Geophysical Research Abstracts,
Vol. 10, EGU2008-A-06787, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-06787
EGU General Assembly 2008

Low-frequency oscillations in the atmosphere induced by a mid-latitude SST front

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Mid-oceanic thermal fronts, such as the Gulf Stream and Kuroshio Extension, are permanent features of the mid-latitude ocean circulation.

The circulation in the atmospheric marine boundary layer (AMBL) adjusts to changes in the oceanic surface conditions within several hours. The AMBL reaches heights of 600–1200 m.

We use a hierarchy of models : idealized, quasi-geostrophic (QG) — barotropic (BT) and baroclinic (BC) models and global circulation model (GCM) — LMD-Z.

For the idealized models, the SST front spins up an eastward jet in the free atmosphere. Three kinds of unstable oscillatory modes are obtained: one symmetric due to barotropic instability, with a period of 30 days; one antisymmetric due to baroclinic instability, with a period of 6–8 months and one with a northward-propagating mode, with an antisymmetric and a symmetric component, having a period of 2–3 months.These effects depend on the atmospheric model's having a sufficiently high resolution, of at least 50 km x 50 km.

We use an IPCC-class GCM, namely LMD-Z, and a realistic time-averaged Gulf Stream SST front. The model is integrated with a high-resolution zoom (hence the 'Z' in LMD-Z) in the Gulf Stream area to resolve correctly the effects of the front. We notice near-surface southward flow above the SST-front and the recirculation gyres of the idealized models.