

Gulf of California and the Baja Pacific Coast

Overview

The Baja Peninsula is located along the Pacific coast of North America (from 33°N, 117°W and extending down to 22°N, 109°W) and bounds the western side of the Gulf of California (Figure 1). The region is characterized by strong tidal currents both along the coast and in the northern part of Gulf that support internal wave production.

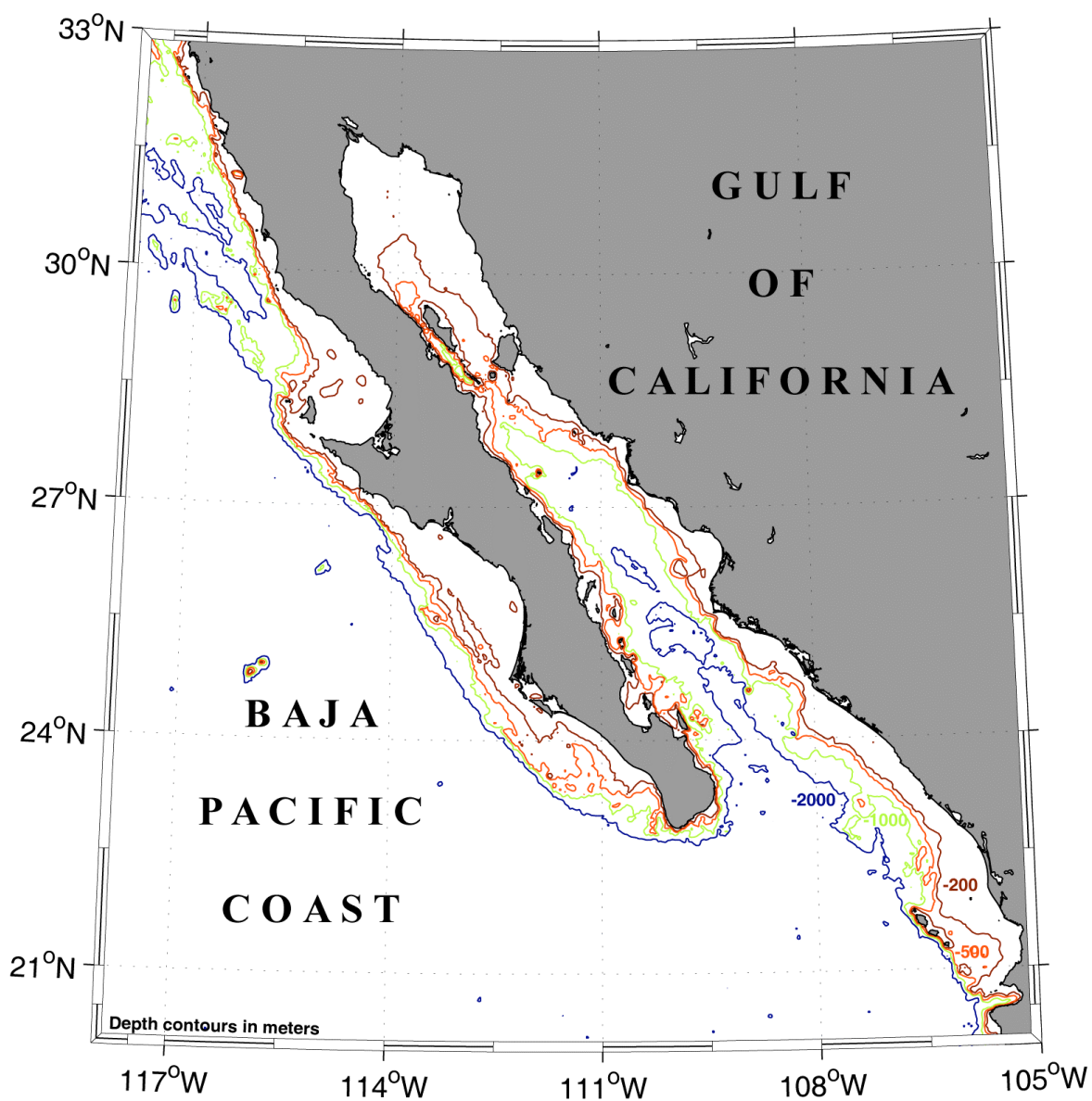


Figure 1. Bathymetry of Gulf of California and Baja Pacific Coast. [Smith and Sandwell, 1997]

Observations

There has been some scientific study of internal wave in the Gulf of California and the Pacific Coast of Baja. Apel and Gonzalez [1983] examined internal wave signatures in SEASAT SAR imagery acquired in the vicinity of Bahia San Juanico in July 1978. Their analysis showed that the waves occurred on the continental shelf inside the 200 meter isobath and were approximately aligned parallel to the bathymetry. The waves occurred in well-defined packets with packets having up to 20 individual waves. Individual wavelengths ranged between 200 m and 1.6 km. Packet separations were 15 to 23 km with along crest length of up to 76 km.

Fu and Holt [1984] also used SEASAT SAR imagery in their study of internal waves in the Gulf of California. They examined nine images over exactly the same ground position collected at three-day intervals between 14 September and 8 October 1978 and demonstrated the correlation between internal wave field variation and strength of the local tides. The internal wave activity was found to be concentrated in the northern part of the Gulf (north of 28°) where the tides are strongest.

Table 1 - Months when internal waves have been observed in the Gulf of California and the Pacific Coast of Baja
 (Numbers indicate unique dates in that month when waves have been noted)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
				2		5	2	6	7		

References

- Apel, J.R., and F.I. Gonzalez, 1983: Nonlinear features of internal waves off Baja California as observed from the SEASAT Imaging Radar. *J. Geophys. Res.*, **88 (C7)**, 4459-4466.
- Fu, L.L., and B. Holt, 1982, Seasat Views Oceans and Sea Ice with Synthetic Aperture Radar, JPL Publication 81-120
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http://topex.ucsd.edu/marine_topo/mar_topo.html

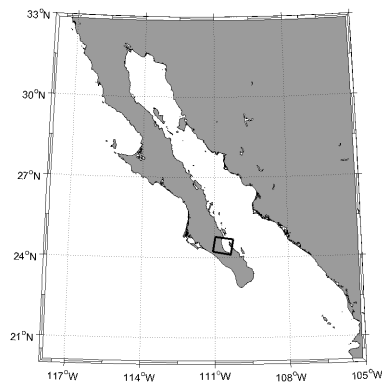
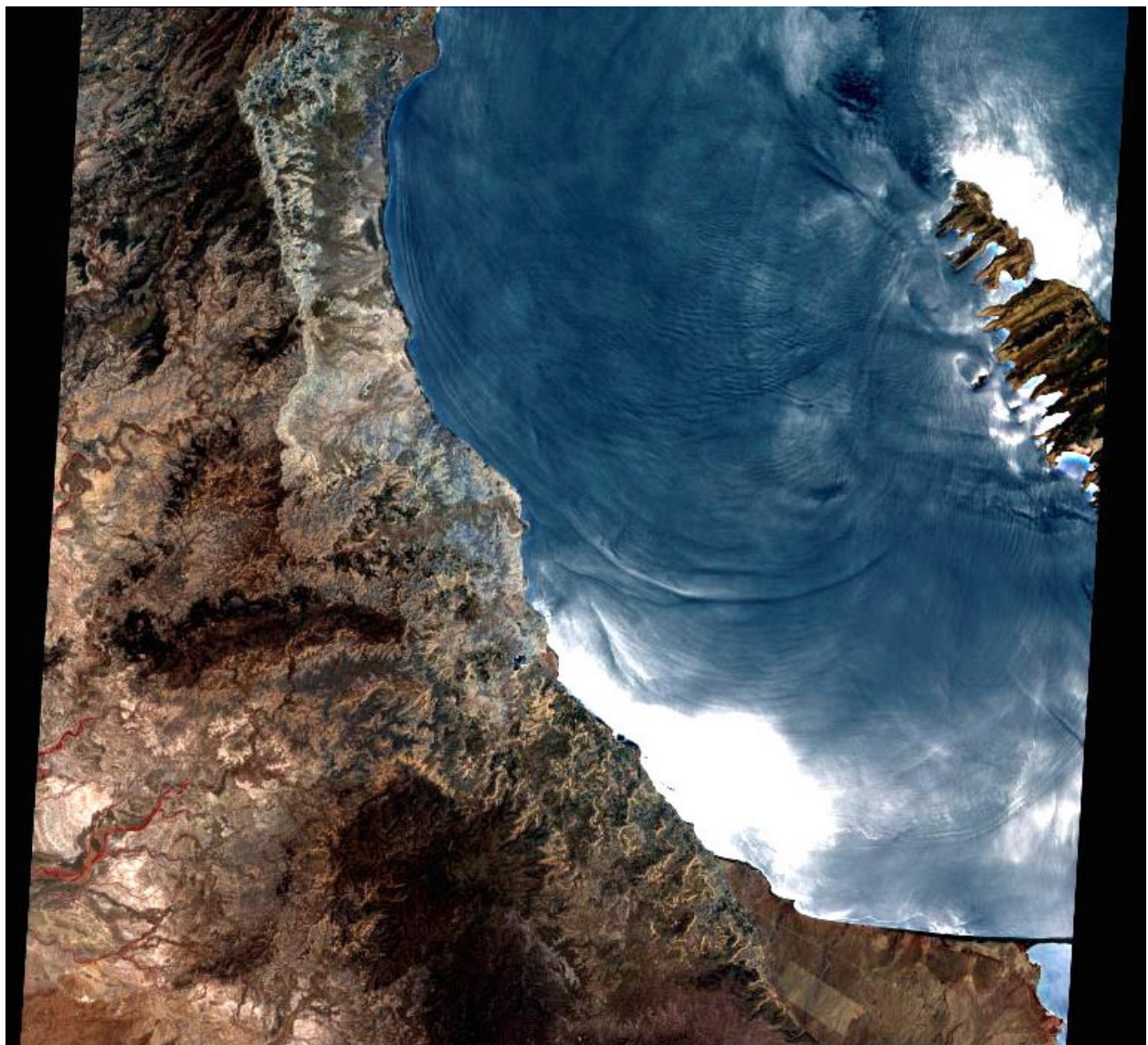


Figure 2. ASTER false-color VNIR image over Bahia de La Paz in the Gulf of California acquired on 10 May 2001 at 1821 UTC. The image shows internal waves can manifest themselves in small enclosed basins over short distances. Imaged area is approximately 60 km x 60 km.



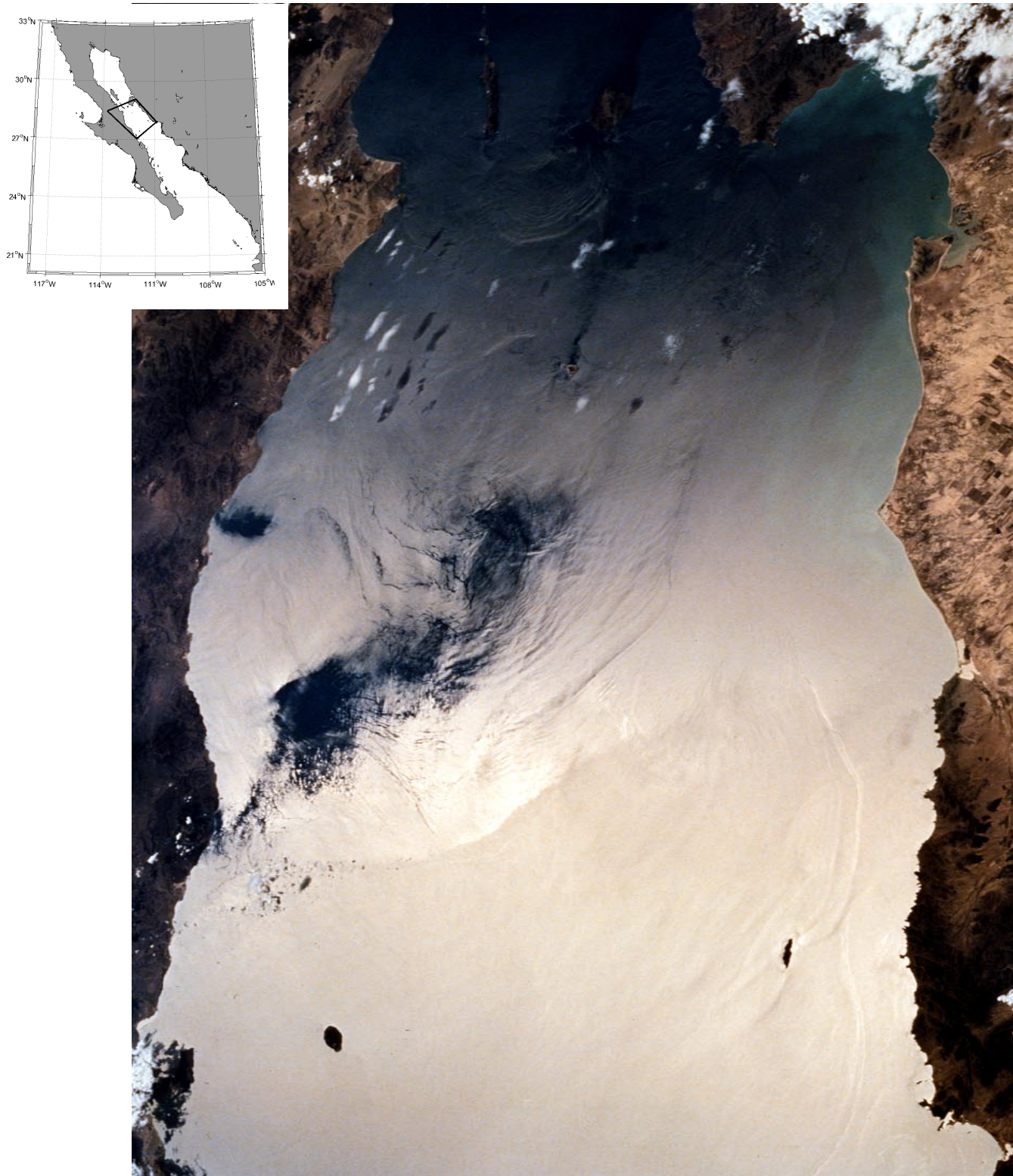


Figure 3. Astronaut Photograph (STS068-264-084) acquired on 2 October 1994 at 2133 UTC. The image shows internal waves originating between San Lorenzo and San Esteban Islands and propagating south. Bathymetric variations are most likely the cause the curvature in the waves propagation path. Imaged area is approximately 150 km x 200 km. [Image Courtesy of Earth Sciences and Image Analysis Laboratory, NASA Johnson Space Center (<http://eol.jsc.nasa.gov>)].

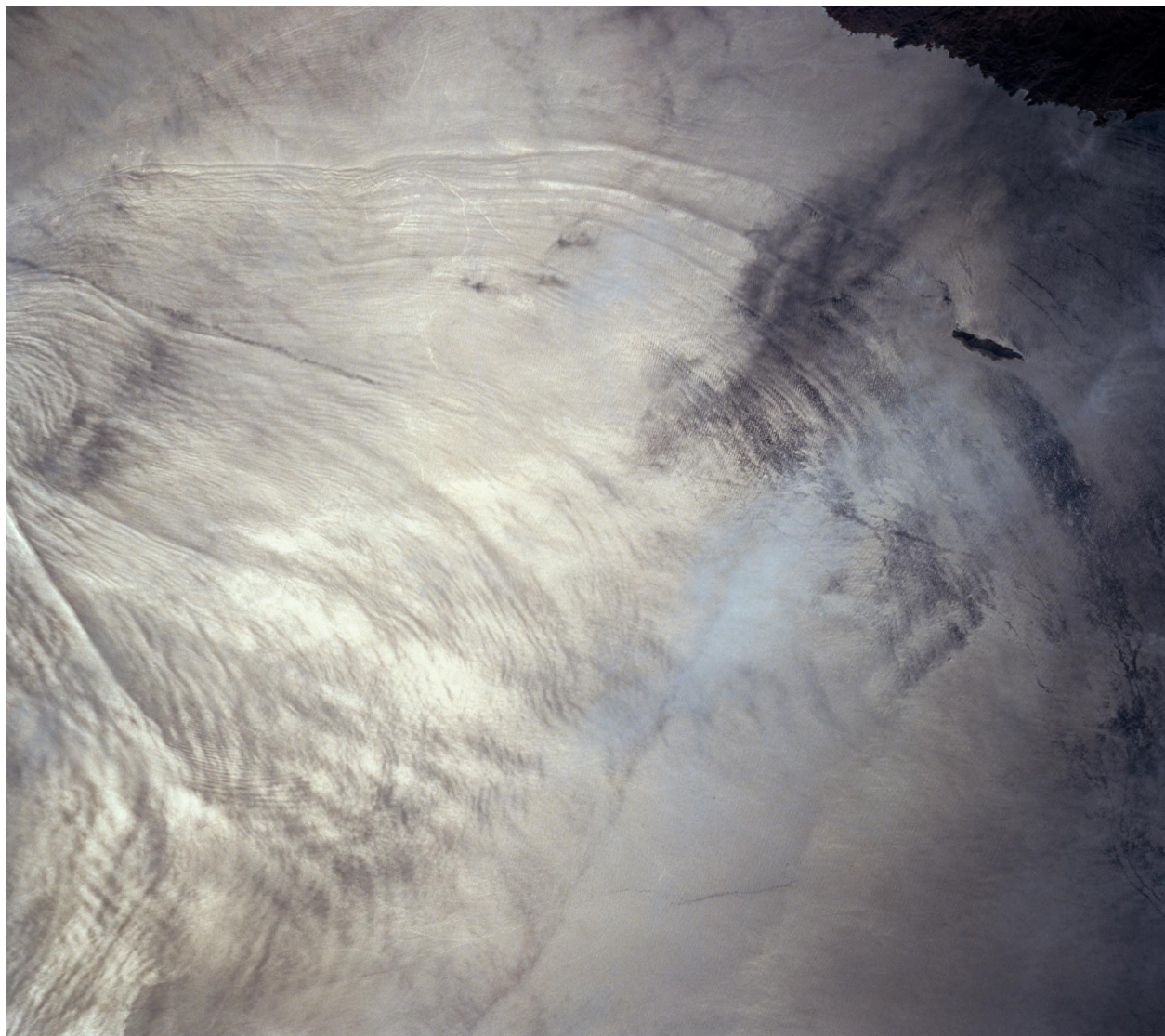
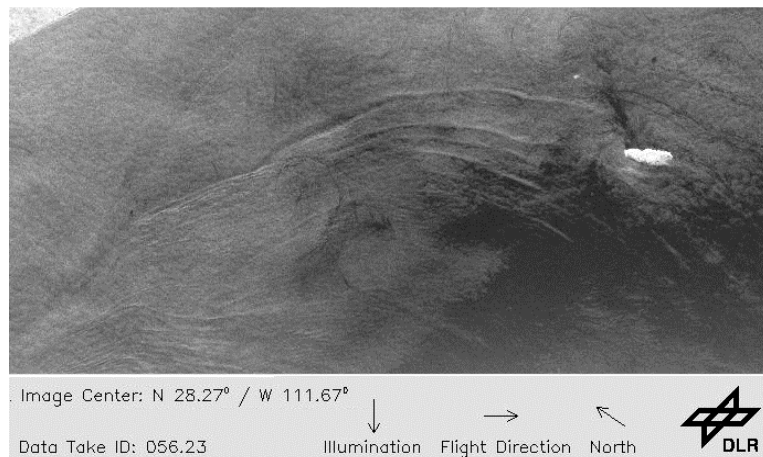
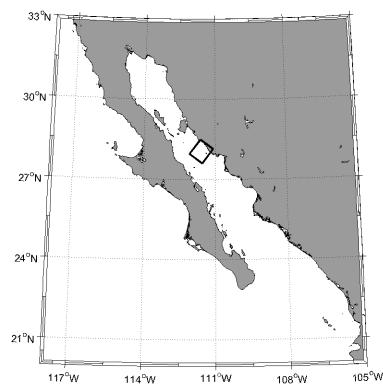


Figure 4. Simultaneous images of internal waves in the Gulf of California acquired with X-Band SAR and astronaut photography (STS068-273-54). The images were acquired 3 October 1994 at 2114 UTC, twenty four hours after STS068-264-084 shown in Figure 3. [X-Band SAR from DLR <http://isis.dlr.de/XSAR/>. Astronaut photograph courtesy of Earth Sciences and Image Analysis Laboratory, NASA Johnson Space Center (<http://eol.jsc.nasa.gov>).]

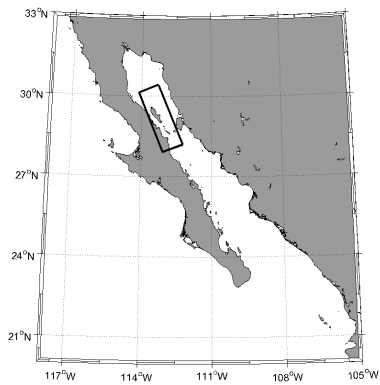


Figure 5. Seasat (L-band, HH) SAR image of the Gulf of California acquired on 29 September 1978 at 1811 UTC (Rev 1355). Eight major wave groups can be identified along with many minor ones [Fu and Holt, 1982]. Nine images over exactly the same ground position collected at three-day intervals between 14 September and 8 October 1978 demonstrated the correlation between internal wave field variation and strength of the local tides. [Fu and Holt 1984]. Imaged area is approximately 100 km x 285 km. [Image courtesy of NASA JPL]

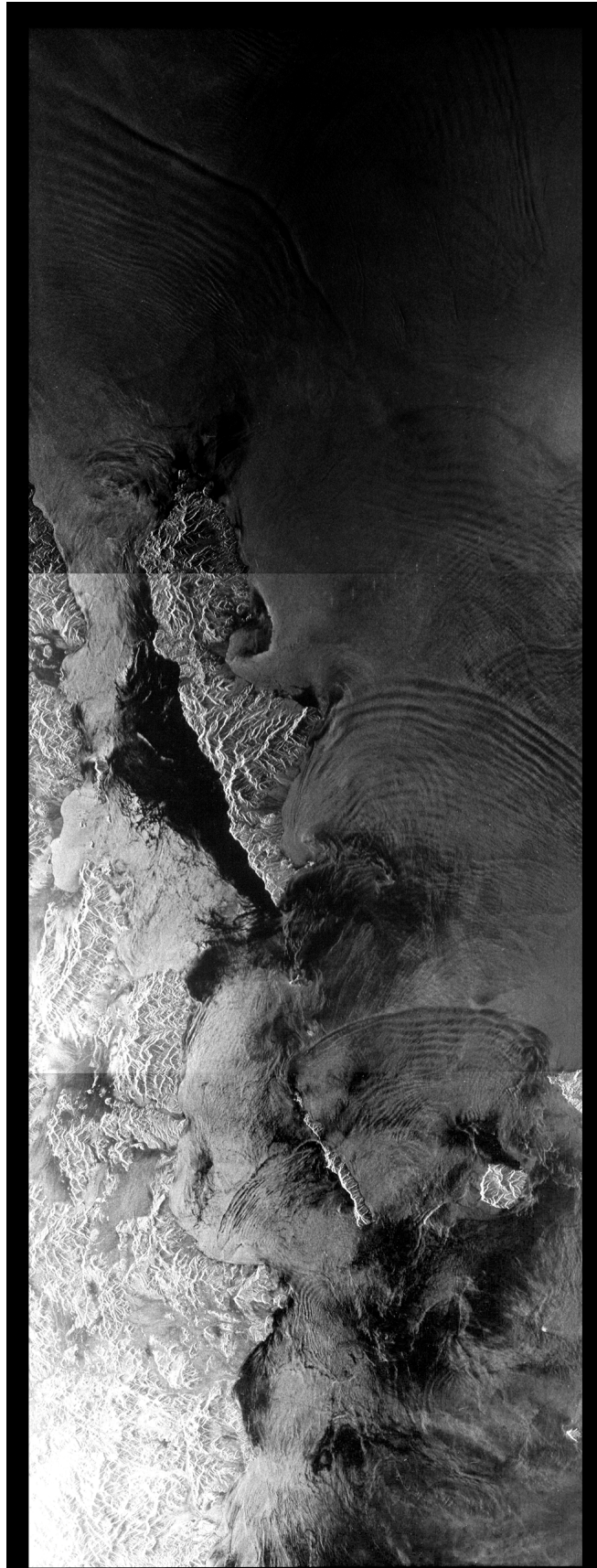
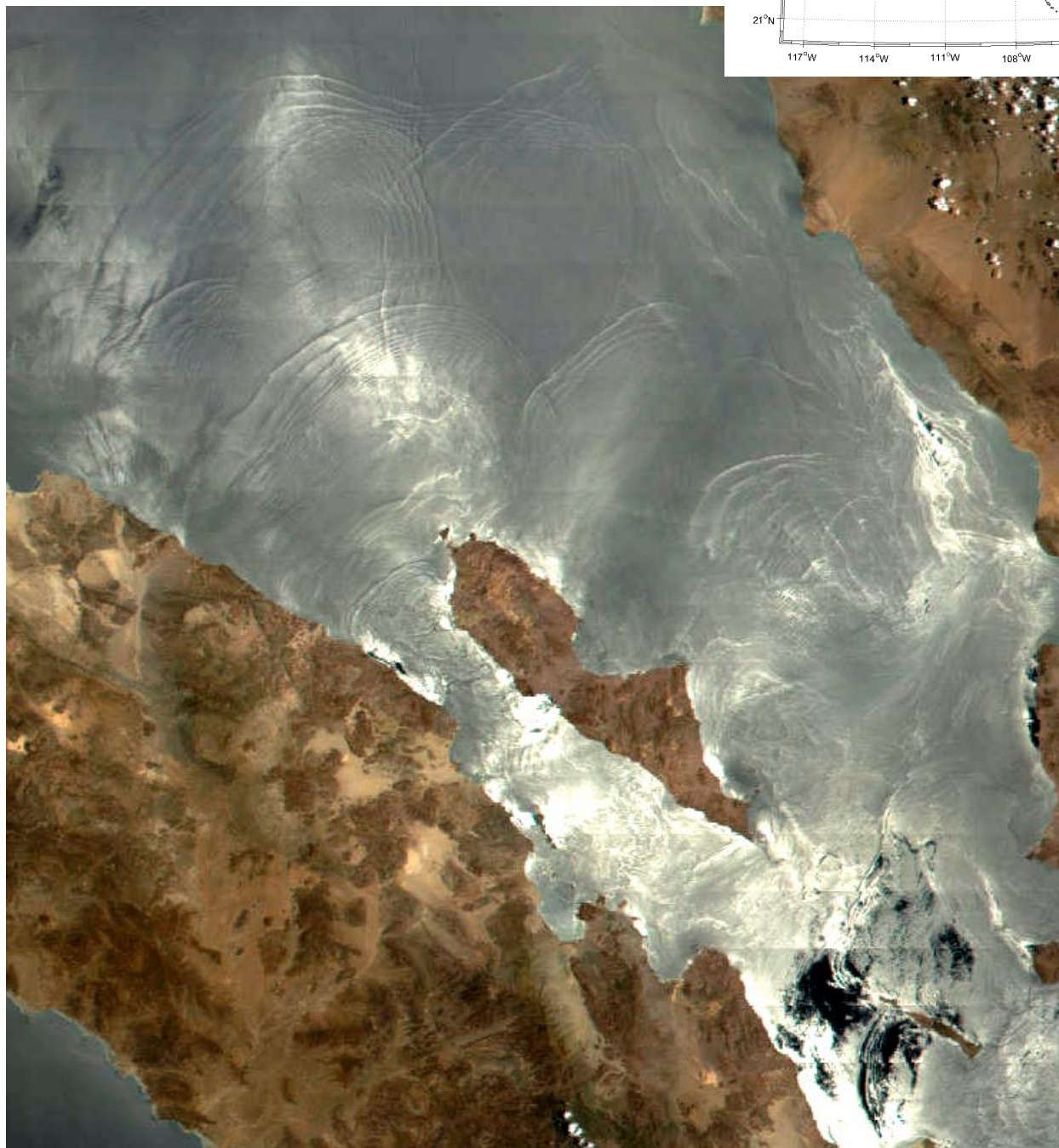


Figure 6. MODIS (Bands 1,3,4) 250-m resolution visible image over the northern Gulf of California acquired on 18 July 2001 at 1835 UTC. More than a dozen individual packets are visible originating from around the various islands. Imaged area is 185 km x 200 km.



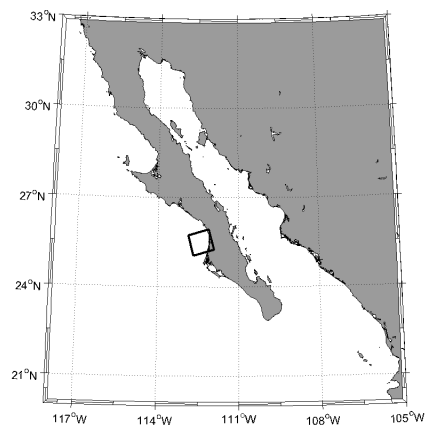
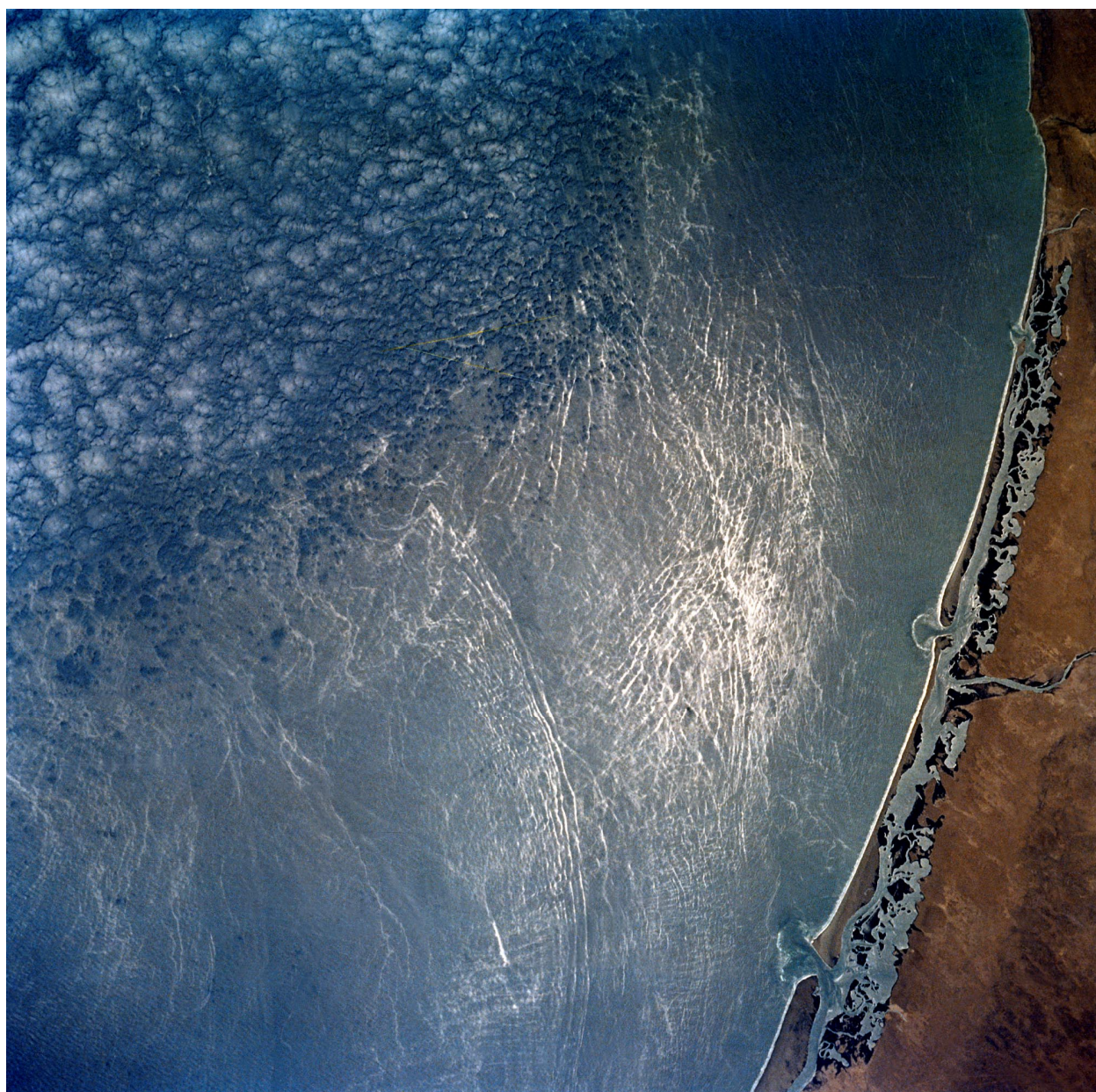


Figure 7. Astronaut photograph (STS030-76-31) acquired on 5 May 1989 at 1855 UTC. The image shows internal wave signatures approaching the Baja coast from two directions. Imaged area is approximately 65 km x 65 km. [Image courtesy of Earth Sciences and Image Analysis Laboratory, NASA Johnson Space Center (<http://eol.jsc.nasa.gov>).]



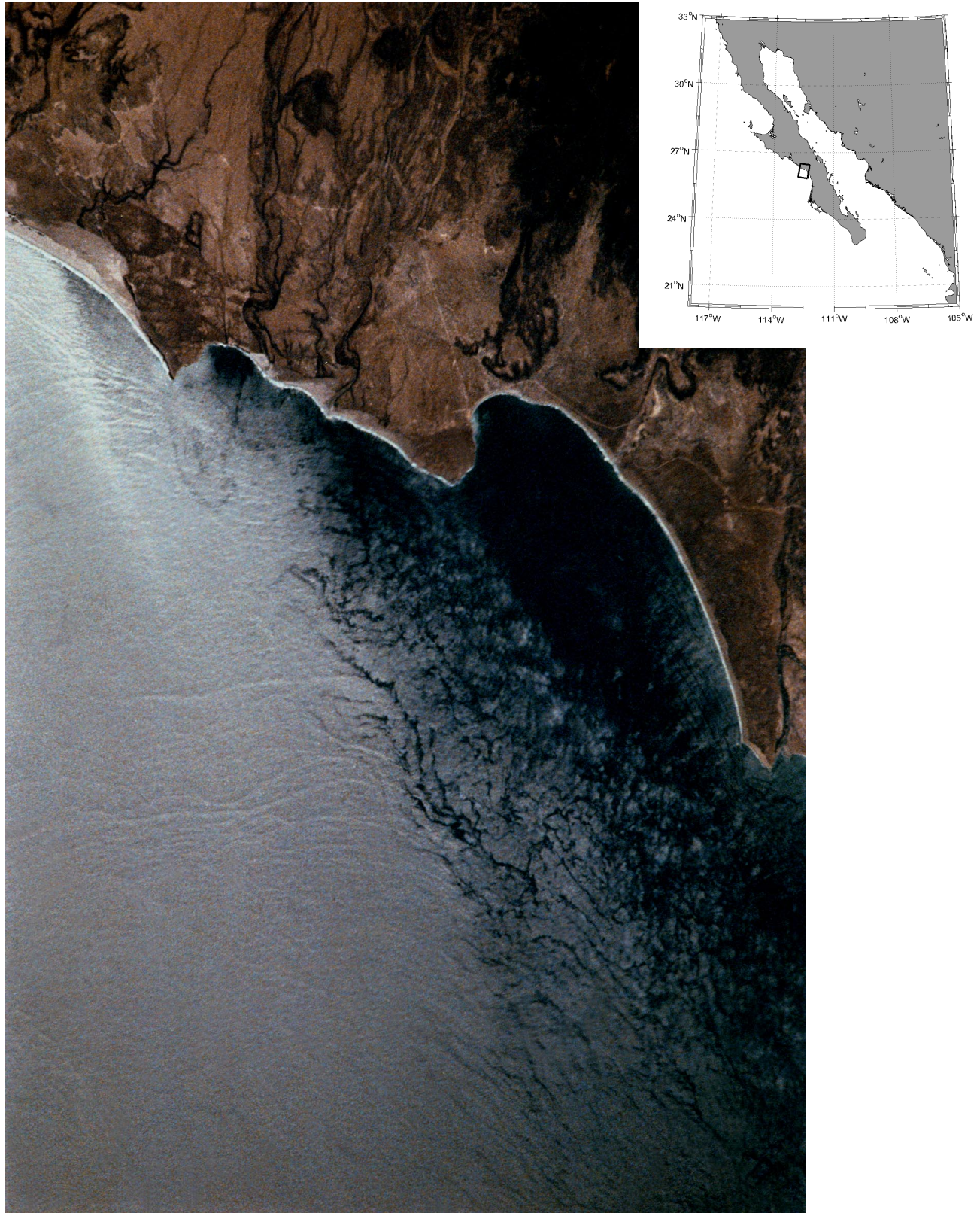


Figure 8. Astronaut photograph (STS043-32-19) acquired in August 1989. The image shows internal waves on the continental shelf on the Pacific Coast of Baja. Imaged area is approximately 35 km x 55 km. [Image courtesy of Earth Sciences and Image Analysis Laboratory, NASA Johnson Space Center (<http://eol.jsc.nasa.gov>)]

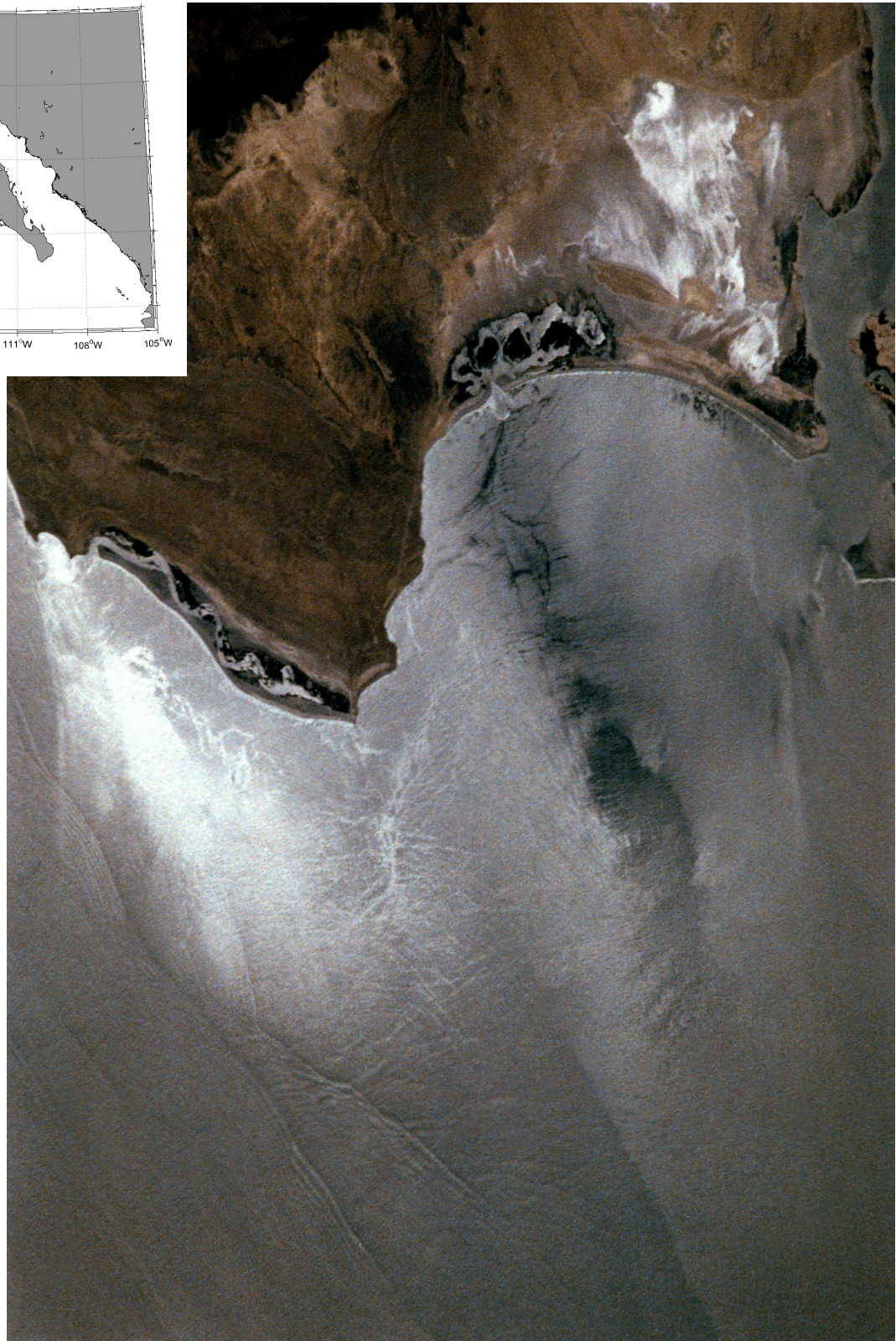
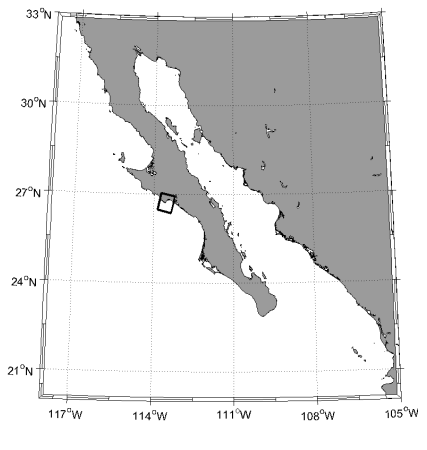


Figure 10. Astronaut photograph (STS043-32-16) acquired in August 1989. The image shows internal waves on the continental shelf on the Pacific Coast of Baja. Imaged area is approximately 35 km x 55 km. [Image courtesy of Earth Sciences and Image Analysis Laboratory, NASA Johnson Space Center (<http://eol.jsc.nasa.gov>)]

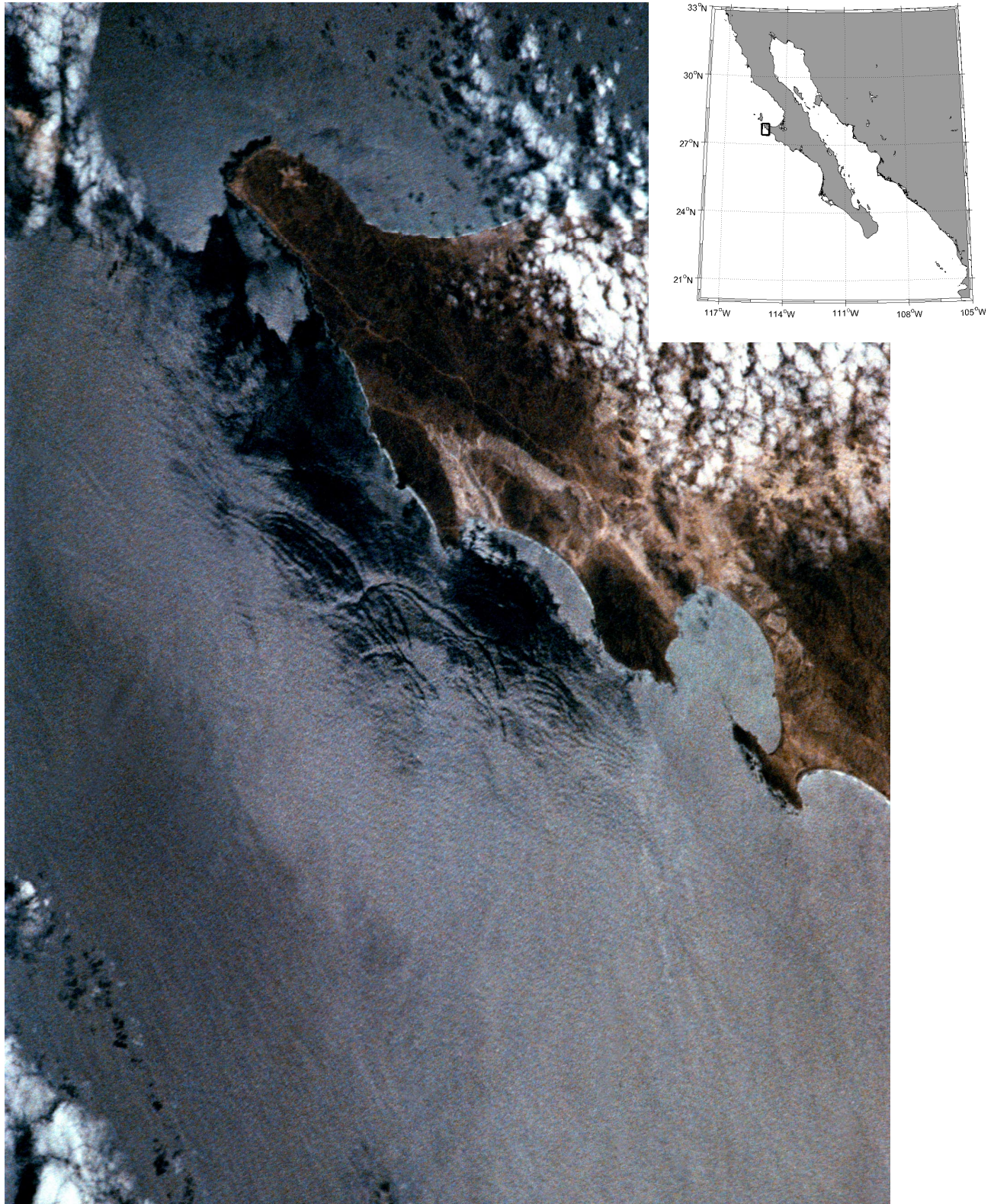


Figure 11. Astronaut photograph (STS043-32-13) acquired in August 1989. The image shows internal waves in the area near Turtle Bay on the Pacific Coast of Baja. Imaged area is approximately 30 km x 50 km. [Image courtesy of Earth Sciences and Image Analysis Laboratory, NASA Johnson Space Center (<http://eol.jsc.nasa.gov>)]

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