and clear.

Renewable Energy, Climate and Climate Forecast

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Key issues

A large field of white wind turbines is visible in the background, stretching across a hilly landscape under a sky filled with soft, white clouds. The turbines are arranged in rows, with some in the foreground and others receding into the distance. The overall scene is bright and airy, suggesting a clean, renewable energy source.

- **Continuous increase in energy demand, especially in “emerging” countries**
- **Role of renewable energies in the global change context**
- **Dependency of renewables upon climate variables such as wind and incoming solar radiation**

The “Energy-Climate” interaction

Climate is changing

Renewables' use depends on climate variables

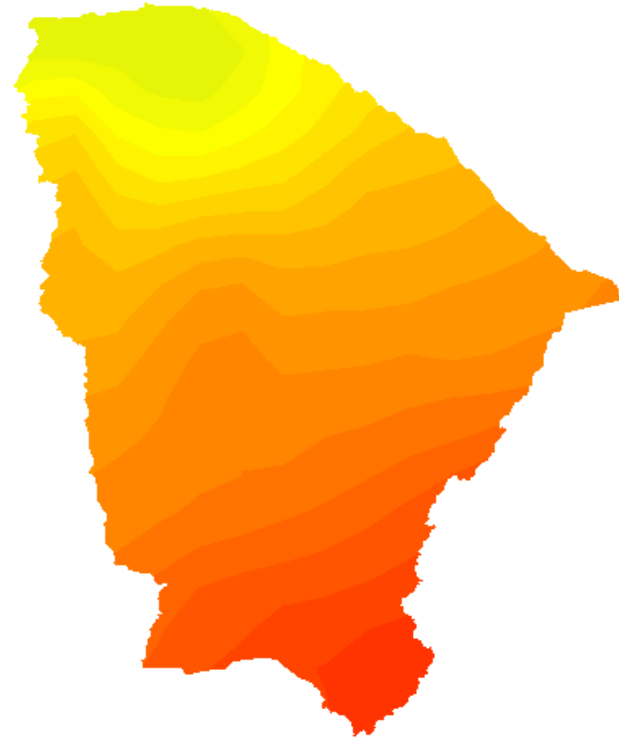
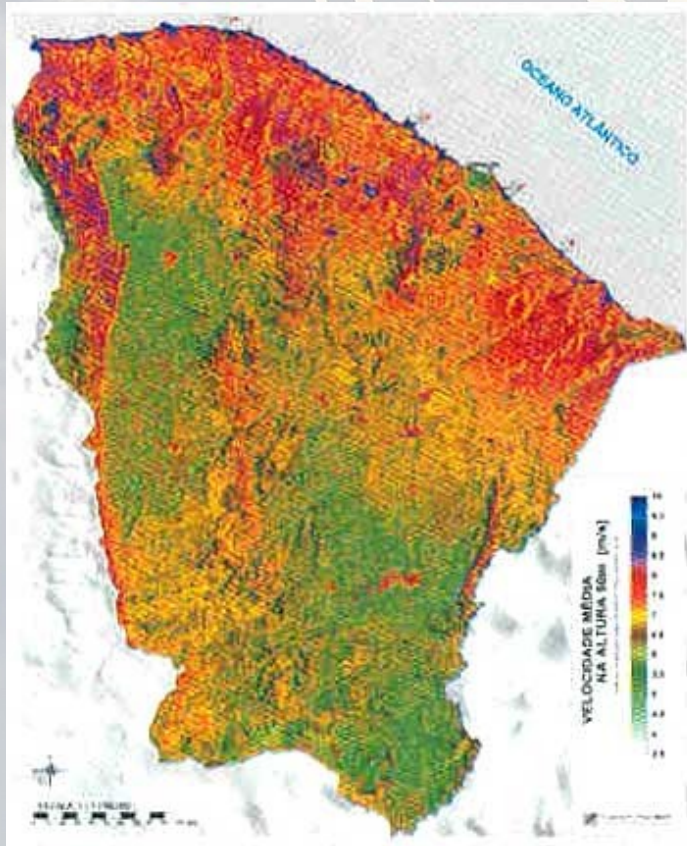
Renewables are important to mitigate climate change

Renewables' use may be optimized via the proper use of climate information (climatology, seasonal forecast, climate change scenarios)

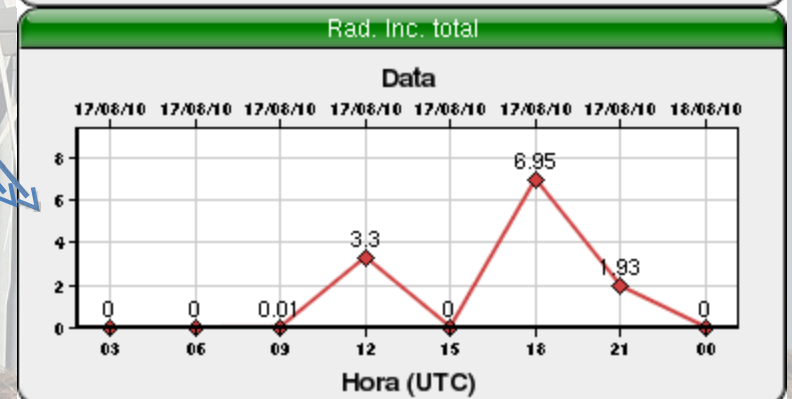
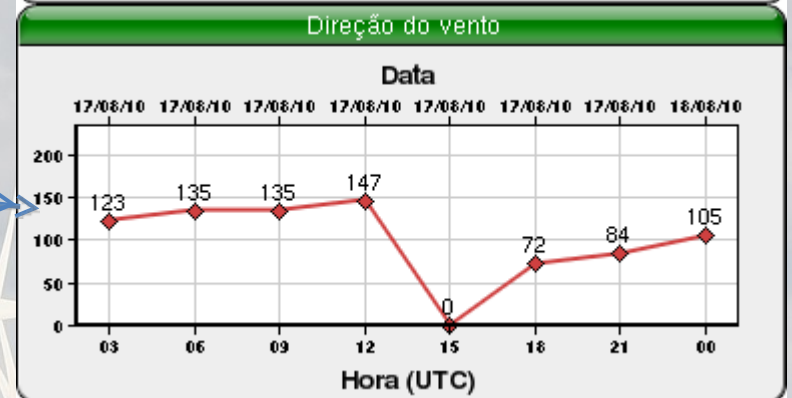
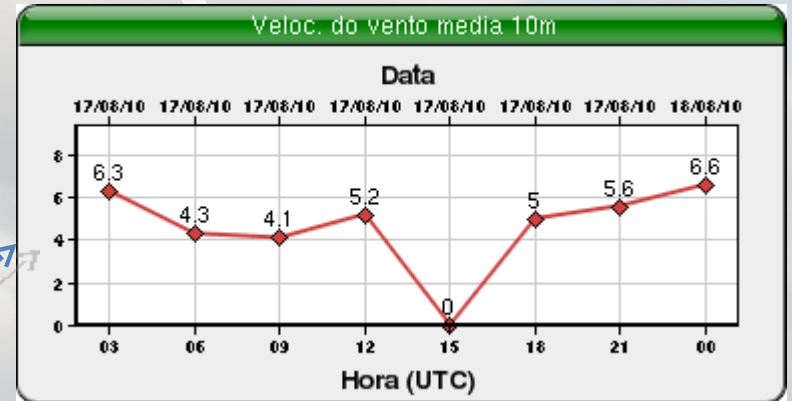
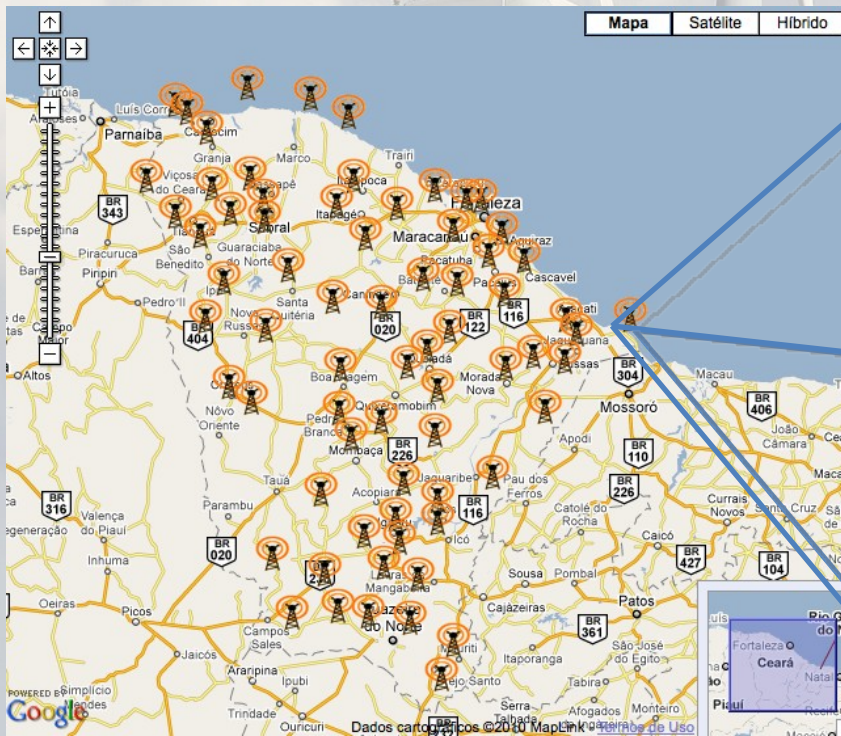
The NE Brazil case

- **Significant wind power (moderately intense, very steady trade wind circulation)**
- **High input of solar radiation at the surface (location close to the equator, reduced cloudiness except during the rainy season)**
- **Advances in monitoring and numerical weather prediction**
- **Significant experience in seasonal forecast because of the high predictability on such scale (focusing on the precipitation, but easily extended to other variables)**
- **Recent involvement in research projects that will allow assessment of the influence of climate change in atmospheric variables that are relevant to renewable energy sources**
- **Cooperative work among Funceme, Uece and other partners (IRI, SEINFRA, INPE, etc.)**

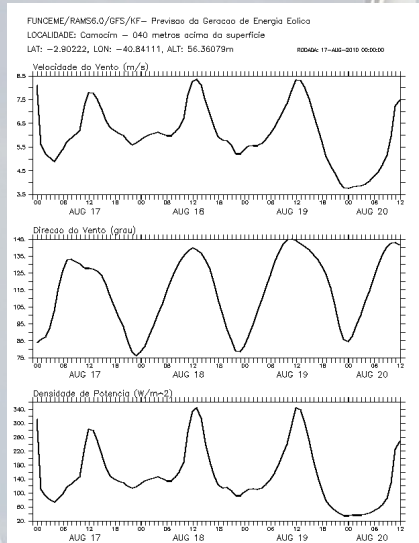
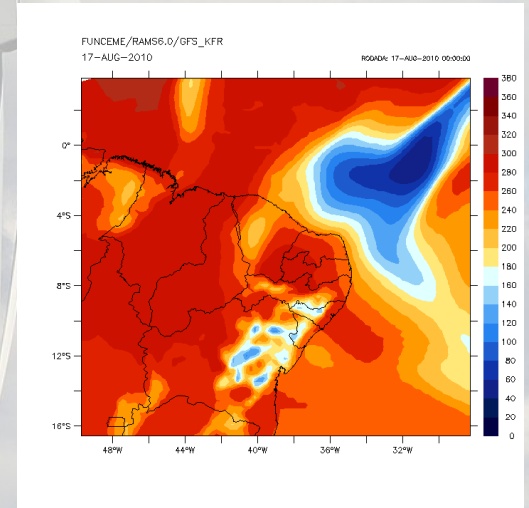
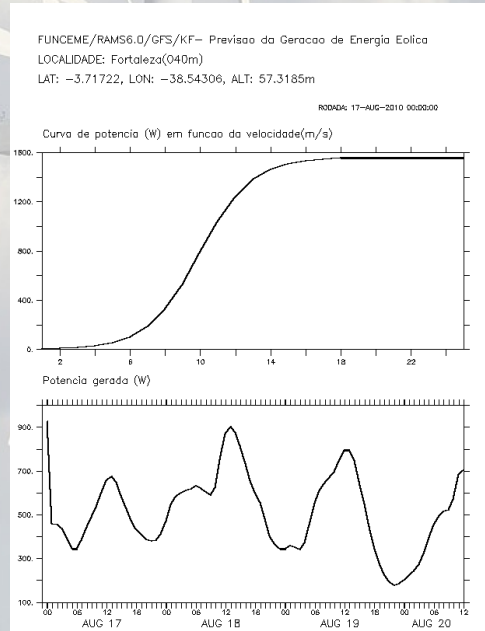
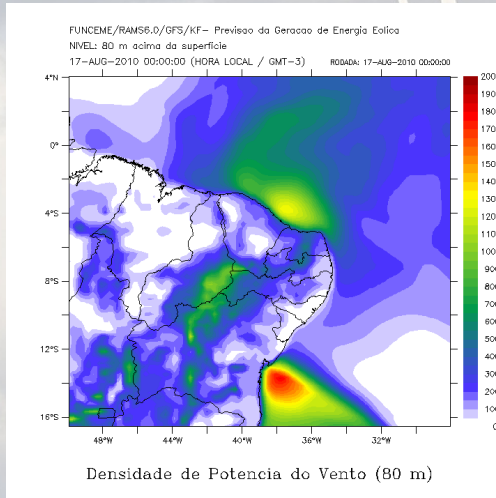
Current conditions



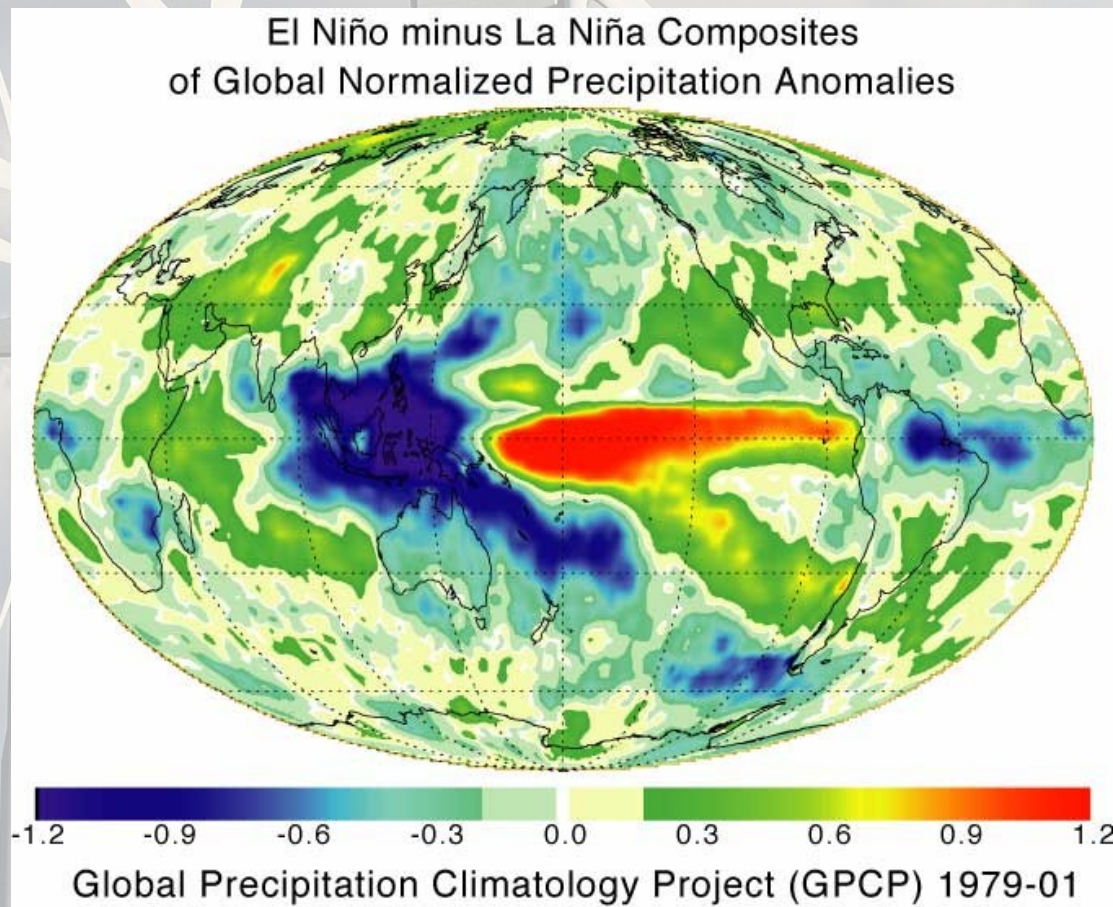
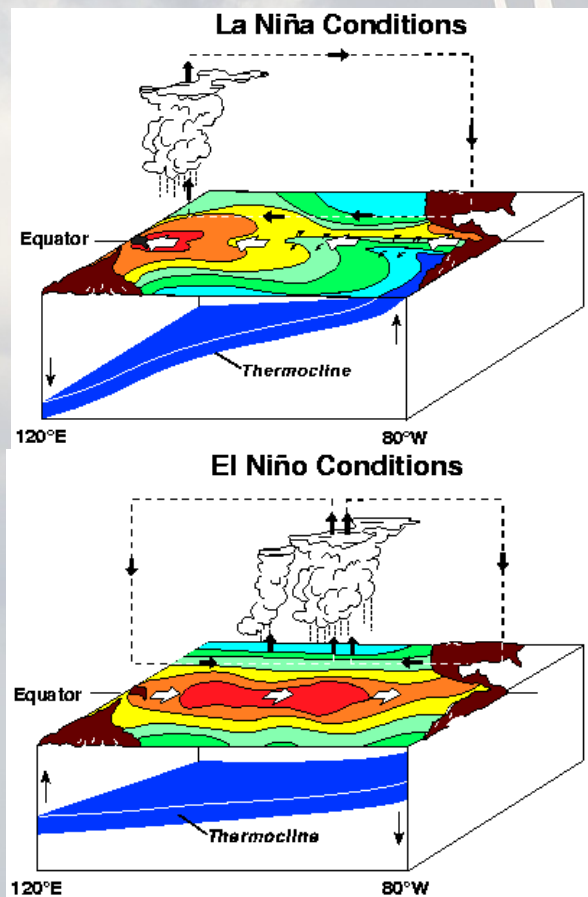
Monitoring



NWP

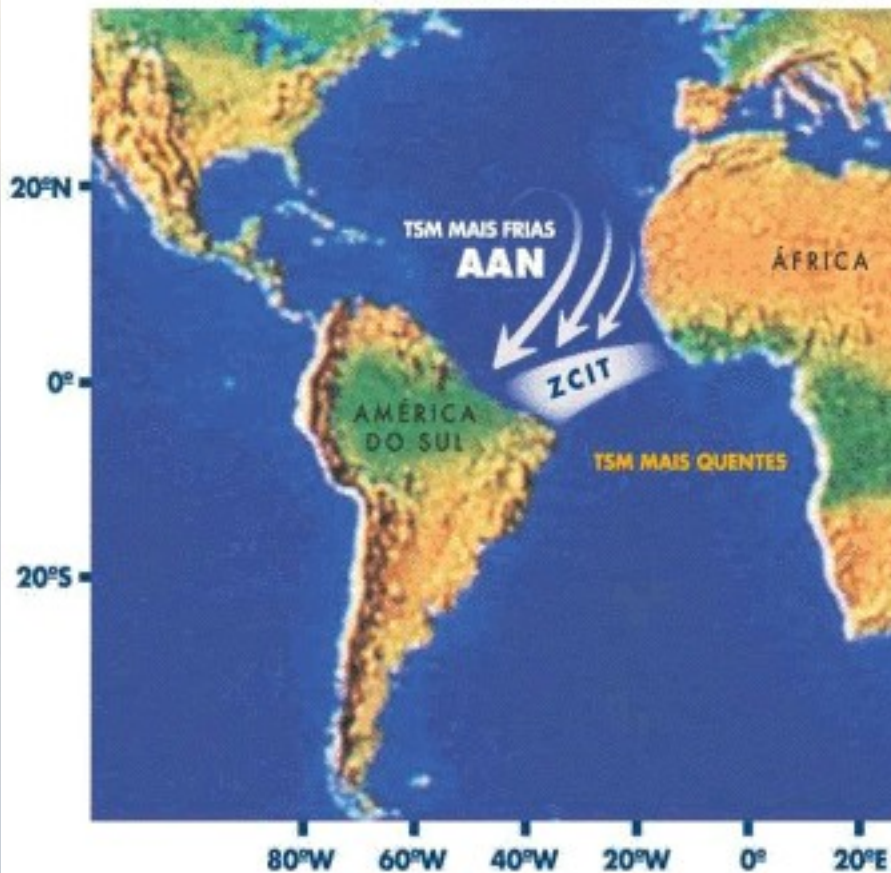


Basis of NE Brazil Seasonal Predictability

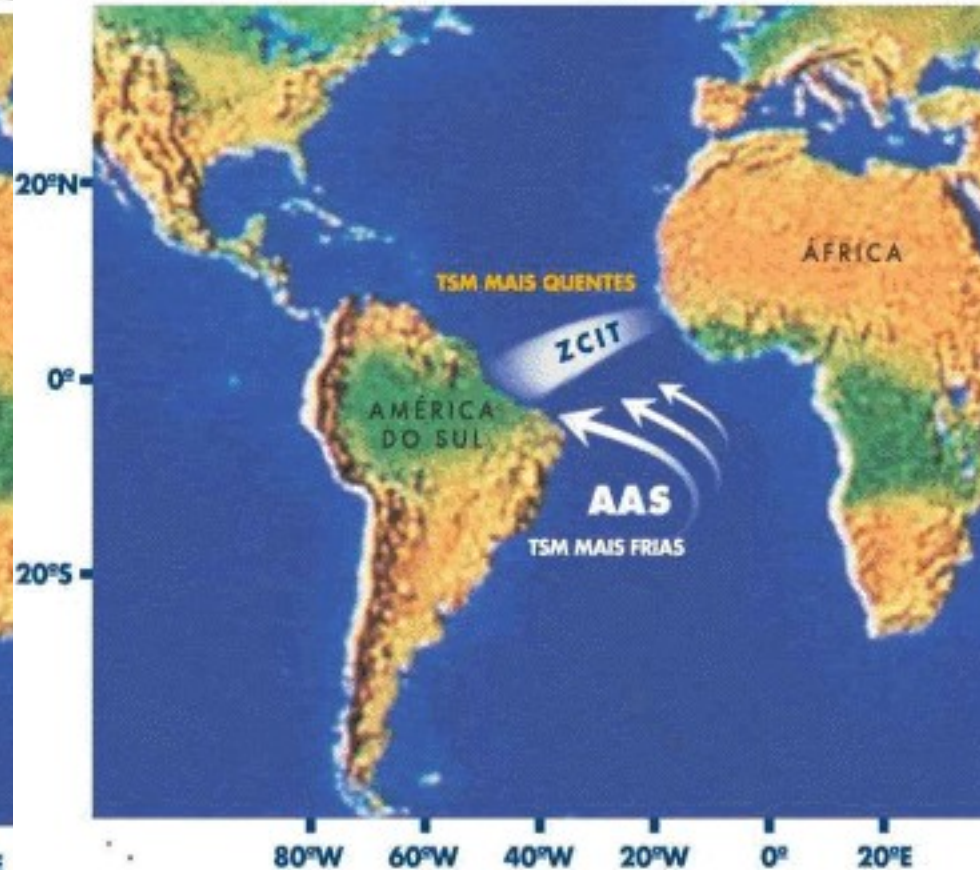


Basis of NE Brazil Seasonal Predictability

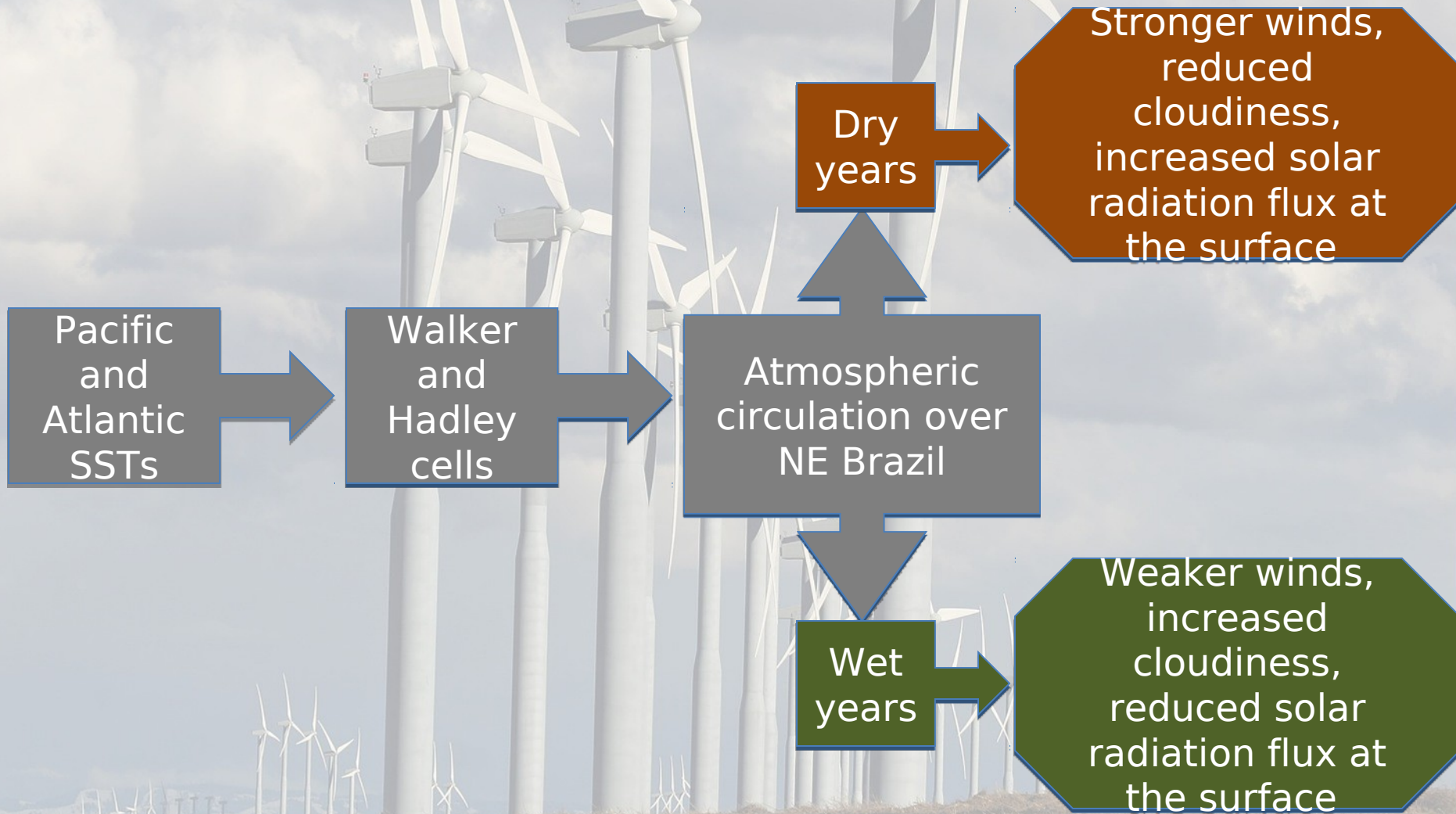
ANO NORMAL, CHUVOSO OU MUITO CHUVOSO



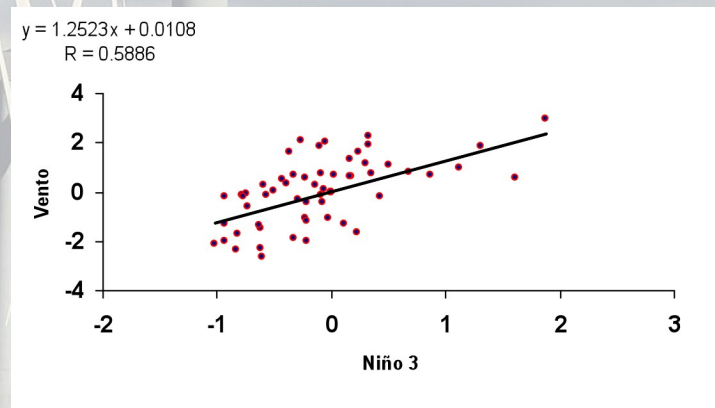
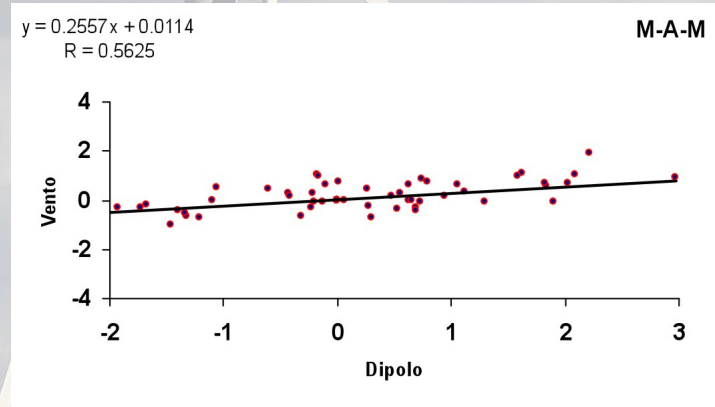
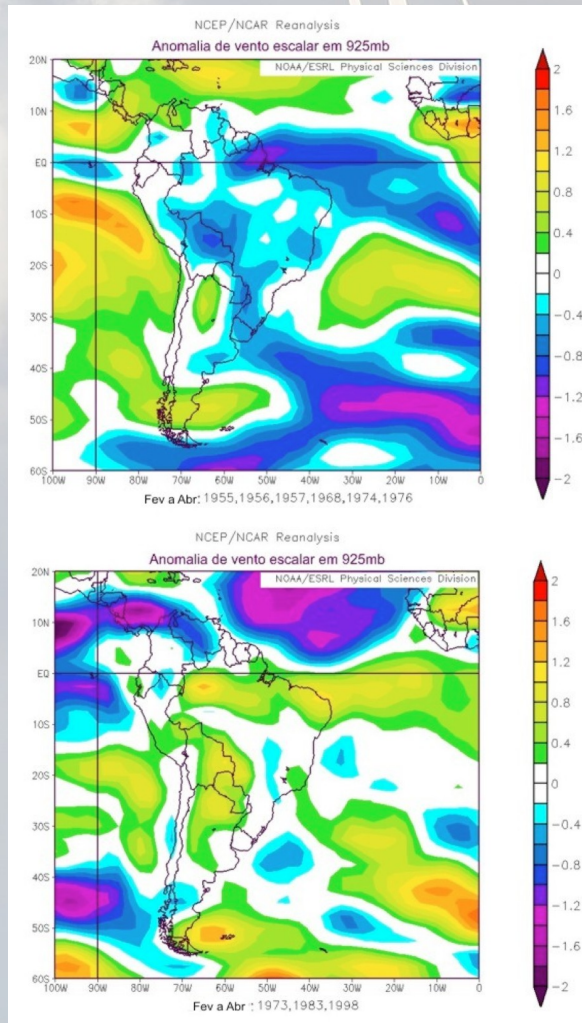
ANO SECO OU MUITO SECO



Tropical SSTs, Large-scale circulation, solar and wind energy



Oceanic indices and NE Brazil winds



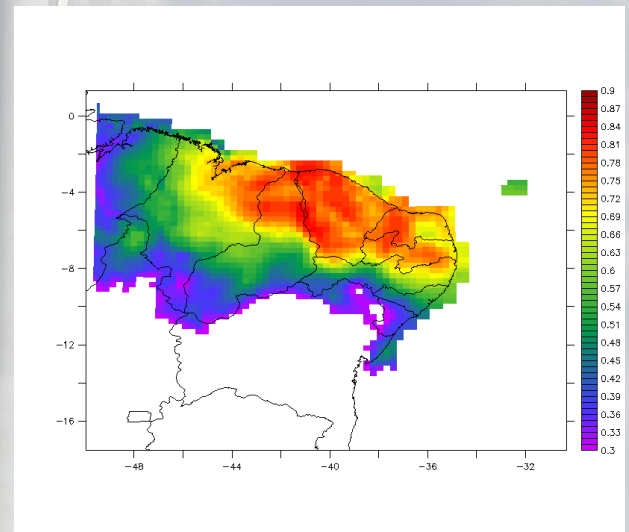
may provide useful information for renewable energy on a seasonal timescale

AMS 6.0 forced by ECHAM 4.5

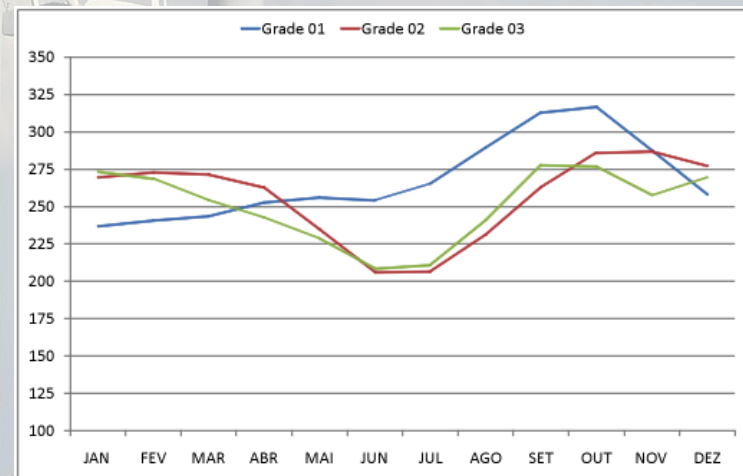
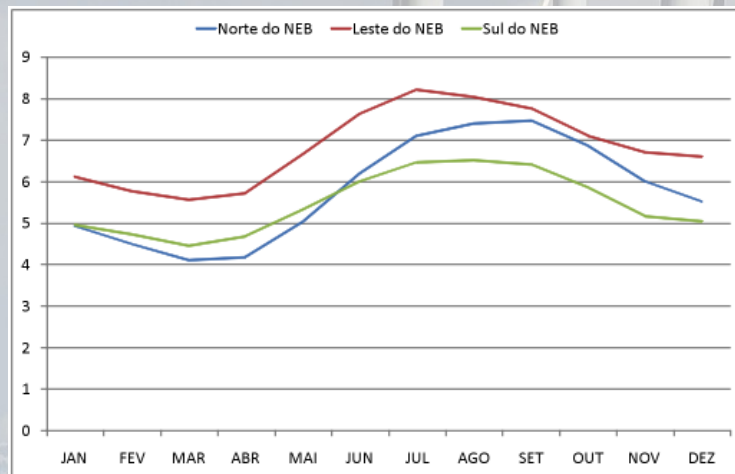
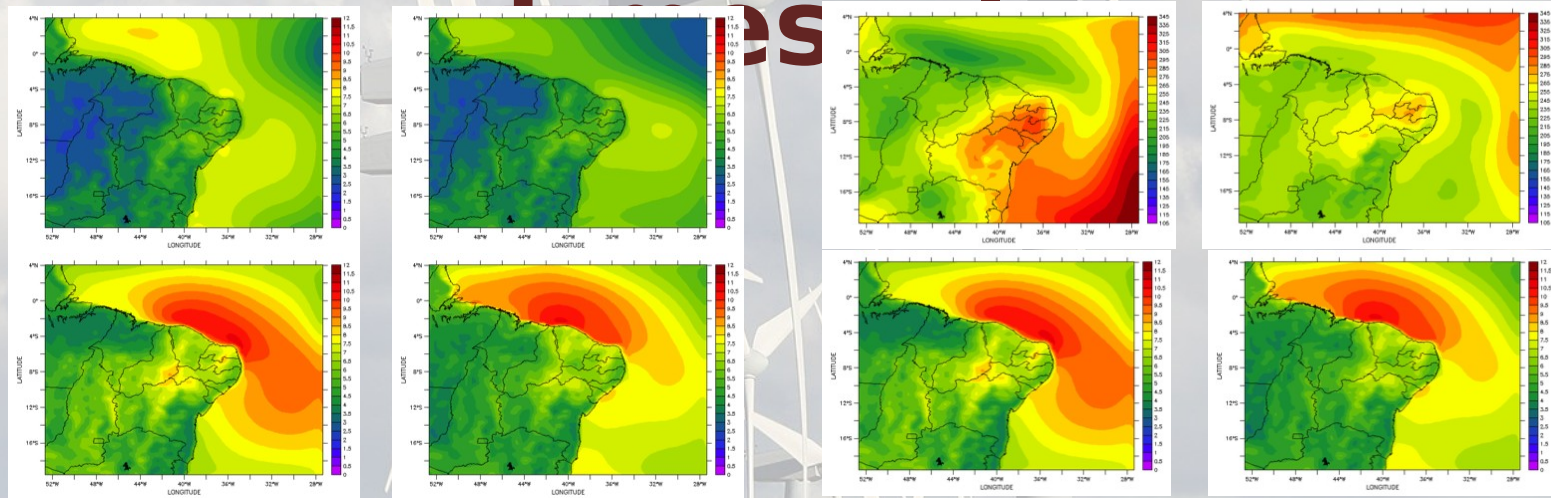
horizontal resolution: 30 km grid spacing

vertical resolution: 38 levels, variable grid spacing

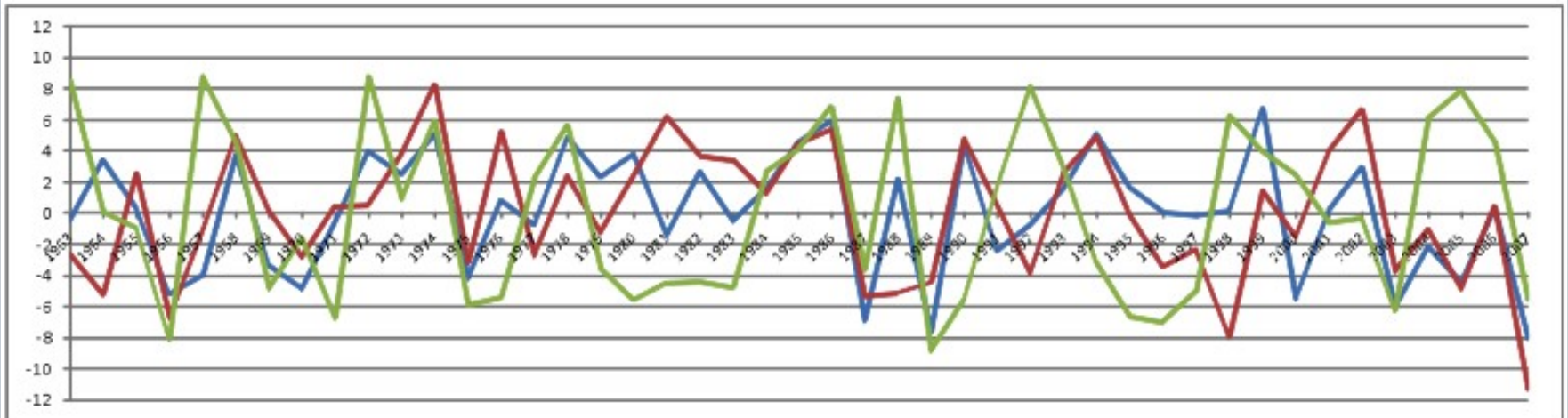
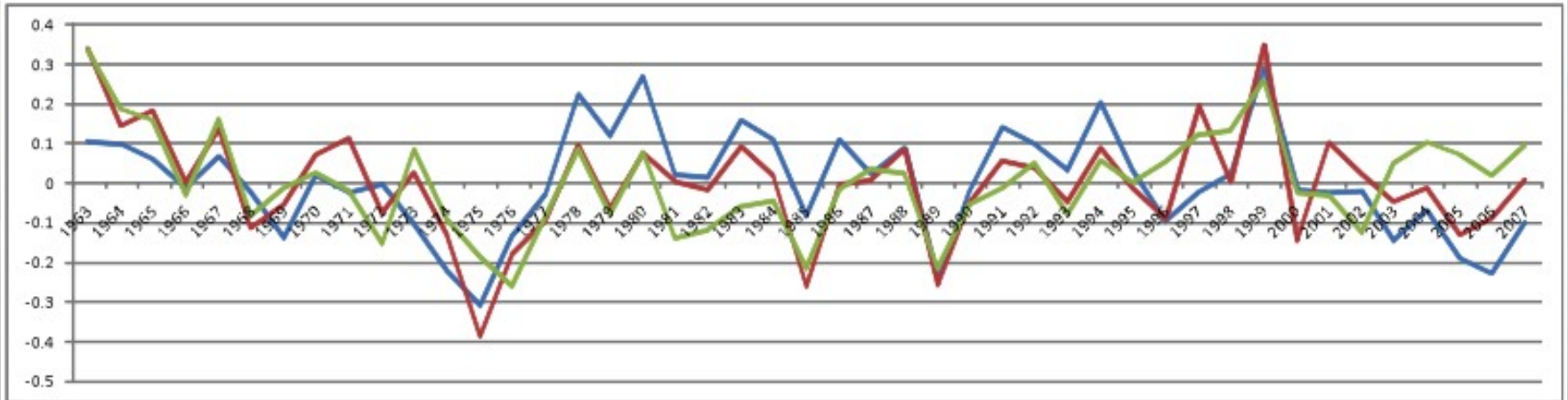
parameterizations for turbulence, surface (soil and vegetation, radiation, convective precipitation and cloud microphysics for large-scale precipitation



may provide useful information for renewable energy on a seasonal

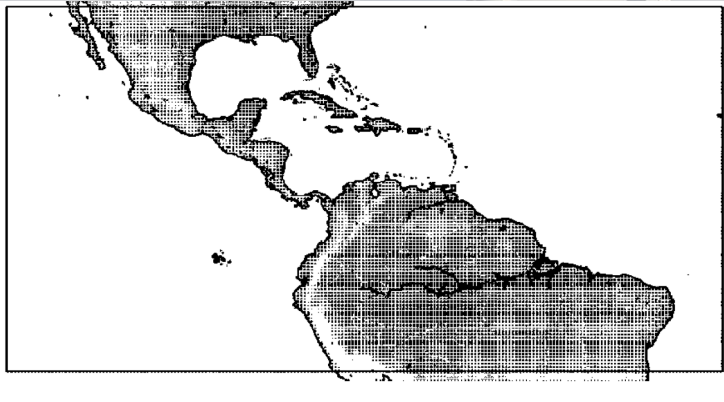


may provide useful information for renewable energy on a seasonal timescale



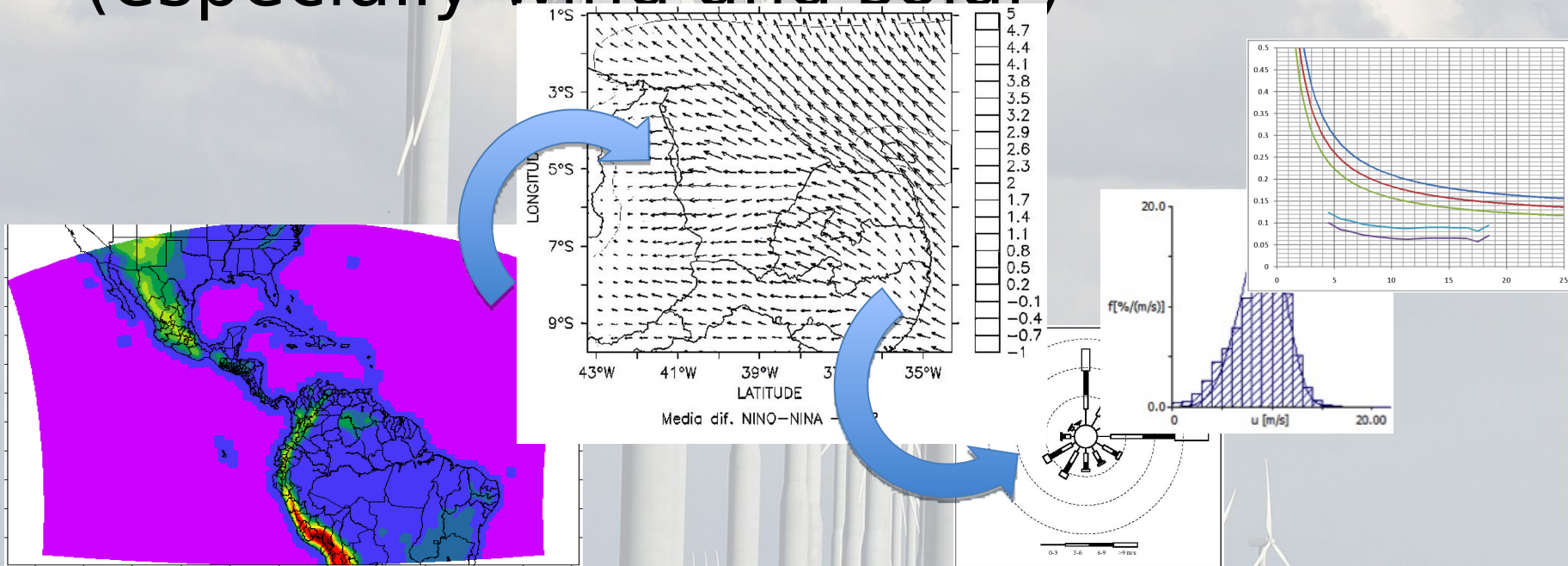
Climate change and renewable energy

- CORDEX: Coordinated Regional Downscaling Experiment



Climate change and renewable energy

- MOREA Project: further downscaling and evaluations of climate change impacts over renewable energies (especially wind and solar)



Meteorology Applications in Renewable Energy in NE Brazil - Summary

- NE Brazil, as other semi-arid regions, have a great potential of renewable energy use, including sources as wind and solar**
- A number of applications have been developed using observation platforms and numerical models**
- Scales range from short to medium-range weather forecast to climate change, including seasonal climate forecast**



Obrigado Grazie Tack

Thank you Спасибо Ευχαριστώ

Merci どうもありがとう Köszönöm

Dziękuję Gracias 谢谢

शुक्रिया Danke Mulțumesc