Northeast Atlantic

Overview

The Northeast Atlantic is roughly the area bounded by the triangle connecting Iceland, the United Kingdom and the Azores (Figure 2). A significant continental shelf exists along the west and north coast of the United Kingdom and the southeast coast of Iceland. The region includes the Faroe Plateau, the broad shelf that surrounds the Faroe Islands. On this shelf a persistent tidal front separates the shelf water from the open ocean. Extreme tidal currents cause the shallow parts of the shelf to be well mixed from surface to bottom without any stratification during the summer. The region is also influenced by a branch of the North Atlantic Drift current that flows north through this area. [LME, 2004]

Observations

There has been some scientific study of internal waves in the Northeast Atlantic, particularly in the area of the Malin Shelf [see Hallock et al, 2000; Inall et al, 2001; Small et al. [1999a,b] and Rockall Trough [Levine et al, 1983]. SEASAT SAR imagery showed internal wave activity in the Northeast Atlantic between August and October both along the continental shelf and in deep-sea regimes [Bagg and Johnson, 1983].

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

Table 1 - Months when internal waves have been observed in the Northeast Atlantic
(Numbers indicate unique dates in that month when waves have been noted)

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

Small et al. [1999] reports internal wave observation on the Malin Shelf via both in-situ and ERS SAR measurements during the SES Acoustic Measuring Experiment (SESAME) in August and September 1995. In-situ measurements of the internal waves reported in *Small et al.* [1999] were characterized by thermocline displacements of up to 50 m and phase speeds from 0.5 to 0.9 m/s

Bagg and Johnson [1983] reported a synoptic analysis SEASAT SAR data consisting of 73 image sequences derived from 30 of the 53 passes recorded at Oakhanger UK (Figure 1). These data, which covered over 5 million sq. km of ocean surface, contained 112 occurrences of internal wave packets. Figure 2 shows the relative observational frequency for internal waves [Bagg and Johnson 1983] in the region. It was produced by dividing the number of internal wave observations made within each 2 degree square by the number of times that square was imaged by SEASAT

The analysis concluded that the highest internal wave activity was in shallow water (less than 600 m). The areas with the most significant activity include the north and west coast of Scotland (over the continental shelf), Rockall Bank, around the Faeroe Islands and the southeast coast of Iceland and northeast of the Azores above the eastern edge of the Mid-Atlantic Ridge.

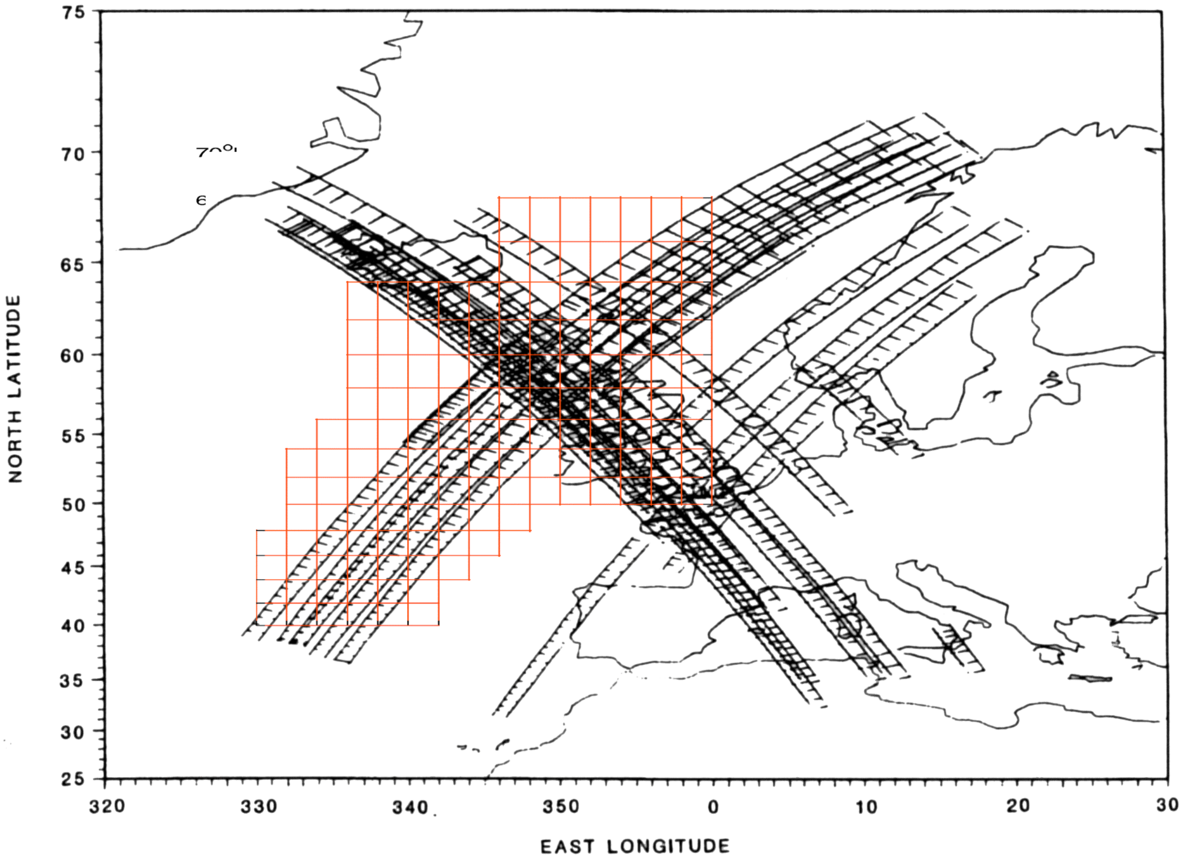


Figure 1. SEASAT data collections received at Oakhanger England, 4 August through 10 October 1978 [Fu and Holt 1982] showing the coverage of the Northeast Atlantic. Red boxes are the analysis grid of Bagg and Johnson for internal wave occurrences [c.f. Figure 2]

Table 2. Environmental Coefficients and Long Wave Phase Speed for Malin Shelf Solitons computed from the KDV Equation. [After Small et al. 1999]

Water depth (m)	c_0 (cm s^{-1})	α	γ
(a) *19–21 August 1995*			
400	48	– 0.016	1535
500	49	– 0.016	2270
600	50	– 0.015	3202
700	51	– 0.014	4449
(b) *4–6 September 1995*			
170	54	– 0.008	667
500	66	– 0.014	4077

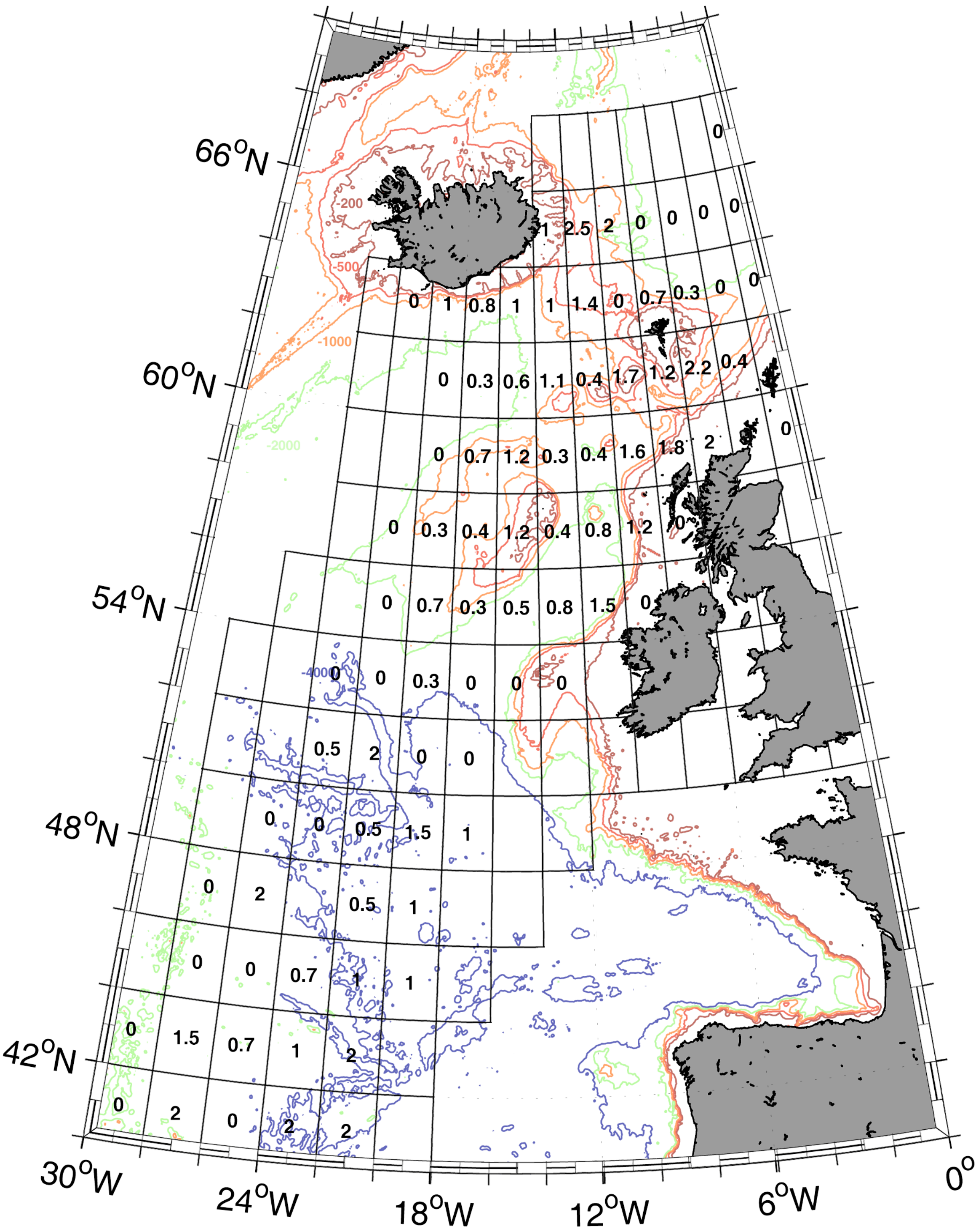


Figure 2. Internal wave observation frequency from SEASAT imagery [After Bagg and Johnson, 1983]. The data are shown with the local bathymetry [Smith and Sandwell, 1997].

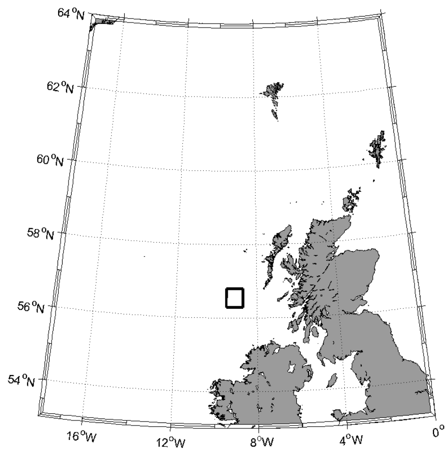
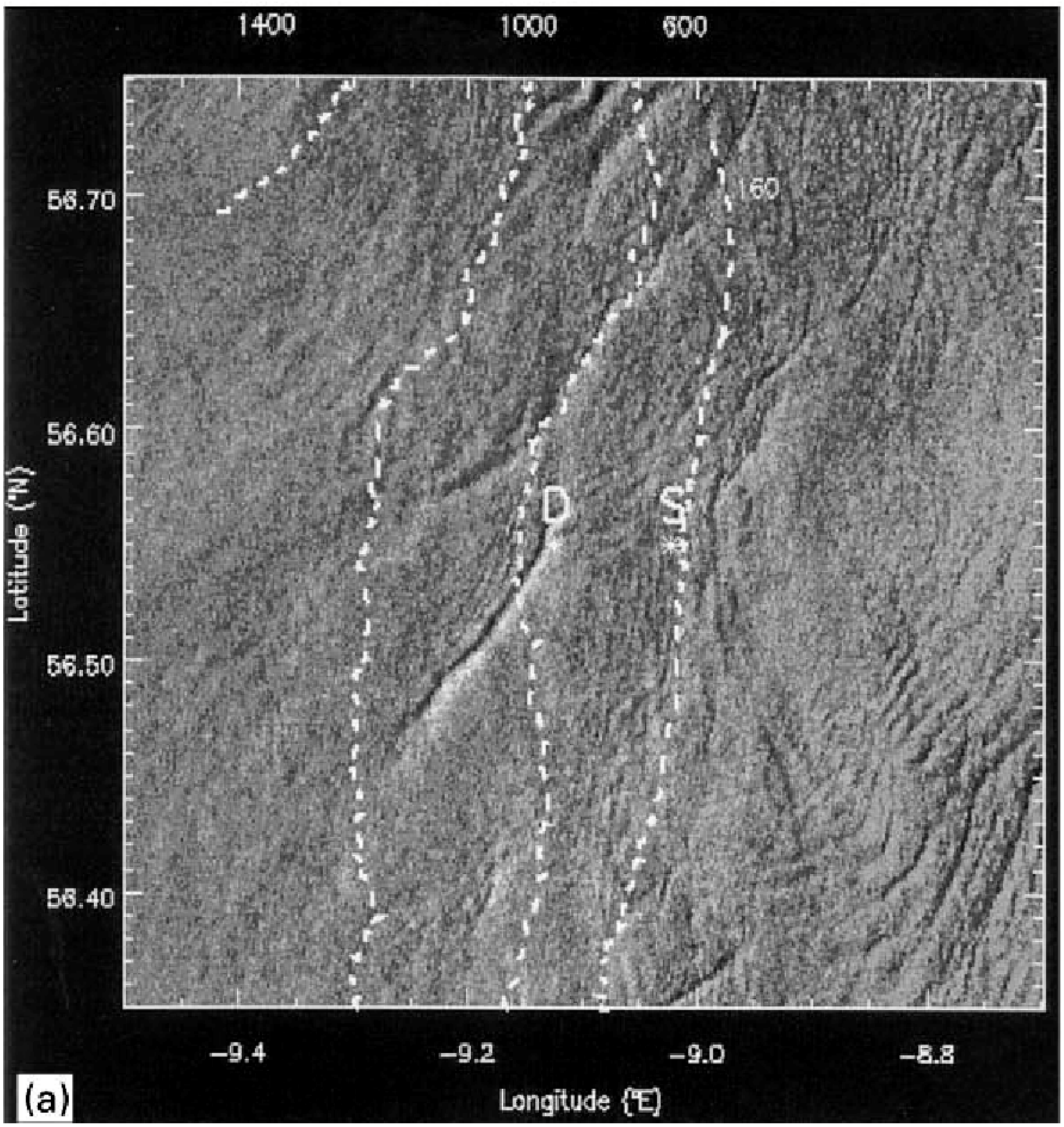
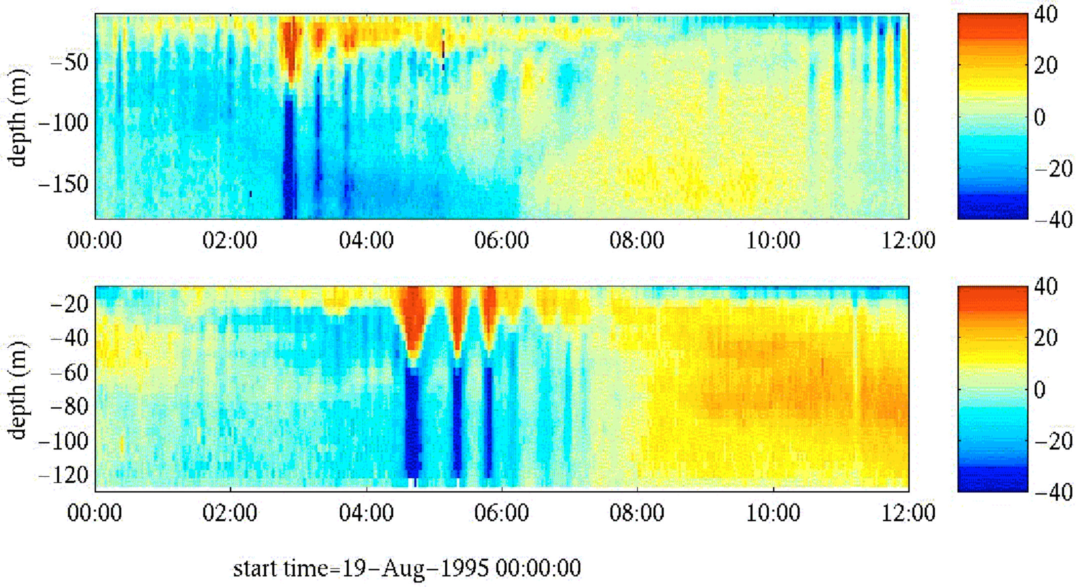


Figure 3. ERS-1 (C-band, VV) SAR image over the Malin Shelf acquired 20 August 1995 at 1136 UTC (orbit 21245, frame 2175). S and D are mooring sites of the SESAME experiment. [After Small et al, 1999]





B)

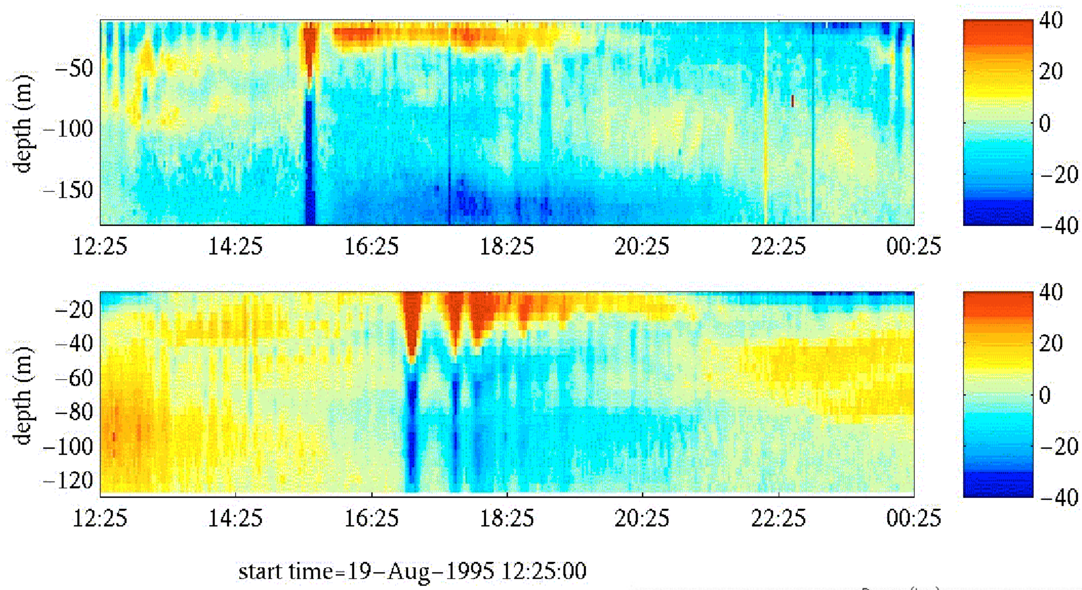
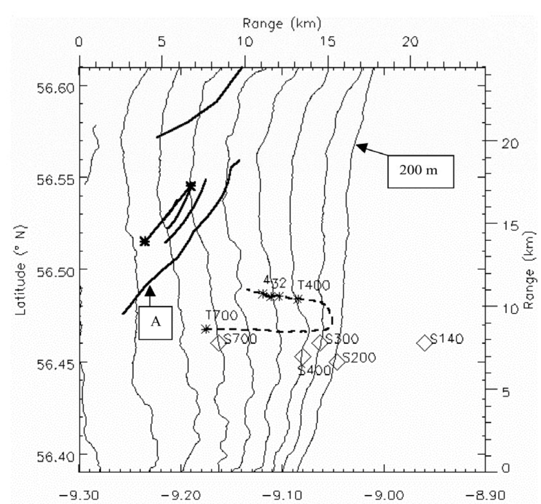


Figure 4. (Above) Full-depth ADCP records from S200 (and S140. A) Morning of 19 August 1995, S200 (top plot), S140 (second plot) B) Afternoon of 19 August 1995, S200 (top plot) S140 (second plot). The current has been resolved in a direction of 120 T. Current velocity in cm/s. Each slice shows a 12 hour record. The slices for both S200 and S140 are offset by 12 hours 25 minutes from each other respectively, i.e. one M2 tidal period. [Figure courtesy of Mark Inall, Dunstaffnage Marine laboratory.] (Right) Map of SESAME mooring locations. The internal wave fronts observed in ERS SAR imager are marked as thick solid lines for the 20 August 1995 and as thick solid line joining asterisks for the 21 August 1995.



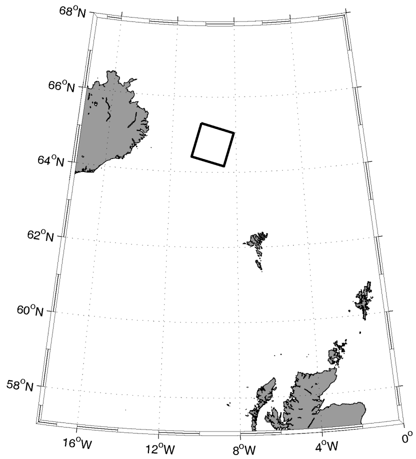
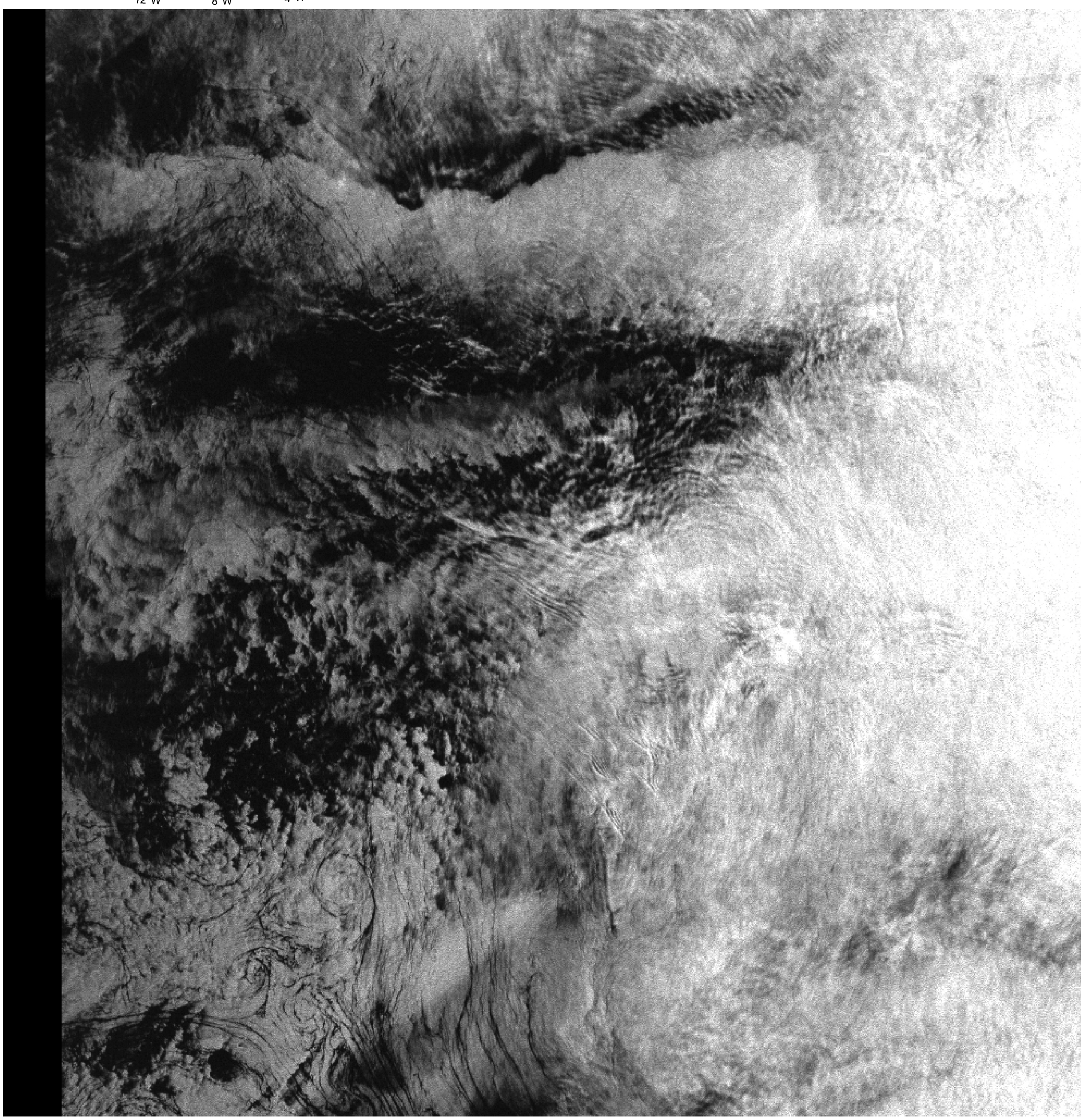
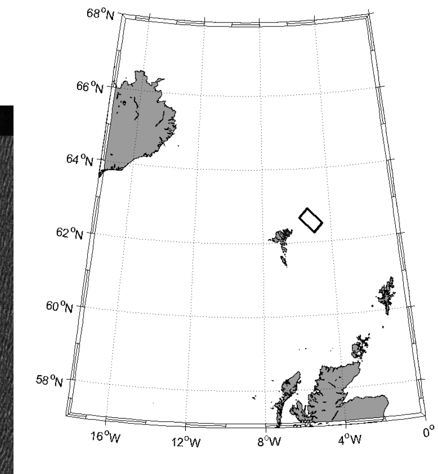


Figure 5. ERS-1 (C-Band, VV) SAR acquired on 7 September 1991 at 1155 UTC (orbit 751, frame 2295). The image shows a complex internal wave pattern in the relatively shallow area between Iceland and Faeroe Islands. Imaged area is 100 km x 100 km. ©ESA 1991. [Image courtesy of Werner Alpers, University of Hamburg, Hamburg, Germany]





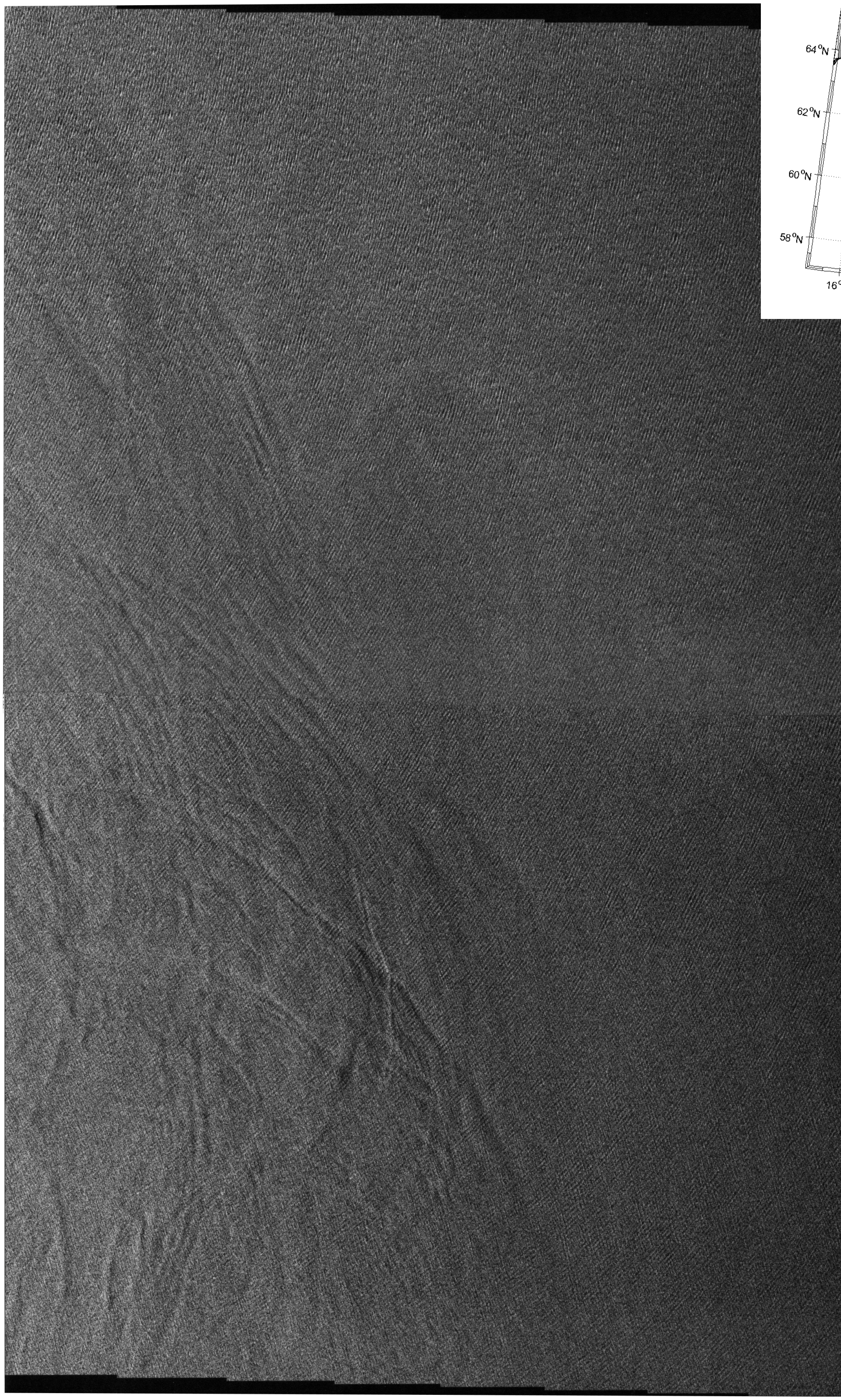


Figure 6. SEASAT (L-Band, HH) SAR image acquired on 15 September 1978 (Rev 1149). The image shows internal waves northeast of the Faeroe Islands. Imaged area is approximately 50 km x 100 km. Image processed by DLR Germany.

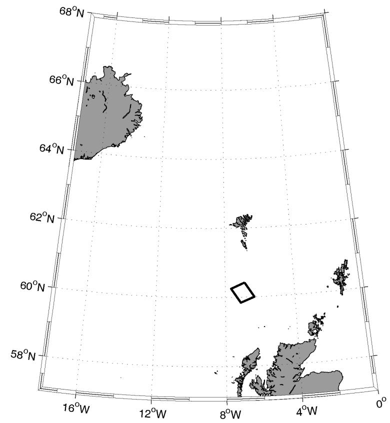


Figure 7. SEASAT (L-Band, HH) SAR image acquired on 19 August 1978 (Rev 762). The image shows internal waves south of the Faeroe Islands. Imaged area is approximately 50 km x 50 km. Image processed by DLR Germany.

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