Data Repository for: The Nature of Eddy Kinetic Energy in the Labrador Sea: Different Types of <u>Mesoscale</u> Eddies, their Temporal Variability and Impact on Deep Convection

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If you have any further questions regarding this data or the simulations used in the study, or want to have access to more datasets, please contact **fb1-od-data@geomar.de**

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Data needed to reproduce the figures in the study can be found in this repository. All files are in netCDF4_CLASSIC format. For each figure, there is a directory, that contains all data needed to plot it, along with the figure as it appears in the paper. Note that we do not include data that we did not produce in this repository.

The observational estimate for EKE is derived from the gridded, delayed time <u>geostrophic</u> surface velocities made available by E.U. Copernicus Marine Service (<u>CMEMS</u>). Additionally, 1 Hz along-track sea level anomaly (<u>SLA</u>) data developed, validated, and distributed by the <u>CTOH/LEGOS</u>, France \citep[X-TRACK;][]{<u>Birol2017</u>} are used in the Labrador Sea (<u>Topex</u>/Poseidon, Jason-1/2/3, Track 72).

The Arctic Oscillation Index used in FIGURE S03 was downloaded from https://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/monthly.ao.index.b5 Occurrent.ascii (Higgins, R. W., Leetmaa, A., and Kousky, V. E. (2002), Relationships between climate variability and winter temperature extremes in the United States, Journal of Climate, 15, 1555–1572.).

If you have any questions concerning the simulations, please refer to them by their original names as listed below:

VIKING20X Hindcast 1958-2009 = VIKING20X.L46-KKG36013H VIKING20X sensitivity no-slip lateral boundary condition = VIKING20X.L46-KKG36009H VIKING20X sensitivity free-slip lateral boundary condition = VIKING20X.L46-KKG36012H ORCA12 = ORCA12.L46-KKG36002H

A detailed list of files together with a description of the contents can be found below. All data is taken from the Hindcast simulation **VIKING20X.L46-KKG36013H** unless indicated otherwise.

FIGURE01/

1_VIKING20X.L46-KKG36013H_5d_20071129_SPEED_94m.nc

5-day mean (2007-11-27 - 2007-12-01) ocean current speed at 94m depth, Subpolar North Atlantic.

1_VIKING20X.L46-KKG36013H_mean_20000101_20091231_ICE_FRACTION.nc mean (2000 - 2009) March ice fraction, Subpolar North Atlantic.

1_VIKING20X.L46-KKG36013H_mean_march_20000101_20091231_MLD_somx1010.nc mean (2000 - 2009) March Mixed Layer Depth, Subpolar North Atlantic.

FIGURE02/

1_VIKING20X.L46-KKG36013H_5d_20071129_94m_relative_vorticity.nc

5-day mean (2007-11-27 - 2007-12-01) relative vorticity at 94m depth, 43.0-64.0W, 53.0-65.0N, normalized by the planetary vorticity f.

1_VIKING20X.L46-KKG36013H_mean_march_20000101_20091231_MLD_somx1010.nc

mean (2000 - 2009) March Mixed Layer Depth, 43.0-64.0W, 53.0-65.0N.

FIGURE03/

1_VIKING20X.L46-KKG36013H_5d_20071129_SAL_54.4W_60-61N_IrmingerRing.nc 5-day mean (2007-11-27 - 2007-12-01) section of salinity at 54.4W, 60.0-61.0N.

1_VIKING20X.L46-KKG36013H_5d_20071129_TEMP_54.4W_60-61N_IrmingerRing.nc 5-day mean (2007-11-27 - 2007-12-01) section of temperature at 54.4W, 60.0-61.0N.

1_VIKING20X.L46-KKG36013H_5d_20071129_UVEL_54.4W_60-61N_IrmingerRing.nc

5-day mean (2007-11-27 - 2007-12-01) section of zonal velocity (in model coordinates) at 54.4W, 60.0-61.0N.

1_VIKING20X.L46-KKG36013H_5d_20071129_VORT_54.4W_60-61N_IrmingerRing.nc 5-day mean (2007-11-27 - 2007-12-01) section of relative vorticity (normalized by planetary vorticity) at 54.4W, 60.0-61.0N.

1_VIKING20X.L46-KKG36013H_5d_20080202_SAL_54.5W_58.3-59.2N_IrmingerRing.nc 5-day mean (2008-01-31 - 2008-02-04) section of salinity at 54.5W, 58.3-59.2N.

1_VIKING20X.L46-KKG36013H_5d_20080202_TEMP_54.5W_58.3-59.2N_IrmingerRing.nc 5-day mean (2008-01-31 - 2008-02-04) section of temperature at 54.5W, 58.3-59.2N.

1_VIKING20X.L46-KKG36013H_5d_20080202_UVEL_54.5W_58.3-59.2N_IrmingerRing.nc 5-day mean (2008-01-31 - 2008-02-04) section of zonal velocity (in model coordinates) at 54.5W, 58.3-59.2N.

1_VIKING20X.L46-KKG36013H_5d_20080202_VORT_54.5W_58.3-59.2N_IrmingerRing.nc 5-day mean (2008-01-31 - 2008-02-04) section of relative vorticity (normalized by planetary vorticity) at 54.5W, 58.3-59.2N.

FIGURE04/

1_VIKING20X.L46-KKG36013H_mean_20000101_20091231_EKE_94m.nc mean (2000 - 2009) Eddy Kinetic Energy at 94 m depth, 30.0-66.0W, 45.0-70.0N.

1_VIKING20X.L46-KKG36013H_mean_March_20000101_20091231_downward_HEAT_FLUX.nc mean (2000 - 2009) March surface heat flux (positive into the ocean), 30.0-66.0W, 45.0-70.0N.

1_VIKING20X.L46-KKG36013H_mean_March_20000101_20091231_ICE_FRACTION.nc mean (2000 - 2009) March ice fraction, 30.0-66.0W, 45.0-70.0N.

1_VIKING20X.L46-KKG36013H_mean_march_20000101_20091231_MLD_somx1010.nc mean (2000 - 2009) March Mixed Layer Depth, 30.0-66.0W, 45.0-70.0N.

FIGURE05/

1_VIKING20X.L46-KKG36009H_KKG36012H_1m_20080101_20081231_MLD_difference_noIR-withIR.nc 1-month mean (March 2008) difference in Mixed Layer Depth between simulations 1_VIKING20X.L46-KKG36009H (free-slip) and 1_VIKING20X.L46-KKG36012H (no slip), 34.0-72.0W, 50.0-70.0N.

1_VIKING20X.L46-KKG36009H_KKG36012H_1y_20080101_20081231_BCI_382-

1655m_difference_noIR-withIR.nc

1-year mean (2008) difference in transfer from mean to eddy available potential energy averaged over 382-1655 m depth between simulations 1_VIKING20X.L46-KKG36009H and 1_VIKING20X.L46-KKG36012H, 34.0-72.0W, 50.0-70.0N.

1_VIKING20X.L46-KKG36009H_KKG36012H_1y_20080101_20081231_BTI_112-322m_difference_noIRwithIR.nc

1-year mean (2008) difference in transfer from mean to eddy kinetic energy averaged over 112–322 m depth between simulations 1_VIKING20X.L46-KKG36009H and 1_VIKING20X.L46-KKG36012H, 34.0-72.0W, 50.0-70.0N.

1_VIKING20X.L46-KKG36009H_KKG36012H_1y_20080101_20081231_EKE_94m_difference_noIRwithIR.nc

1-year mean (2008) difference in Eddy Kinetic Energy at 94 m depth between simulations 1_VIKING20X.L46-KKG36009H and 1_VIKING20X.L46-KKG36012H, 34.0-72.0W, 50.0-70.0N.

1_VIKING20X.L46-KKG36012H_1m_20080301_20080331_MLD.nc

1-month mean (March 2008) Mixed Layer Depth from 1_VIKING20X.L46-KKG36012H (no slip), 34.0-72.0W, 50.0-70.0N.

FIGURE06/

1_VIKING20X.L46-KKG36013H_1m_clim_20000101_20091231_BC_WGC_average_112-322m.nc Climatological monthly mean (2000 - 2009) seasonal cycle of transfer from mean to eddy available potential energy averaged over 112-322 m depth, 49.0-56.0W, 60.0-62.5N.

1_VIKING20X.L46-KKG36013H_1m_clim_20000101_20091231_BC_WGC_average_382-1655m.nc

Climatological monthly mean (2000 - 2009) seasonal cycle of transfer from mean to eddy available potential energy averaged over 382-1655 m depth, 49.0-56.0W, 60.0-62.5N.

1_VIKING20X.L46-KKG36013H_1m_clim_20000101_20091231_BT_WGC_average_112-322m.nc Climatological monthly mean (2000 - 2009) seasonal cycle of transfer from mean to eddy kinetic energy averaged over 112-322 m depth, 49.0-56.0W, 60.0-62.5N.

1_VIKING20X.L46-KKG36013H_1m_clim_20000101_20091231_BT_WGC_average_382-1655m.nc Climatological monthly mean (2000 - 2009) seasonal cycle of transfer from mean to eddy kinetic energy averaged over 382-1655 m depth, 49.0-56.0W, 60.0-62.5N.

1_VIKING20X.L46-KKG36013H_1m_clim_20000101_20091231_EKE_WGC_average_112-322m.nc Climatological monthly mean (2000 - 2009) seasonal cycle of Eddy Kinetic Energy averaged over 112-322 m depth, 49.0-56.0W, 60.0-62.5N.

1_VIKING20X.L46-KKG36013H_1m_clim_20000101_20091231_EKE_WGC_average_382-1655m.nc Climatological monthly mean (2000 - 2009) seasonal cycle of Eddy Kinetic Energy averaged over 382-1655 m depth, 49.0-56.0W, 60.0-62.5N.

FIGURE07/

1_VIKING20X.L46-KKG36013H_10y_diff_1988-1997_minus_1966-1975BC_average_382-1655m.nc Difference between 10-year mean transfer from mean to eddy available potential energy in a positive phase of the Subpolar Gyre Index (1988 - 1997) and a negative phase of the Subpolar Gyre Index (1966 - 1975), averaged over 382-1655 m depth, 43.0-62.0W, 55.0-63.0N.

1_VIKING20X.L46-KKG36013H_10y_diff_1988-1997_minus_1966-1975BT_average_112-322m.nc Difference between 10-year mean transfer from mean to eddy kinetic energy in a positive phase of the Subpolar Gyre Index (1988 - 1997) and a negative phase of the Subpolar Gyre Index (1966 - 1975), averaged over 112-322 m depth, 43.0-62.0W, 55.0-63.0N.

1_VIKING20X.L46-KKG36013H_10y_diff_1988-1997_minus_1966-1975EKE_average_112-322m.nc Difference between 10-year mean eddy kinetic energy in a positive phase of the Subpolar Gyre Index (1988 - 1997) and a negative phase of the Subpolar Gyre Index (1966 - 1975), averaged over 112-322 m depth, 43.0-62.0W, 55.0-63.0N.

1_VIKING20X.L46-KKG36013H_10y_diff_1988-1997_minus_1966-1975MLD_average.nc Difference between 10-year mean Mixed Layer Depth in a positive phase of the Subpolar Gyre Index (1988 - 1997) and a negative phase of the Subpolar Gyre Index (1966 - 1975), 43.0-62.0W, 55.0-63.0N.

1_VIKING20X.L46-KKG36013H_10y_diff_1988-1997_minus_1966-1975SPEEED_average_112-322m.nc Difference between 10-year mean ocean current speed in a positive phase of the Subpolar Gyre Index (1988 - 1997) and a negative phase of the Subpolar Gyre Index (1966 - 1975), averaged over 112-322 m depth, 43.0-62.0W, 55.0-63.0N.

1_VIKING20X.L46-KKG36013H_10y_diff_1988-1997_minus_1966-1975SPEEED_average_382-1655m.nc

Difference between 10-year mean ocean current speed in a positive phase of the Subpolar Gyre Index (1988 - 1997) and a negative phase of the Subpolar Gyre Index (1966 - 1975), averaged over 382-1655 m depth, 43.0-62.0W, 55.0-63.0N.

FIGURE08/

1_VIKING20X.L46-KKG36013H_1m_19800101_20091231_EKE_94m_zonal_average_52.5-57W.nc Monthly mean (1980 - 2009), zonal average (52.5-57W) Eddy Kinetic Energy at 94 m depth, 56.0-62.0N.

FIGURE09/

1_VIKING20X.L46-KKG36013H_5d_20071129_989m_relative_vorticity.nc

5-day mean (2007-11-27 – 2007-12-01) relative vorticity (normalized by the planetary vorticity f) at 989 m depth, 43.0-64.0W, 53.0-65.0N.

1_VIKING20X.L46-KKG36013H_5d_20080329_989m_relative_vorticity.nc

5-day mean (2008-03-27 – 2008-03-31) relative vorticity (normalized by the planetary vorticity f) at 989 m depth, 43.0-64.0W, 53.0-65.0N.

1_VIKING20X.L46-KKG36013H_5d_20080329_MLD.nc

5-day mean (2008-03-27 - 2008-03-31) Mixed Layer Depth, 43.0-64.0W, 53.0-65.0N.

1_VIKING20X.L46-KKG36013H_5d_20080528_989m_relative_vorticity.nc

5-day mean (2008-05-26 - 2008-05-30) relative vorticity (normalized by the planetary vorticity f) at 989 m depth, 43.0-64.0W, 53.0-65.0N.

1_VIKING20X.L46-KKG36013H_5d_20081005_989m_relative_vorticity.nc

5-day mean (2008-10-03 – 2008-10-07) relative vorticity (normalized by the planetary vorticity f) at 989 m depth, 43.0-64.0W, 53.0-65.0N.

FIGURE10/

1_VIKING20X.L46-KKG36013H_5d_20071129_potvort_section_52W.nc

5-day mean (2007-11-27 - 2007-12-01) potential vorticity section at 52.0W, 52.0-60.0N.

1_VIKING20X.L46-KKG36013H_5d_20071129_vorticity_section_52W.nc

5-day mean (2007-11-27 – 2007-12-01) relative vorticity (normalized by the planetary vorticity f) section at 52.0W, 52.0-60.0N.

1_VIKING20X.L46-KKG36013H_5d_20080329_potvort_section_52W.nc

5-day mean (2008-03-27 – 2008-03-31) potential vorticity section at 52.0W, 52.0-60.0N.

1_VIKING20X.L46-KKG36013H_5d_20080329_vorticity_section_52W.nc

5-day mean (2008-03-27 – 2008-03-31) relative vorticity (normalized by the planetary vorticity f) section at 52.0W, 52.0-60.0N.

FIGURE11/

1_VIKING20X.L46-KKG36013H_5d_20080408_PVOR_52.5W_55.8-56.4N_ConvectiveEddy.nc 5-day mean (2008-04-06 - 2008-04-10) section of potential vorticity at 52.5W, 55.8-56.4N.

1_VIKING20X.L46-KKG36013H_5d_20080408_SAL_52.5W_55.8-56.4N_ConvectiveEddy.nc 5-day mean (2008-04-06 - 2008-04-10) section of salinity at 52.5W, 55.8-56.4N.

1_VIKING20X.L46-KKG36013H_5d_20080408_TEMP_52.5W_55.8-56.4N_ConvectiveEddy.nc 5-day mean (2008-04-06 - 2008-04-10) section of temperature at 52.5W, 55.8-56.4N.

1_VIKING20X.L46-KKG36013H_5d_20080408_UVEL_52.5W_55.8-56.4N_ConvectiveEddy.nc 5-day mean (2008-04-06 - 2008-04-10) section of zonal velocity (in model coordinates) at 52.5W, 55.8-56.4N.

FIGURE12/

1_VIKING20X.L46-KKG36013H_1m_clim_20000101_20091231_BC_centralLS_average_112-322m.nc Climatological monthly mean (2000 - 2009) seasonal cycle of transfer from mean to eddy available potential energy averaged over 112-322 m depth, 53.0-56.0W, 56.0-57.0N.

1_VIKING20X.L46-KKG36013H_1m_clim_20000101_20091231_BC_centralLS_average_382-1655m.nc Climatological monthly mean (2000 - 2009) seasonal cycle of transfer from mean to eddy available potential energy averaged over 382-1655 m depth, 53.0-56.0W, 56.0-57.0N.

1_VIKING20X.L46-KKG36013H_1m_clim_20000101_20091231_BT_centralLS_average_112-322m.nc Climatological monthly mean (2000 - 2009) seasonal cycle of transfer from mean to eddy kinetic energy averaged over 112-322 m depth, 53.0-56.0W, 56.0-57.0N.

1_VIKING20X.L46-KKG36013H_1m_clim_20000101_20091231_BT_centralLS_average_382-1655m.nc Climatological monthly mean (2000 - 2009) seasonal cycle of transfer from mean to eddy kinteic energy averaged over 382-1655 m depth, 53.0-56.0W, 56.0-57.0N.

1_VIKING20X.L46-KKG36013H_1m_clim_20000101_20091231_EKE_centralLS_average_112-322m.nc Climatological monthly mean (2000 - 2009) seasonal cycle of eddy kinetic energy averaged over 112-322 m depth, 53.0-56.0W, 56.0-57.0N.

1_VIKING20X.L46-KKG36013H_1m_clim_20000101_20091231_EKE_centralLS_average_382-1655m.nc Climatological monthly mean (2000 - 2009) seasonal cycle of eddy kinetic energy averaged over 382-1655 m depth, 53.0-56.0W, 56.0-57.0N.

FIGURE13/

1_VIKING20X.L46-KKG36013H_clim_anomaly_19830101_19911231_EddyBuoyFlux_average_534-2054m_53-56W_56-57.5N.nc

Climatological monthly mean (1983 – 1991) eddy buoyancy flux convergence anomaly averaged over 534-2054 m and 53.0-56.0W, 56.0-57.5N.

1_VIKING20X.L46-KKG36013H_clim_anomaly_19830101_19911231_sigma1_average_534-2054m_53-56W_56-57.5N.nc

Climatological monthly mean (1983 – 1991) potential density (referenced to 1000 m) anomaly averaged over 534-2054 m and 53.0-56.0W, 56.0-57.5N.

ORCA12.L46-KKG36002H_clim_anomaly_19830101_19911231_EddyBuoyFlux_average_534-2054m_53-56W_56-57.5N.nc

Climatological monthly mean (1983 – 1991) eddy buoyancy flux convergence anomaly from a 1/12 deg. simulation averaged over 534-2054 m and 53.0-56.0W, 56.0-57.5N.

ORCA12.L46-KKG36002H_clim_anomaly_19830101_19911231_sigma1_average_534-2054m_53-56W_56-57.5N.nc

Climatological monthly mean (1983 – 1991) potential density (referenced to 1000 m) anomaly from a 1/12 deg. simulation averaged over 534-2054 m and 53.0-56.0W, 56.0-57.5N.

FIGURE14/

1_VIKING20X.L46-KKG36013H_5d_20090329_PVOR_58.2W_57.7-58.4N_BoundaryCurrentEddy.nc 5-day mean (2009-03-27 - 2009-03-31) section of potential vorticity at 58.2W, 57.7-58.4N.

1_VIKING20X.L46-KKG36013H_5d_20090329_SAL_58.2W_57.7-58.4N_BoundaryCurrentEddy.nc 5-day mean (2009-03-27 - 2009-03-31) section of salinity at 58.2W, 57.7-58.4N.

1_VIKING20X.L46-KKG36013H_5d_20090329_TEMP_58.2W_57.7-58.4N_BoundaryCurrentEddy.nc 5-day mean (2009-03-27 - 2009-03-31) section of temperature at 58.2W, 57.7-58.4N.

1_VIKING20X.L46-KKG36013H_5d_20090329_UVEL_58.2W_57.7-58.4N_BoundaryCurrentEddy.nc 5-day mean (2009-03-27 - 2009-03-31) section of zonal velocity (in model coordinates) at 58.2W, 57.7-58.4N.

FIGURE15/

1_VIKING20X.L46-KKG36013H_1m_clim_20000101_20091231_EKE_94m.nc

Climatological monthly mean (2000 - 2009) Eddy Kinetic Energy at 94 m depth, 30.0-66.0W, 45.0-70.0N.

1_VIKING20X.L46-KKG36013H_1m_clim_20000101_20091231_MLD.nc

Climatological monthly mean (2000 - 2009) Mixed Layer Depth, 30.0-66.0W, 45.0-70.0N.

FIGURES01/

1_VIKING20X.L46-KKG36013H_mean_20000101_20091231_EKE_94m_along_satellite_track72_CTOH_LabSea.nc Mean (2000 - 2009) simulated Eddy Kinetic Energy along satellite track 72 from X-TRACK (Topex/Poseidon, Jason-1/2/3; 1 Hz along-track sea level anomaly data developed,

FIGURES02/

1_VIKING20X.L46-KKG36013H_mean_2000101_20091231_EddyBuoyFlux_ub_average_191-1137m_43-65W_53-63N.nc

Mean (2000 – 2009) zonal eddy buoyancy flux u'b' averaged over 191-1137 m depth, 43.0-65.0W, 53.0-63.0N.

1_VIKING20X.L46-KKG36013H_mean_2000101_20091231_EddyBuoyFlux_vb_average_191-1137m_43-65W_53-63N.nc

Mean (2000 – 2009) meridional eddy buoyancy flux v'b' averaged over 191-1137 m depth, 43.0-65.0W, 53.0-63.0N.

1_VIKING20X.L46-KKG36013H_mean_2000101_20091231_sigma0_average_191-1137m_43-65W_53-63N.nc

Mean (2000 – 2009) potential density (referenced to the surface) averaged over 191-1137 m depth, 43.0-65.0W, 53.0-63.0N.

FIGURES03/

1_VIKING20X.L46-KKG36013H_1m_19580101_20091231_SPG_INDEX.nc Subpolar Gyre Index time series (1958 – 2009) from simulated Sea Surface Height in the subpolar North Atlantic, 40.0-65.0N.

FIGURES04/

1_VIKING20X.L46-KKG36013H_1y_19600101_20091231_BC_centralLS_average_112-322m.nc Yearly mean (1960 - 2009) transfer from mean to eddy available potential energy averaged over 112-322 m depth, 53.0-56.0W, 56.0-57.0N.

1_VIKING20X.L46-KKG36013H_1y_19600101_20091231_BC_centralLS_average_382-1655m.nc Yearly mean (1960 - 2009) transfer from mean to eddy available potential energy averaged over 382-1655 m depth, 53.0-56.0W, 56.0-57.0N.

1_VIKING20X.L46-KKG36013H_1y_19600101_20091231_BT_centralLS_average_112-322m.nc Yearly mean (1960 - 2009) transfer from mean to eddy kinetic energy averaged over 112-322 m depth, 53.0-56.0W, 56.0-57.0N.

1_VIKING20X.L46-KKG36013H_1y_19600101_20091231_BT_centralLS_average_382-1655m.nc Yearly mean (1960 - 2009) transfer from mean to eddy kinetic energy averaged over 382-1655 m depth, 53.0-56.0W, 56.0-57.0N.

1_VIKING20X.L46-KKG36013H_1y_19600101_20091231_EKE_centralLS_average_112-322m.nc Yearly mean (1960 - 2009) eddy kinetic energy averaged over 112-322 m depth, 53.0-56.0W, 56.0-57.0N.

1_VIKING20X.L46-KKG36013H_1y_19600101_20091231_EKE_centralLS_average_382-1655m.nc Yearly mean (1960 - 2009) eddy kinetic energy averaged over 382-1655 m depth, 53.0-56.0W, 56.0-57.0N.

1_VIKING20X.L46-KKG36013H_1y_19600101_20091231_HFLX_centralLS_average.nc

Yearly winter (January, February, March) mean (1960 - 2009) surface heat flux (positive upward), 53.0-56.0W, 56.0-57.0N.