

## **Hurricanes — How do they Change under Increased Greenhouse-Gas Concentration?**

**Klaus Arpe**

Max-Planck Institute for Meteorology, Bundesstr. 55, D-20146 Hamburg, Germany

---

### **ABSTRACT**

Many hurricanes are initiated over northern Africa with the development of an easterly wave. They move westward and appear over the tropical Atlantic as cloud clusters. On their way further to the west these nuclei of disturbances may or may not develop into hurricanes. One limiting factor for developing into a hurricane is the oceanic sea-surface temperature (SST). While mid-latitude cyclones gain their energy from horizontal temperature gradients at the frontal zones between cold arctic and warm subtropical air, hurricanes need water vapor for their development, which is evaporated from the ocean. Only when the ocean temperatures exceed  $27^{\circ}\text{C}$  is enough water evaporated to sustain a balance of energy gain from condensation of water vapor and energy loss by friction in the circulation.

It is now agreed by most scientists that increased greenhouse-gas concentrations will lead to increased SSTs for most of the oceans, so one might also expect more hurricanes. However, already the first simulations with atmospheric models using increased greenhouse-gas concentration, made as early as 10 years ago, revealed that it is not the number of hurricanes which will increase, but their strength. Indeed we have observed in recent years many more severe hurricanes than in earlier years. The statistical significance of this is discussed and the results of the most recent model simulations with increased greenhouse-gas concentration will be shown to give a comprehensive overview of the likely trend of hurricane development in the future.