

Stream Bundles - Cohesive Advection through Flow Fields

David Weinstein
Gordon Kindlmann
Eric Lundberg

Email: dmw@cs.utah.edu
gk@cs.utah.edu
lundberg@cs.utah.edu

UUCS-99-005

Department of Computer Science
University of Utah
Salt Lake City, UT 84112 USA

June 4, 1999

Abstract

Streamline advection has proven an effective method for visualizing vector flow field data. Traditional streamlines do not, however, provide for investigating the coarser-grained features of complex datasets, such as the white matter tracts in the brain or the thermal conveyor belts in the ocean. In this paper, we introduce a cohesive advection primitive, called a *stream bundle*. Whereas traditional streamlines describe the advection patterns of single, infinitesimal micro-particles, stream bundles indicate advection paths for larger macro-particles. Implementationally, stream bundles are composed of a collection of individual streamlines (here termed *fibers*), each of which only advects a short distance before being terminated and re-seeded in a new location. The individual fibers combine to dictate the instantaneous distribution of the bundle, and it is this collective distribution which is used in determining where fibers are re-seeded. By carefully controlling the termination and re-seeding policies of the fibers, we can prevent the bundle from becoming frayed in divergent regions. By maintaining a cohesive form, the bundles can indicate the coarse structure of complex vector fields. In this paper, we use stream bundles to investigate the oceanic currents.