



Abstract View

[Volume 18, Issue 11 \(November 1988\)](#)

Journal of Physical Oceanography

Article: pp. 1627–1640 | [Abstract](#) | [PDF \(1.10M\)](#)

Meandering and Eddy Detachment According to a Simple (Looking) Path Equation

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(Manuscript received July 7, 1987, in final form May 17, 1988)

DOI: 10.1175/1520-0485(1988)018<1627:MAEDAT>2.0.CO;2

ABSTRACT

Nonlinear meandering and “pinching off” process are investigated by solving the path equation As shown by Pratt and Stern, this dimensioned equation determines the center line latitude l of a slowly-varying, equivalent barotropic, quasi-geostrophic, f -plane jet with cusped velocity profile and center line curvature $\kappa = l_{xx}/(1 + l_x^2)^{3/2}$. A class of exact solutions consisting of steadily propagating meanders is found having wavelength $2\pi/k$ and amplitude a . The meanders form a wave train which can be single-valued (for $ak < 2.61$) or multivalued (for $2.61 < ak < 8.30$) with respect to the x (eastward) coordinate. For $ak = 8.30$ grazing contact occurs between neighboring meanders and a type of vortex street is formed. The amplitude-dependent dispersion relation for the meanders shows that phase propagation is eastward with speed that increases with decreasing wavelength and/or amplitude, trends observed for Gulf Stream meanders near 72 W by Vazquez and Watts.

Numerical solutions are presented for isolated, single-valued initial disturbances having a characteristic wavenumber k_0 and amplitude a_0 . When $a_0 k_0$ is less than a critical value between 1.5 and 2.0, the disturbance disperses. For larger values of $a_0 k_0$, the evolution leads to a “pinching off” phenomenon in which meanders begin to detach from the main portion of the jet and form roughly elliptical eddies.

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