Pre-1854 ship positions need careful scrutinizing before they can be used. Floating meridian practices are applied by almost every country, as the captains used to reset their longitude at every land sighting. Combined with an accumulation of systematic errors, this results into seemingly chaotic ship tracks over the globe. A procedure is developed to reconstruct the most likely paths from old reports.

1. Introduction
The method described here was developed during the CLIWOC project, which aimed at digitization of ship data over the world’s oceans 1750-1854. Among the 4,816 CLIWOC voyages, 646 different zero-meridians were identified. It became clear from the very beginning of the CLIWOC project that the digitizing effort had only sense if the zero-meridian problem was solved.

2. Procedure
2.1 Data extraction
Raw positions were extracted from the logbooks, together with all notes and remarks about land sightings, bearings and distances. Then, using GIS software - ESRI ArcMap 8.2 (ArcView) - the daily ship positions were plotted in a map. Change in zero-meridian showed up in the plotted tracks (see Fig. 1).

2.2 Identifying landmarks
At the places where a break in the track occurred, the ship likely changed their zero-meridian. If the break was not accompanied by a comment in the logbook, we searched along the latitude of this break, where the land sighting could have occurred.

2.3 Correcting the longitude
When a candidate zero-meridian was identified, the ship’s longitude was adjusted and the track was plotted again. Through a range of trials and errors the best track was reconstructed (see Fig. 2).

2.4 Accumulation of errors
After all the adjustments of the zero-meridians, some routes still appeared over land due to the accumulation of errors in their methods of dead reckoning (see Fig. 3).

3. Conclusion
The procedures, followed to establish the best possible positions of the “CLIWOC-ships”, has proven to be very helpful. The method revealed 646 zero-meridians, of which more than 300 were not marked as such in the ships’ logbooks. About 50% of all CLIWOC data needed zero-meridian corrections; 7% of the data needed a correction for accumulated errors. Without these corrections, the CLIWOC database would have stayed worthless for quantitative studies.

Figure 1. Raw positions of HMS Surprise (1750-1751) on her return voyage from England to the Gulf of Guinea without correcting the longitude to the current standard, i.e. Greenwich. During the voyage back no transition in zero-meridian occurred by absence of land sightings.

Figure 2. Corrected positions of HMS Surprise after converting the longitudes to the Greenwich meridian. Every colour refers to the use of another zero-meridian: Start Point, Ushant, Cape Roxent, Madeira, Point Negro, Isle of May Bay, Cape St. Maryes, Bananas and (at the start of the trip back) St. Thomas.

Figure 3. The track of HMS Blandford in 1750 en route from Senegal to Lisbon. The red triangles represent the original logbook positions, with the voyage ending deep into Spain. After incremental errors were corrected, the blue triangles give the most likely ship track.

To correct for this kind of error, we applied incremental adjustments to the ship’s longitudes to derive the most likely track.