Australian Northwest Shelf

Overview

The Australian Northwest shelf extends roughly 2000 km along the coast of Western Australia (Figure 1). The region is influenced by part of the South Equatorial Current that runs southwest out of the Arafura Sea.

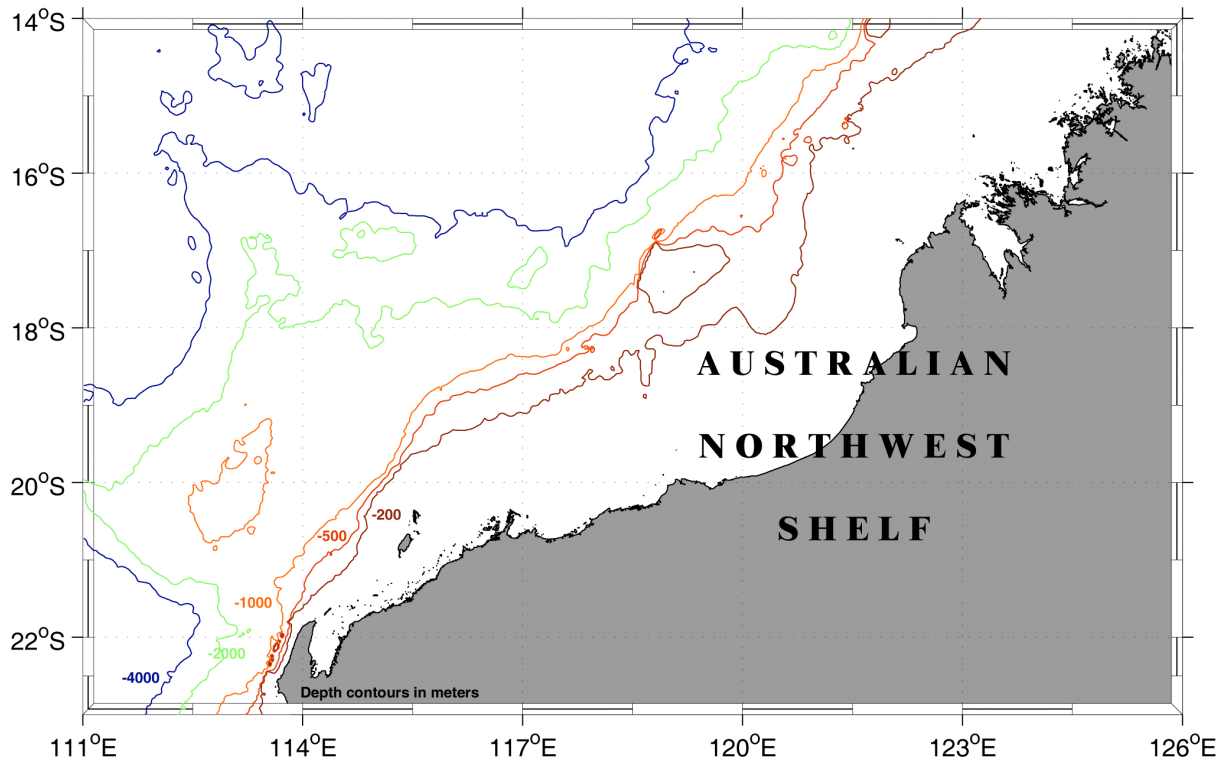


Figure 1. Bathymetry of Australian Northwest Shelf [Smith and Sandwell, 1997]

Observations

There has been considerable scientific investigation into the internal tide and associated internal waves on the Australian Northwest Shelf [Holloway, 1987, 1994; Smyth and Holloway, 1988; Holloway et al. 1997, 1998, 1999a, 199b; Holloway and Pelinovsky, 2001; Pelinovsky et al, 1995]

Observations on the Northwest Australian Shelf by Holloway show long internal waves of semi-diurnal tidal origin (internal tides) with wavelengths of approximately 20 km evolving into a variety of nonlinear waveforms. These forms include bores on both the leading and trailing faces of the long internal tide, as well as short period (approximately 10 minutes, close to the buoyancy period) internal solitary waves. The nonlinear features develop as the waves propagate shoreward into decreasing water depth with a propagation speeds of approximately 0.4 m/s.

Peak to trough amplitudes of 25 meters have been measured but many of the observed waves from the Northwest Shelf are strongly nonlinear with heights exceeding half the water depth [Holloway and Pelinovsky, 2001]

Table 1 shows the months of the year when internal wave observations have been made.

Table 1 - Months when internal waves have been observed along the Australian Northwest Shelf (Numbers indicate unique dates in that month when waves have been noted)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
	1	X	X				1	1	1	1	1

References

Holloway P.E., 1987. Internal Hydraulic Jumps and Solitons at a Shelf Break Region on the Australian North West Shelf, *J. Geoph. Res.,* C92, 5405 -5416.

Holloway, P.E., 1994, Observations of internal tide propagation on the Australian North West Shelf., *J. Phys. Oceanogr. 24*, 1706-1716

Holloway, P.E., E. Pelinovsky, T. Talipova, and B. Barnes, 1997: A nonlinear Model of Internal Tide Transformation on the Australian North West Shelf, *J. Phys. Oceanogr.* 27, 871 - 896.

Holloway P., Pelinovsky E., Talipova T., Barnes B. (1998). The rotated-modified extended Korteweg-de Vries equation for the description of nonlinear internal wave transformation in the ocean. *Computational Techniques and Appli-cations: CTAC9*7, (Proc. 8th Biennial Conf., Adelaide, Australia, Eds: B.J. Noye, M.D. Teubner, A.W.Gill). World Sci., Singapore, 297 - 304.

Holloway P, E. Pelinovsky, T. Talipova, 1999a: A Generalised Korteweg – de Vries Model of Internal Tide Transformation in the Coastal Zone. *J. Geophys. Researc*h, 104 (C8), 18,333 - 18,350.

Holloway P, E. Pelinovsky, T. Talipova 1999b: Strongly nonlinear internal waves on the Australian North West Shelf, p197-202. In: The 1998 WHOI/IOS/ONR Internal Solitary Wave Workshop: Contributed papers. Ed. T.F. Duda and D. M. Farmer, Woods Hole Oceanographic Institution, technical report WHOI-99-07, 247pp.

Holloway, P.E., E. Pelinovsky, 2001: Internal tide transformation and oceanic internal solitary waves, Ch2, Environmental Stratified Flows (ed. R. Grimshaw), Kluwer Acad. pp 29-61

Pelinovsky, E., Holloway P., and T. Talipova, 1995: A statistical analysis of extreme events in current variations due to internal waves from the Australian North West Shelf. *J. Geophys. Re*s., **100 (C12**), 24831-24839.

Smith, W. H. F., and D. T. Sandwell, 1997: Global seafloor topography from satellite altimetry and ship depth soundings, Science, v. 277, p. 1957-1962, 26 Sept., 1997.
http://topex.ucsd.edu/marine_topo/mar_topo.html

Smyth N.F. and Holloway P. (1988). Hydraulic Jump and Undular Bore Formation on a Shelf Break, *J. Phys. Oceanogr.* **1**8, 947 - 962.

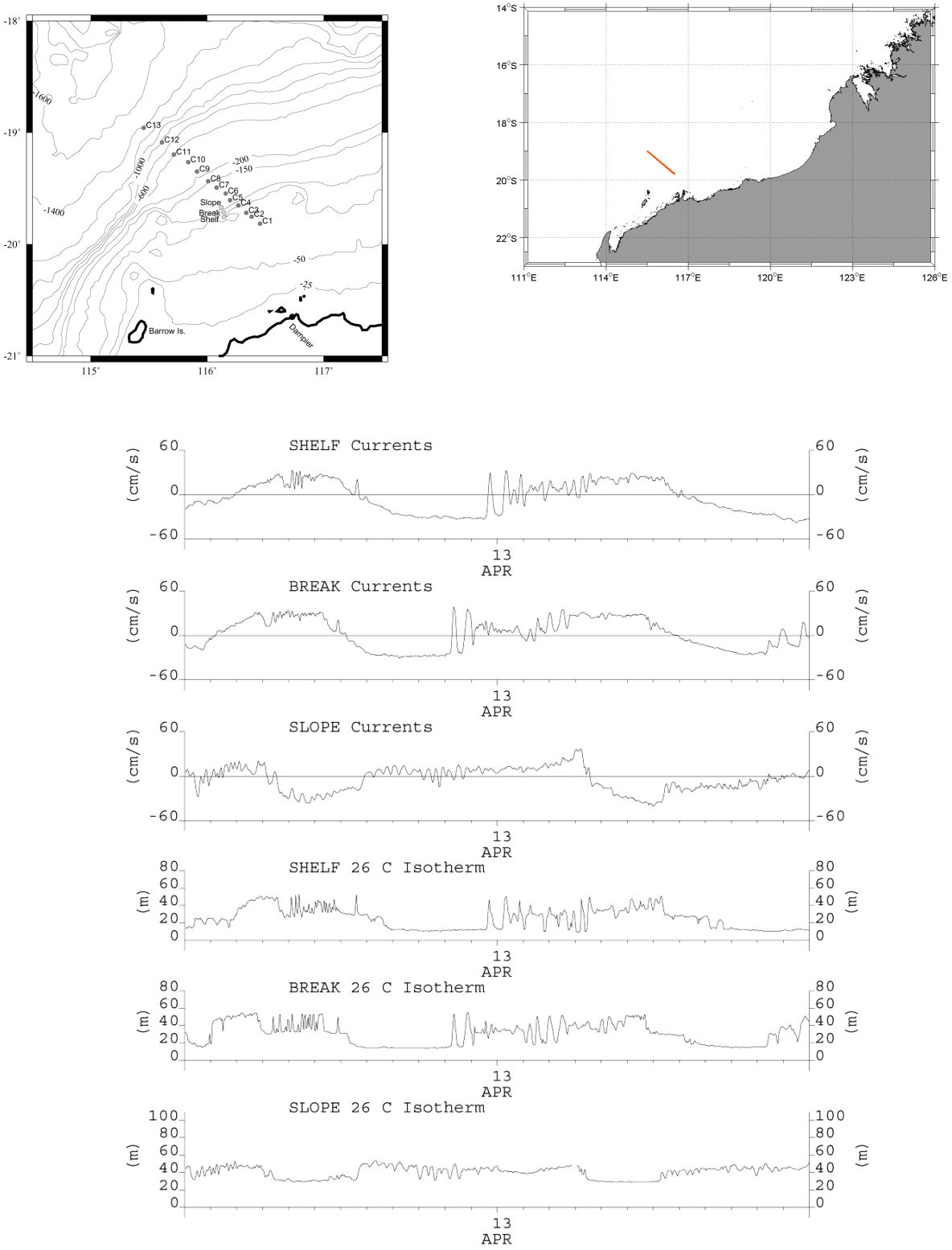


Figure 2. Time series of isotherm displacements and onshore currents are shown from 3 moorings, (*Slope, Break* and *Shelf*), located in 78 to 109 m water depths, and a few kilometers apart at the outer edge of the Australian Northwest continental shelf. The plots show a variety of nonlinear wave forms including bores on both the leading and trailing faces of the long internal tide, as well as short period (approximately 10 minutes, close to the buoyancy period) internal solitary waves. [After Holloway and Pelinovsky, 2001]

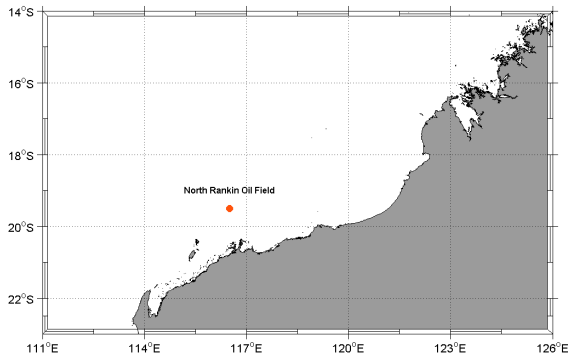
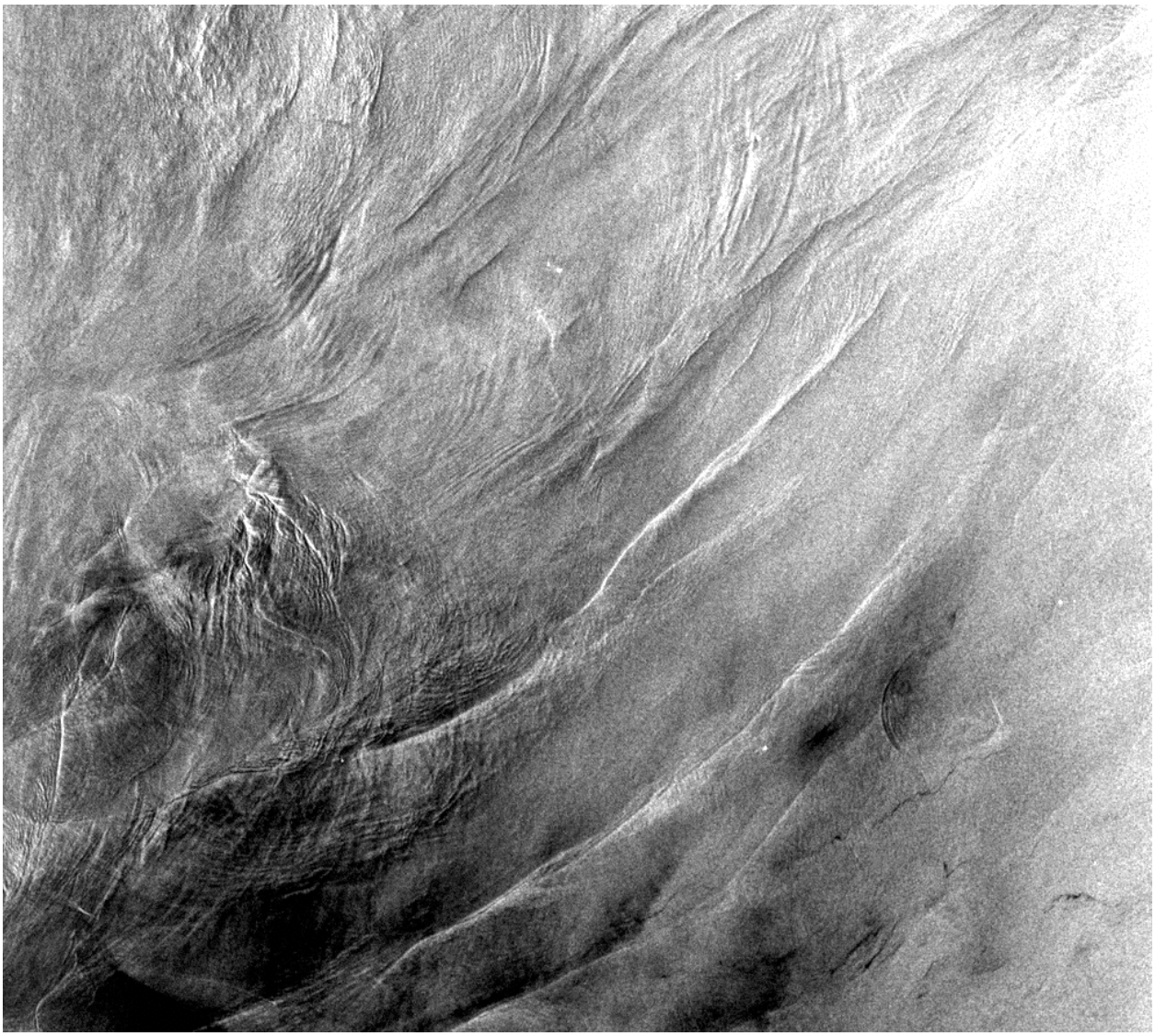


Figure 3. RADARSAT-1 (C-band HH) Standard Mode SAR image acquired over the North Rankin oil and gas field of Western Australia on 12 February 1997 (orbit 11881). The image shows a complex pattern of internal wave signatures. Imaged area is approximately 100 km x 100 km. ©CSA 1997. [Image courtesy of George Cresswell, CSIRO Marine Research, Hobart, Tasmania, Australia. RADARSAT image acquired as part of ADRO Project #72 Cresswell and Tildesley]



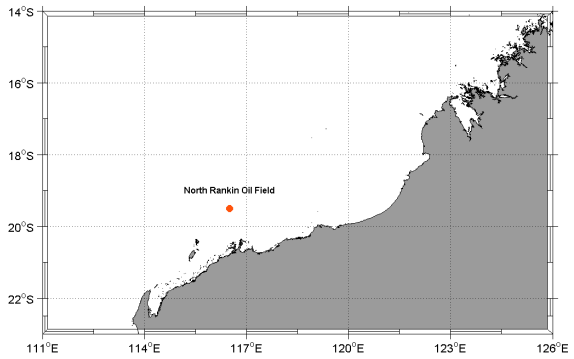
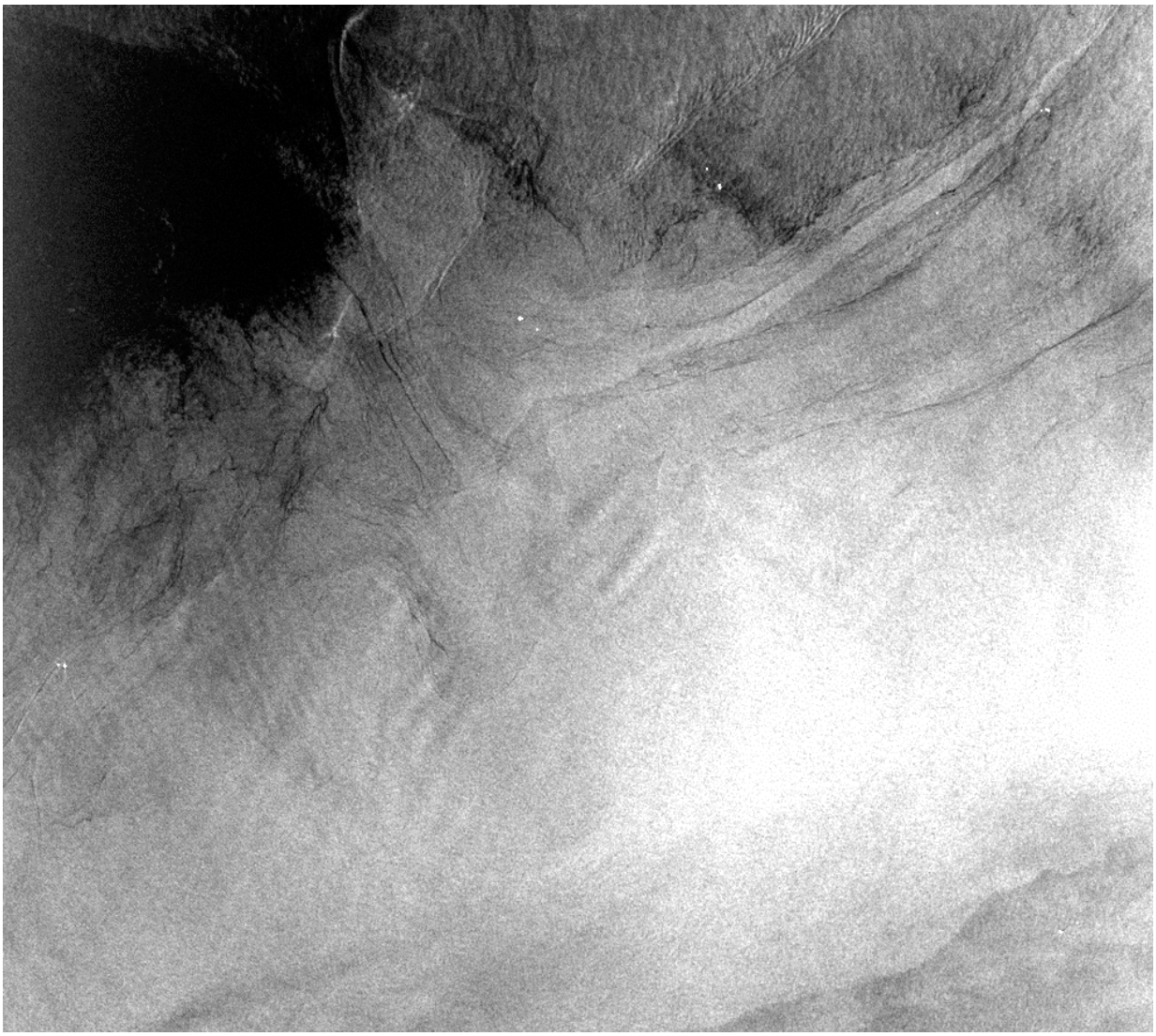


Figure 4. RADARSAT-1 (C-band HH) Standard Mode SAR image acquired over the North Rankin oil and gas field of Western Australia on 28 August 1997 (orbit 9480). The image shows a several weak internal wave signatures. Imaged area is approximately 100 km x 100 km. ©CSA 1997. [Image courtesy of George Cresswell, CSIRO Marine Research, Hobart, Tasmania, Australia. RADARSAT image acquired as part of ADRO Project #72 Cresswell and Tildesley]



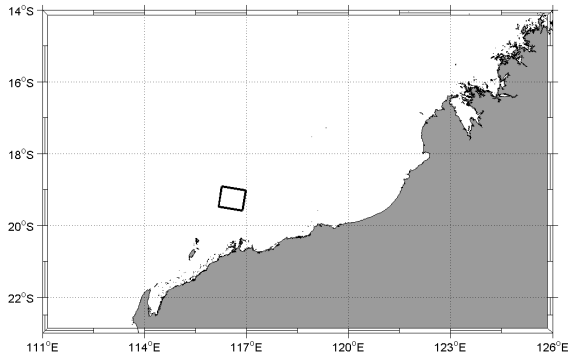
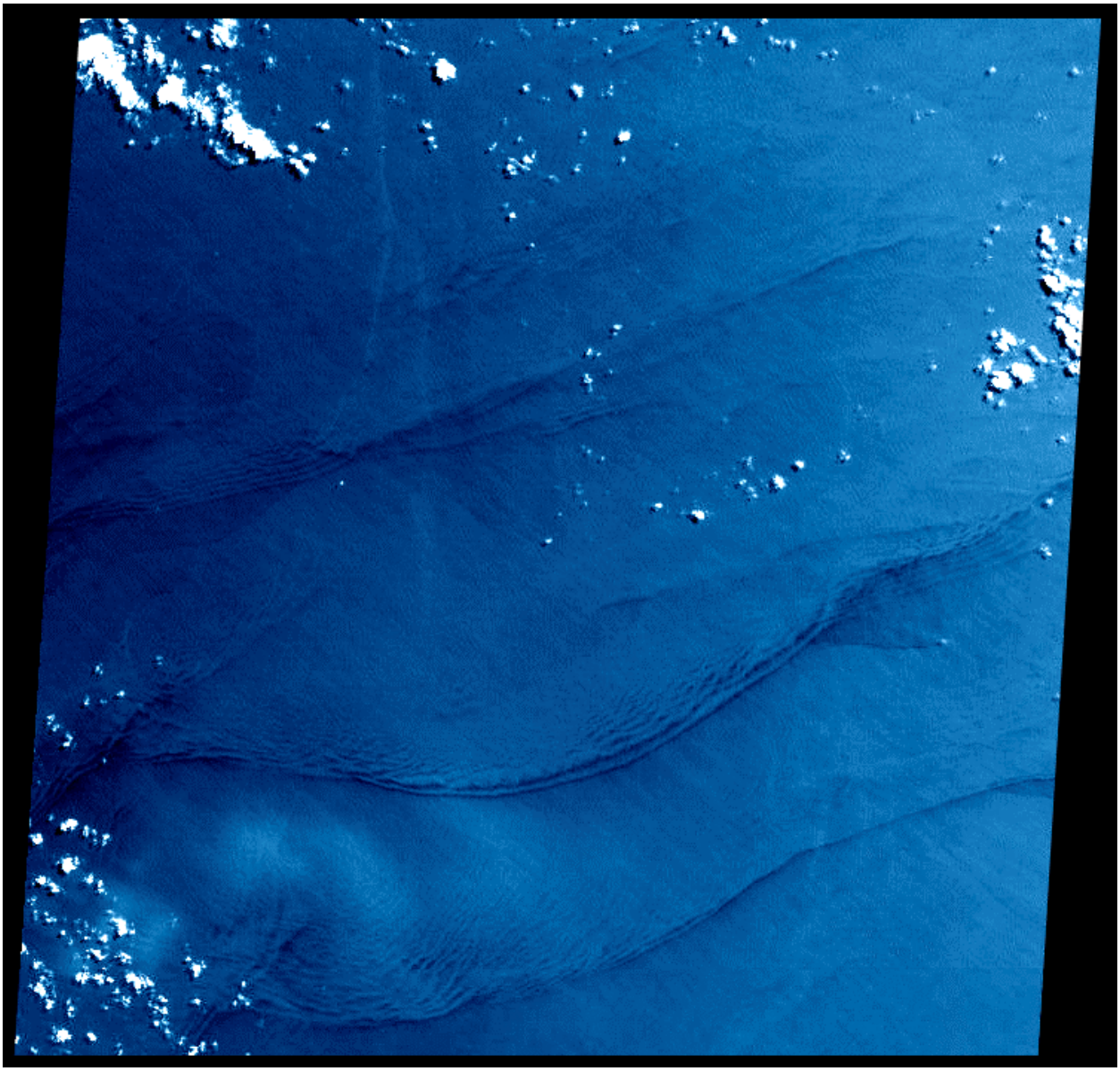


Figure 5. ASTER false-color VNIR image over the Australian Northwest Shelf acquired on 11 October 2001 at 0238 UTC. Imaged area is 60 km x 60 km.



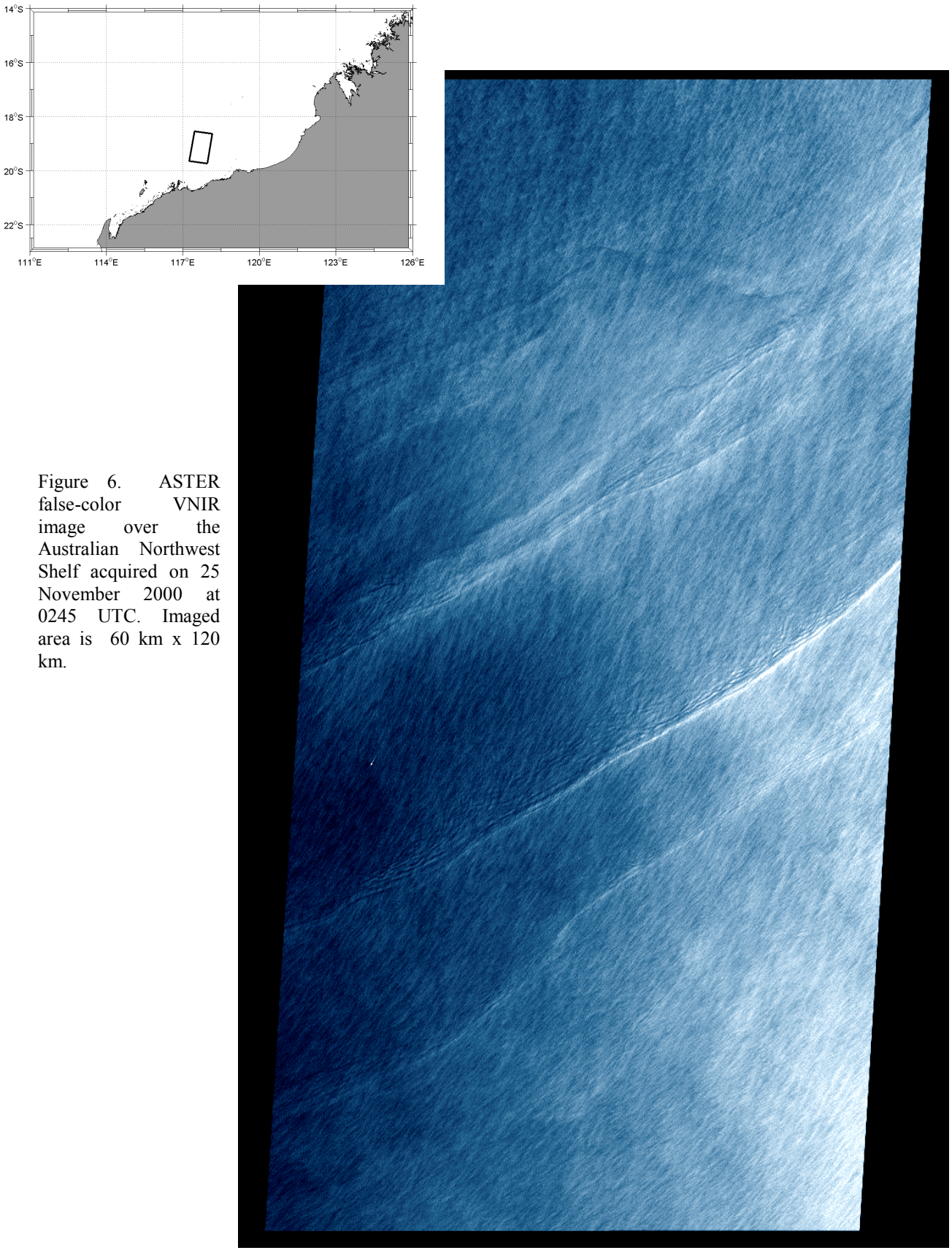


Figure 6. ASTER false-color VNIR image over the Australian Northwest Shelf acquired on 25 November 2000 at 0245 UTC. Imaged area is 60 km x 120 km.

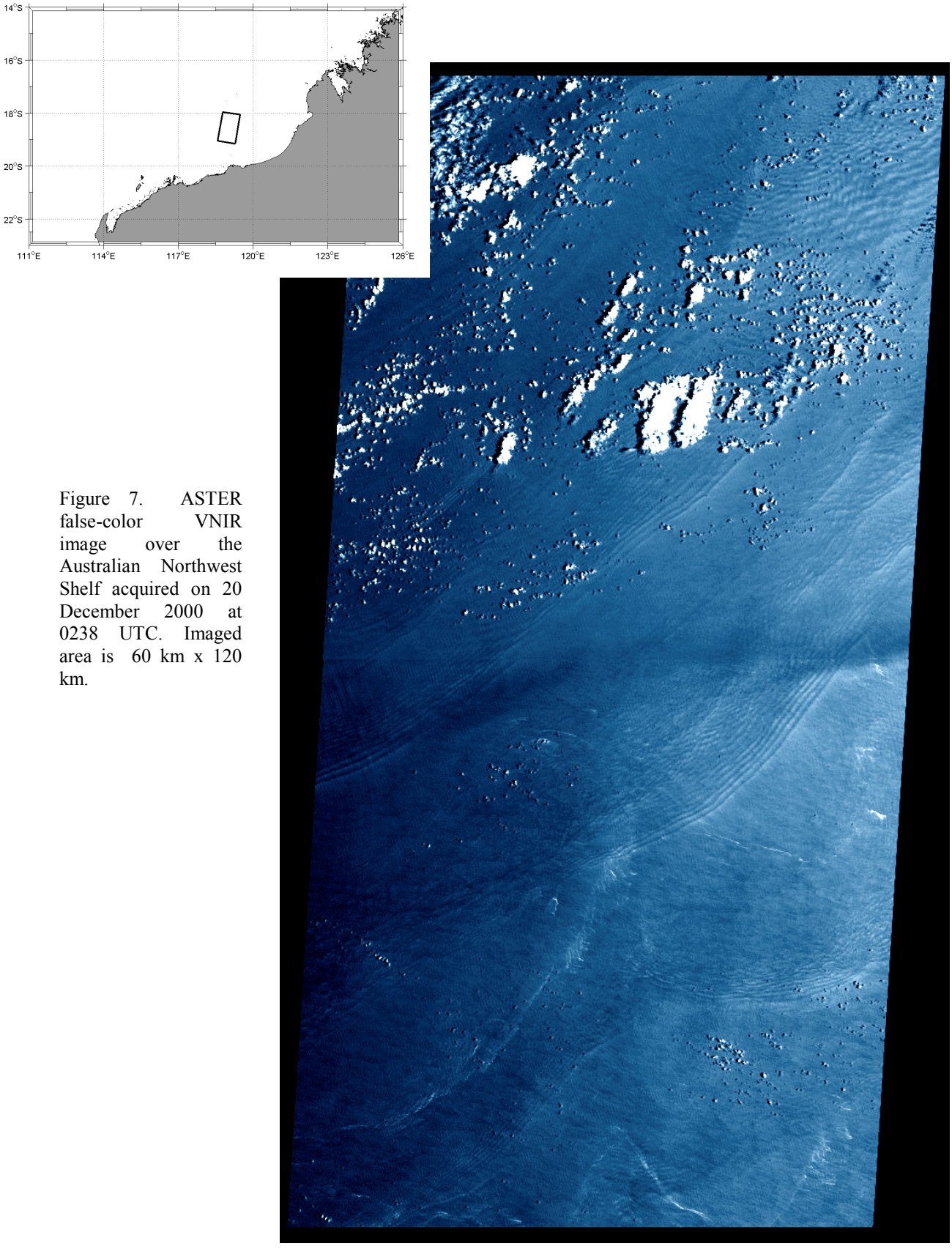
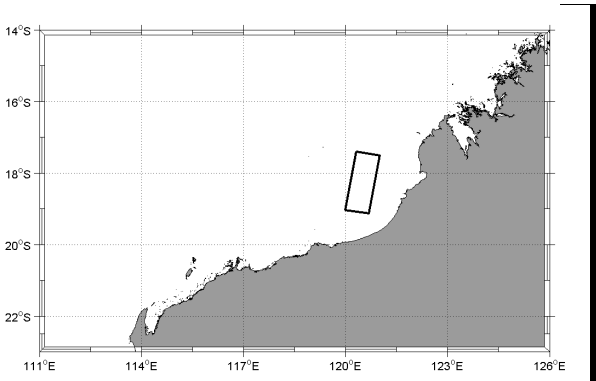


Figure 7. ASTER false-color VNIR image over the Australian Northwest Shelf acquired on 20 December 2000 at 0238 UTC. Imaged area is 60 km x 120 km.



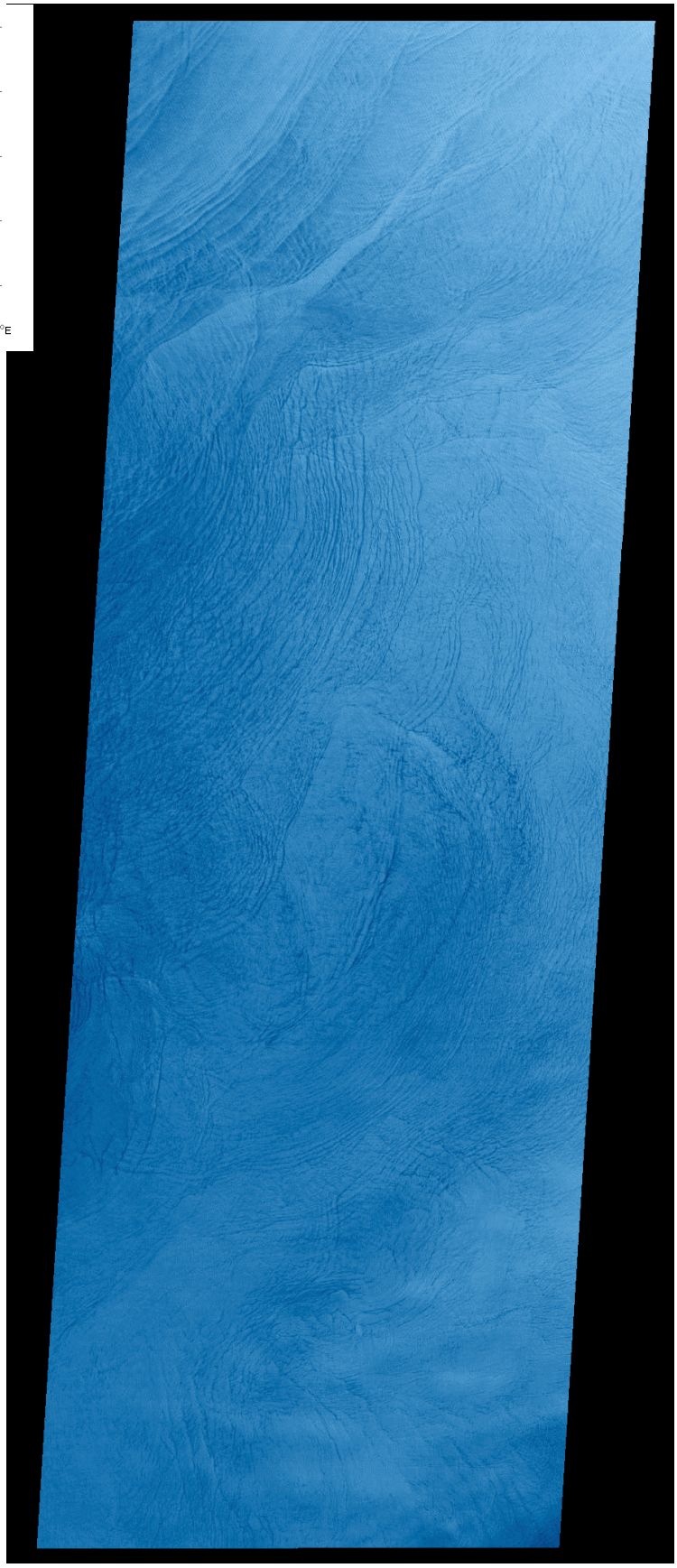


Figure 8. ASTER false-color VNIR image over the Australian Northwest Shelf acquired on 24 September 2000 at 0234 UTC. Imaged area is 60 km x 180 km.

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