Direct observation of 1000m deep convection in the Irminger Sea by ARGO-O2 floats during winter 2011-2012
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1. Summary
Using ARGO float data, we describe here an intense deep convection event, covering a large area in the Irminger Sea during winter 2011-2012.

2. Past observations of deep convection in the Irminger basin: limited in space and time

- Våge et al., 2008 (Nature Geosci.)
  MLD 1000m (April 2008)
- Bacon et al., 2003 (GRL)
  MLD 700m and 1000m (August-September 1997)
- Pickart et al., 2003 (DRSL)
  MLD 1800m (June 2006)
- de Jong et al., 2012 (DRSL)
  MLD > 800m at LOCO2 and LOCO3 (winters 2007-08 and 2008-09)

Past observations of deep convection were generally obtained after summer restratification.

3. Observation of the 2011-2012 convective event with ARGO data

- The convection event spreads over such great domain! We identify:
  - a pre-convective phase from 19 January to 9 March, 2012 (9.5 weeks) with different pre-convective areas
  - a short deep convection phase between 10 and 25 March, 2012 reaching 1000m depth
  - a rapid restratification in some days after 25 March, 2012

4. Active mixing

- ARGO oxygen data highlight an active mixing

5. Mixed layer deepening

- The gradual deepening of the mixed layer from November, 2011 to March, 2012 is marked by:
  - a short restratification period early February
  - a late rapid deep convective activity (10-16 March)

6. Link to atmospheric forcings

- Air-sea heat fluxes explain at the first order the heat content variation in the mixed layer and the gradual deepening of the MLD from November, 2011 to March, 2012.
- Reduced heat loss end of January/early February explains the observed short restratification phase during this period.
- The deepening of the MLD up to 1000m is caused by a late event of intense heat loss occurring between mid-February and mid-March, 2012 linked to high NAO-index characterized by strong winds and successive low-pressures over the Irminger Sea (not shown here).

Conclusion: this study presents the first direct observation of much widespread deep convection in the Irminger Sea than ever observed before, thanks to several ARGO floats cruises in the area.

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