Quantifying North Brazil Current rings heat and mass transport using Lagrangian tracers

Roberto De Almeida and Paulo Nobre

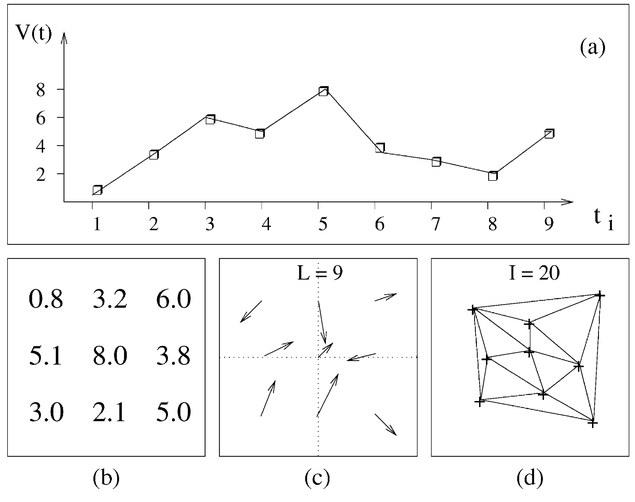
Centro de Previsão de Tempo e Estudos Climáticos
Instituto Nacional de Pesquisas Espaciais
{almeida,pnobre}@cptec.inpe.br

Summary

In this work we describe a technique for the programmatic identification of water parcels that are part of rings produced by the North Brazil Current (NBC). We use the Gradient Pattern Analysis (GPA) asymmetry operator to characterize the Lagrangian flow as laminar or quasi-periodic (Assireu et al. 2002); water parcels composing NBC rings exhibit a quasi-periodic behavior that breaks the velocity vector asymmetry, resulting in lower values for the coefficient. We are now combining this technique with Lagrangian tracers (Marsh and Megann 2002; De Vries and Döös 2001) in order to quantify the interhemispheric heat and mass transport that is performed by NBC rings in a fully coupled numerical simulation.

Methodology

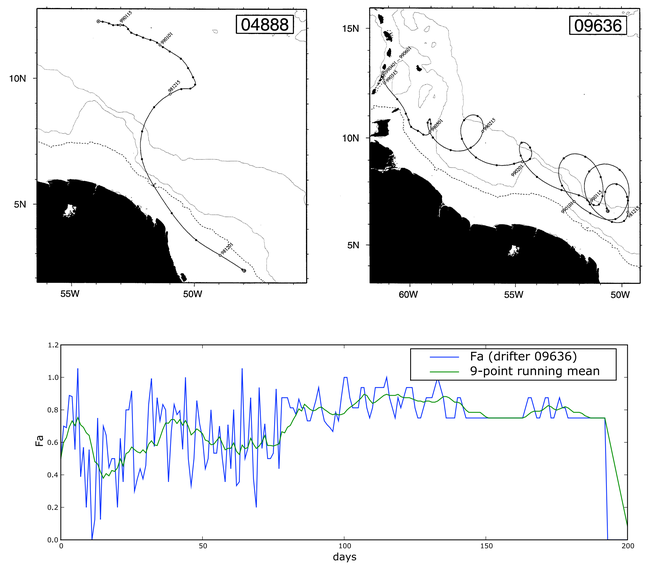
This poster describes part of an ongoing work in quantifying the interhemispheric heat and mass transport performed by North Brazil Current (NBC) rings using Lagrangian tracers in a fully coupled ocean–atmosphere model run. The first step consists in the determination of water parcels that are part of the NBC rings. This is done by calculating an **asymmetry factor** F_a, an estimation of the flow velocity vector assymmetry. Using F_a we are able to qualify the water parcel flow in two different regimes: a **quasi-periodic** regime and a **laminar flow**.



The coefficient F_a is calculated from a **delaunay triangulation** of a 3×3 composition of the velocity vector field: $F_a = (I - L)/L$. We use a 9-point running mean to reduce noise from spurious data values.

Data

In order to validate the method we computed the asymmetry factor for 2 drifter trajectories from the NBC ring experiment (Glickson et al. 2000), trajectories number 04888 and 09636:



The figure above show the calculated F_a for drifter 09636. The figures to the right show the coefficient calculated for both trajectories, plotted on the map. A cutoff value of $\mathbf{0.77} = (16-9)/9$ is used to differentiate between water parcels inside an NBC ring and water being transported by the basic flow.

References

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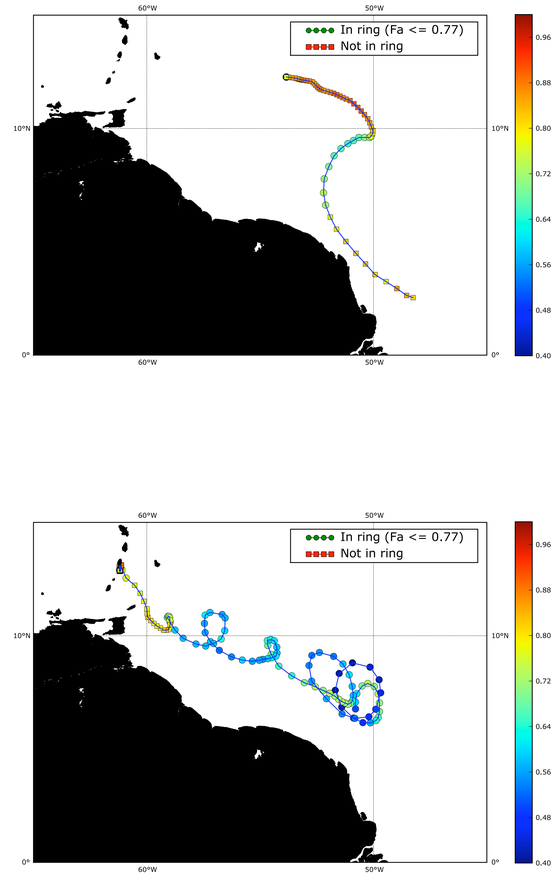
- Glickson D. A., D. M. Fratantoni, C. M. Wooding, and P. L. Richardson, 2000: North Brazil Current Rings Experiment: Surface drifter data report November 1998–June 2000. Woods Hole Oceanographic Institution Tech. Rep. WHOI-2000-10, 129 pp.
- Marsh, R., and A. P. Megann (2002). Tracing water masses with particle trajectories in an isopycnic-coordinate model of the global ocean. Ocean Modelling, 4, 27-53.
- Vries, P.d., and K. Döös, 2001: Calculating Lagrangian Trajectories Using Time-Dependent Velocity Fields. J. Atmos. Oceanic Technol., 18, 1092–1101.

Results



Acknowledgements

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