

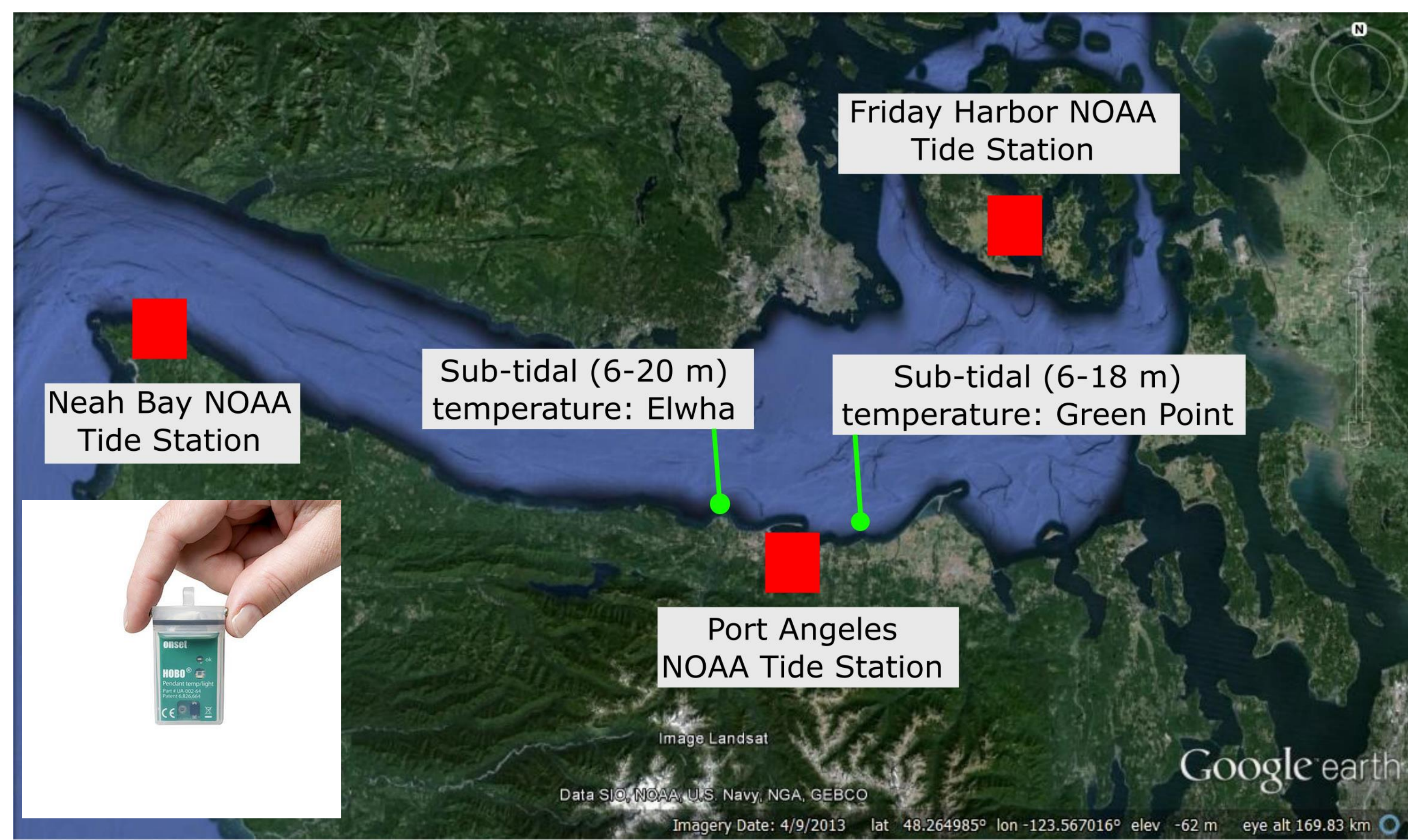
Characteristics of nearshore bottom water temperature anomalies in the Strait of Juan de Fuca in 2013 and 2014

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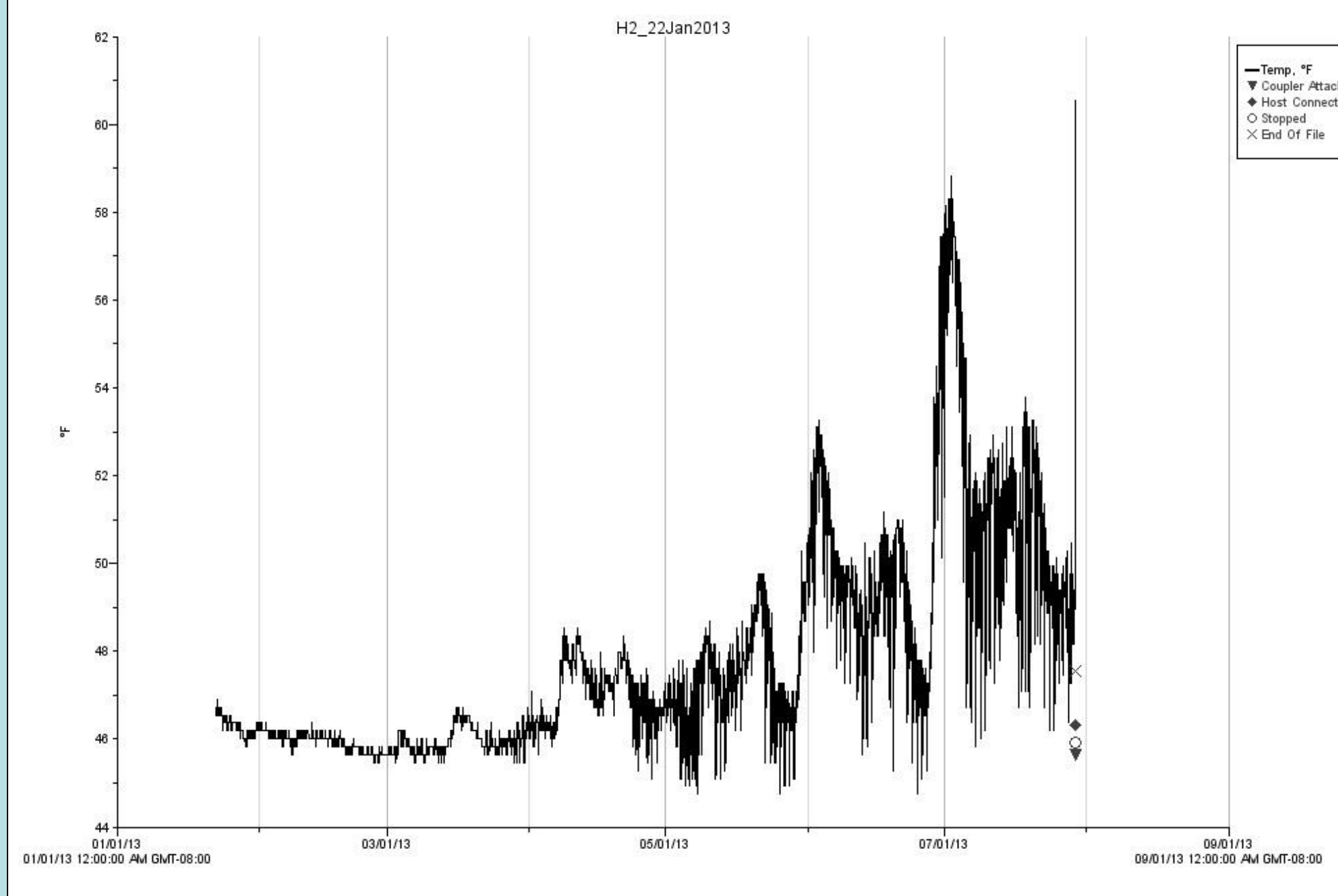
Introduction

Onset HOBO temperature and light loggers (inset photo in map below) have been deployed at an array of sites near the Elwha River delta and Green Point (green dots on map below) on the Strait of Juan de Fuca since summer 2011 to support investigations associated with the Elwha Dam removals. The sites are at depths between 6 and 20 m. HOBOS recovered after summer 2013 suggested an anomalous “spike” in temperature in July (event “A”), which was followed by another similar event in October 2013 (“B”), and again in October/November 2014 (“C”).



Event Characteristics

Raw returns (sampling interval = 20 min) from a HOBO recovered from a site ~1500 m east of the Elwha River, at a depth of ~ 12 m (see plot below) are similar to what was observed across the system. The event “A” in July 2013 had a duration of ~ 1 week, and temperatures reached approximately 15°C, a reading that would be considered warm even for surface waters in the Strait of Juan de Fuca. This “spike” motivated a variety of questions.

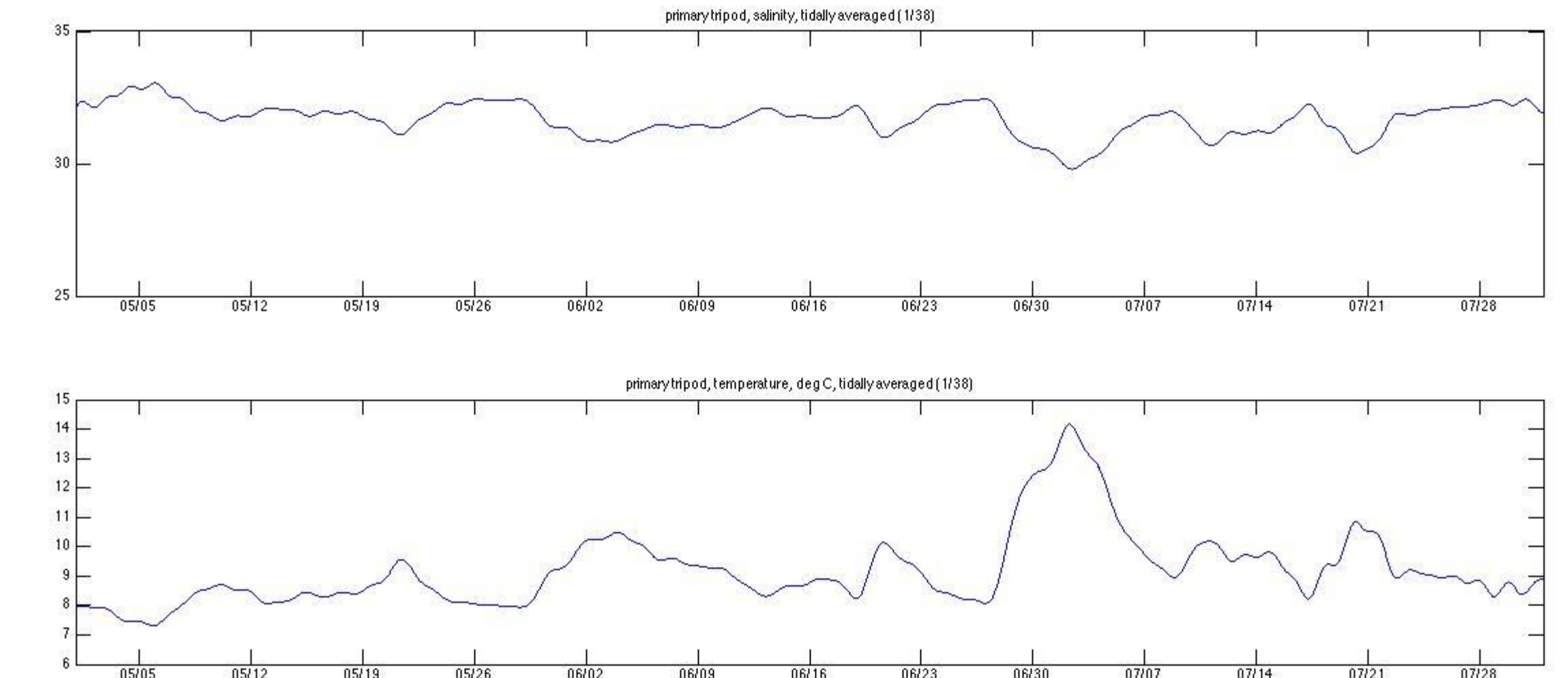


Questions

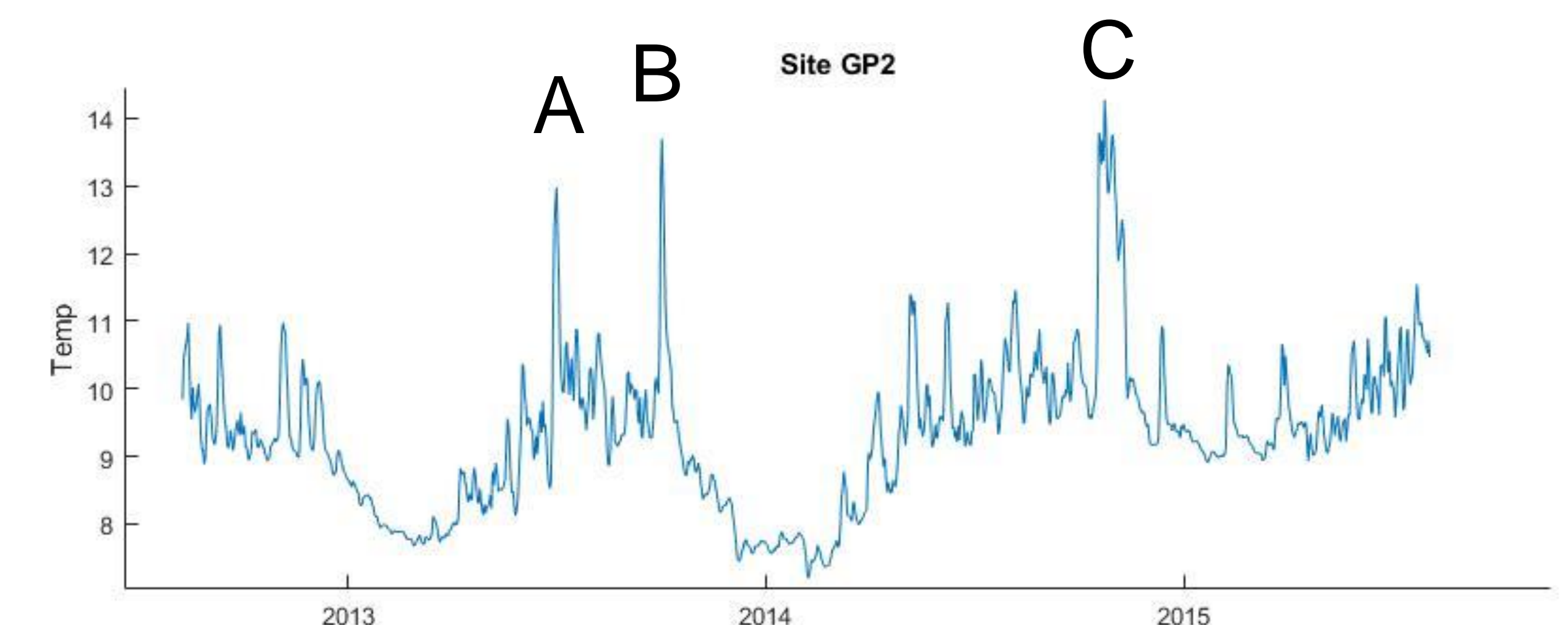
- 1) Was this a local process, perhaps associated with river outflow?
- 1) How anomalous were these events?
- 2) Where was the warm water from?

Question #1

Was this a local process, perhaps associated with river outflow?

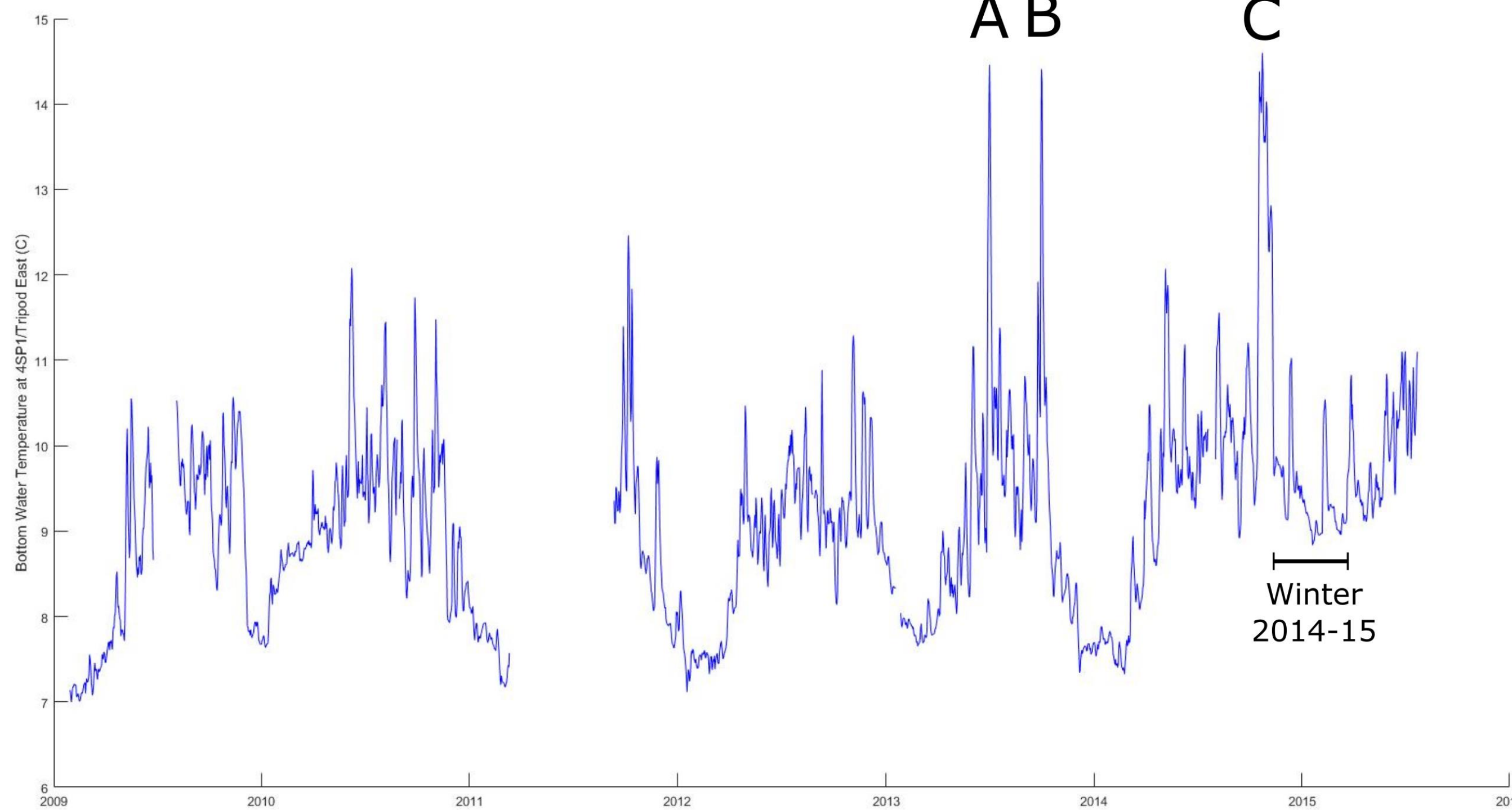


Tidally-averaged temperature and salinity from a CTD at 15m depth and ~1000 m north of the Elwha River mouth suggest that event “A” was associated with lower salinity (see above), but all three events were recorded by a HOBO near Green Point (see below) at ~18m depth and distant from a freshwater source.



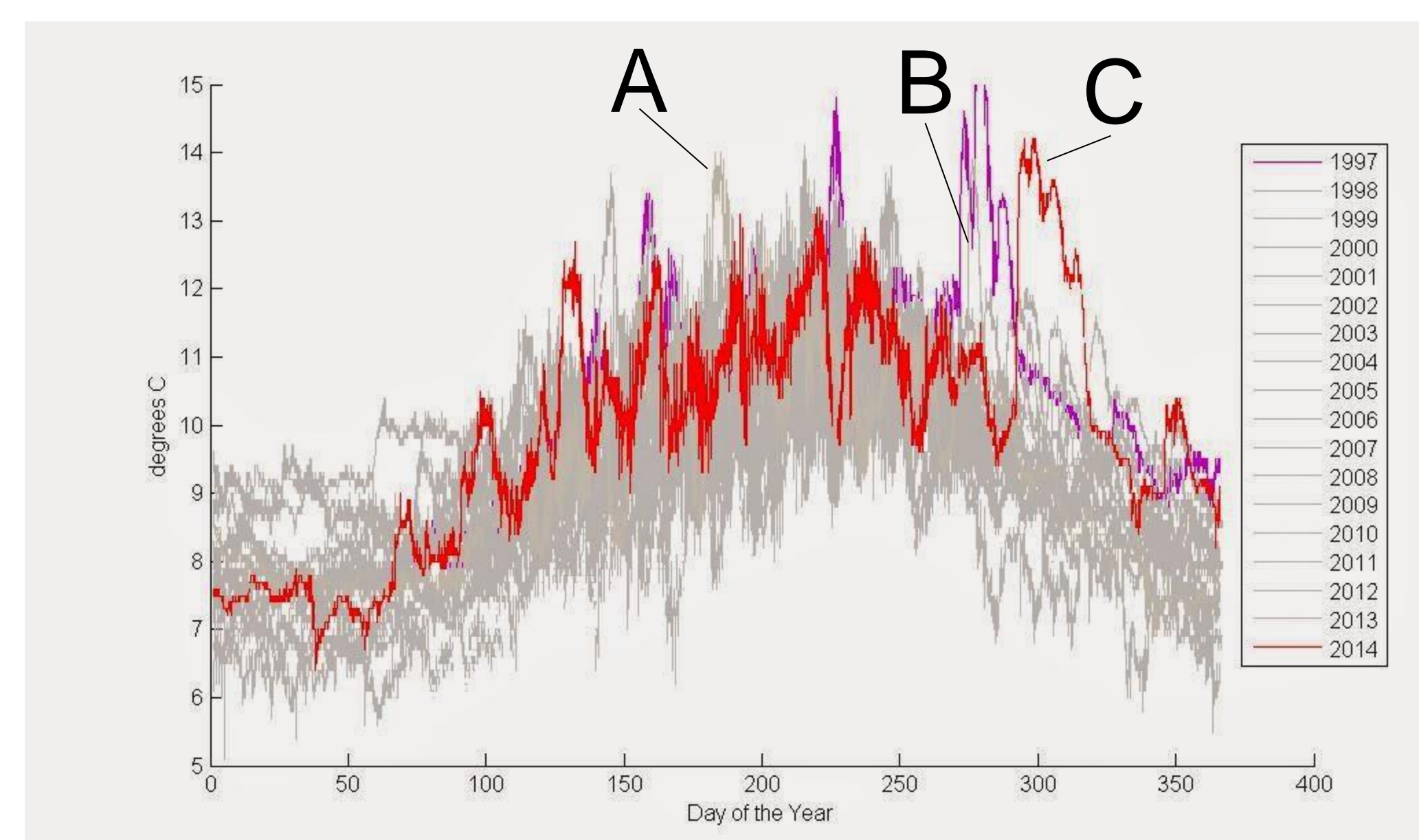
Question #2

How anomalous were these events?



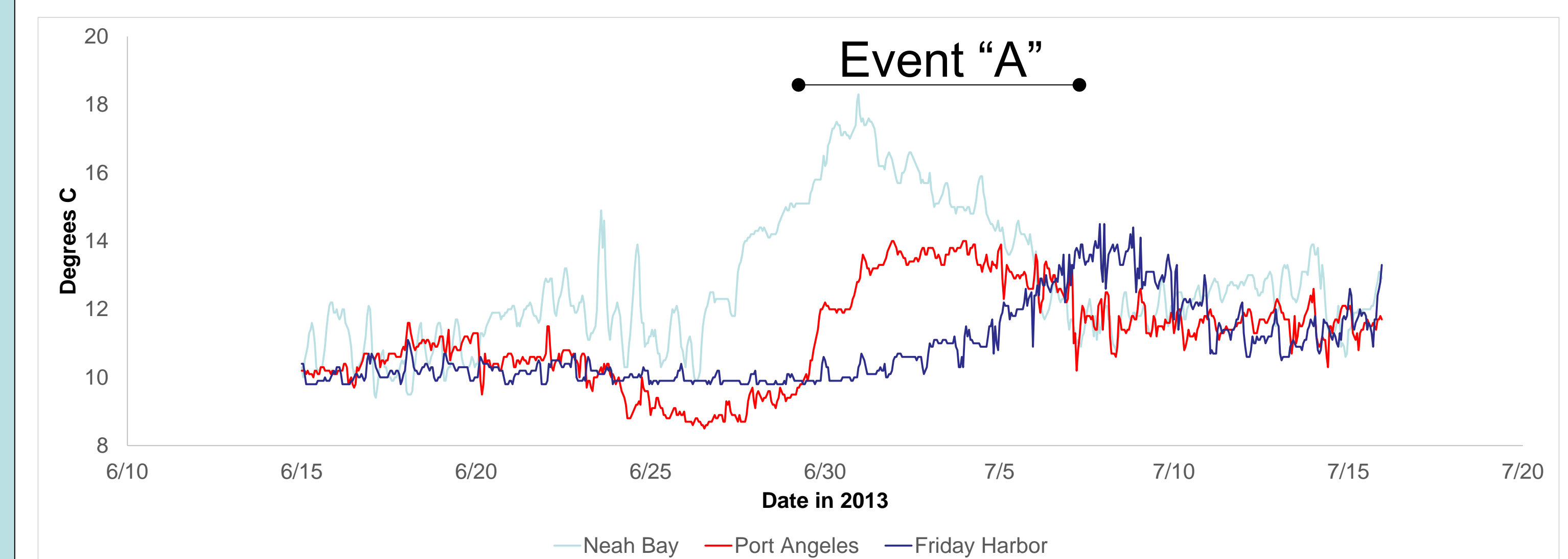
Coupling HOBO data collected between 2011-2015 from a site at Elwha at ~6m depth with temperature data collected using a Seabird SB26+ pressure sensor deployed at the same location from early 2009-2011, a longer time-series is developed (above). These three events were associated with temperatures ~2C higher than anything in the record

Events “A” and “B” are also evident in surface water temperature data collected since 1997 at the Port Angeles tide station (see map at upper left, and data below). The two events equaled the highest temperatures observed excluding the El Niño year in 1997. The two fall events (“B” and “C”) exceeded the previously measured range of variability for that season by >2C when the 1997 El Niño year is excluded



Question #3

Where was the warm water from?



The timing of elevated surface water temperature at two NOAA tide stations (Neah Bay and Friday Harbor; see map at upper left) relative to event “A” suggests that the warm water propagated into the Strait from offshore.