The recent morphological evolution of Pagham Harbour entrance and the cause of the breach to Church Norton spit in Winter 2016

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Outline

1. Aims and objectives
2. Site introduction
3. Importance of study
4. Methodology
5. Results
6. Key findings
7. What happened next?

1. Aims and Objectives

AIM: To determine how Pagham Harbour entrance and the Church Norton spit evolved around the time of the breach in 2016 and to identify the cause(s) of this breach.

OBJECTIVES:

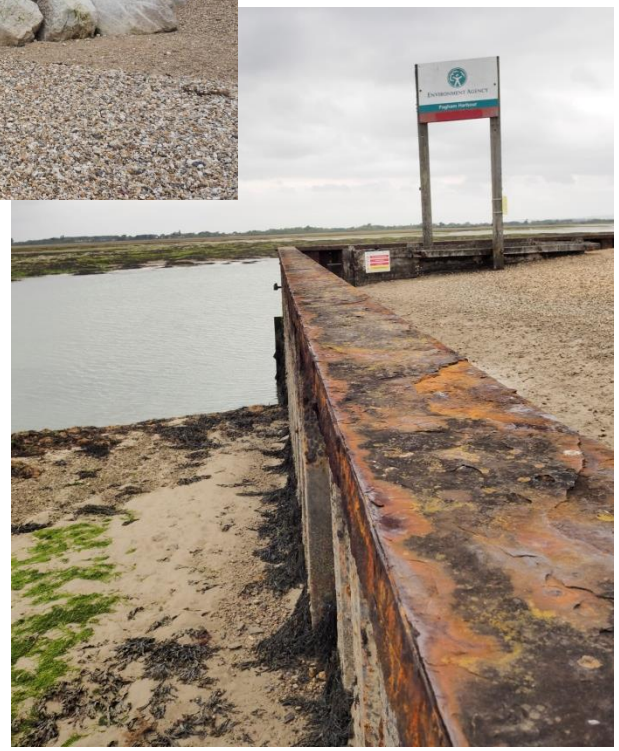
- To assess the rate of volume change of sediment across Pagham Harbour entrance, before and after the breach.
- To examine the nearshore water level and wave climate in CoastalTools, both before and after the breach, to identify storm activity.
- To assess the volume changes observed in baseline profiles, before and after the breach in CoastalTools.

2. Pagham Harbour - Site introduction

- Ebb dominant tidal inlet
- Double spit system
- Located to the east of Selsey Bill
- Nationally and internationally designated site for habitats and species:
  - Ramsar
  - Special Protection Area (SPA)
  - Site of Specific Scientific Interest (SSSI)

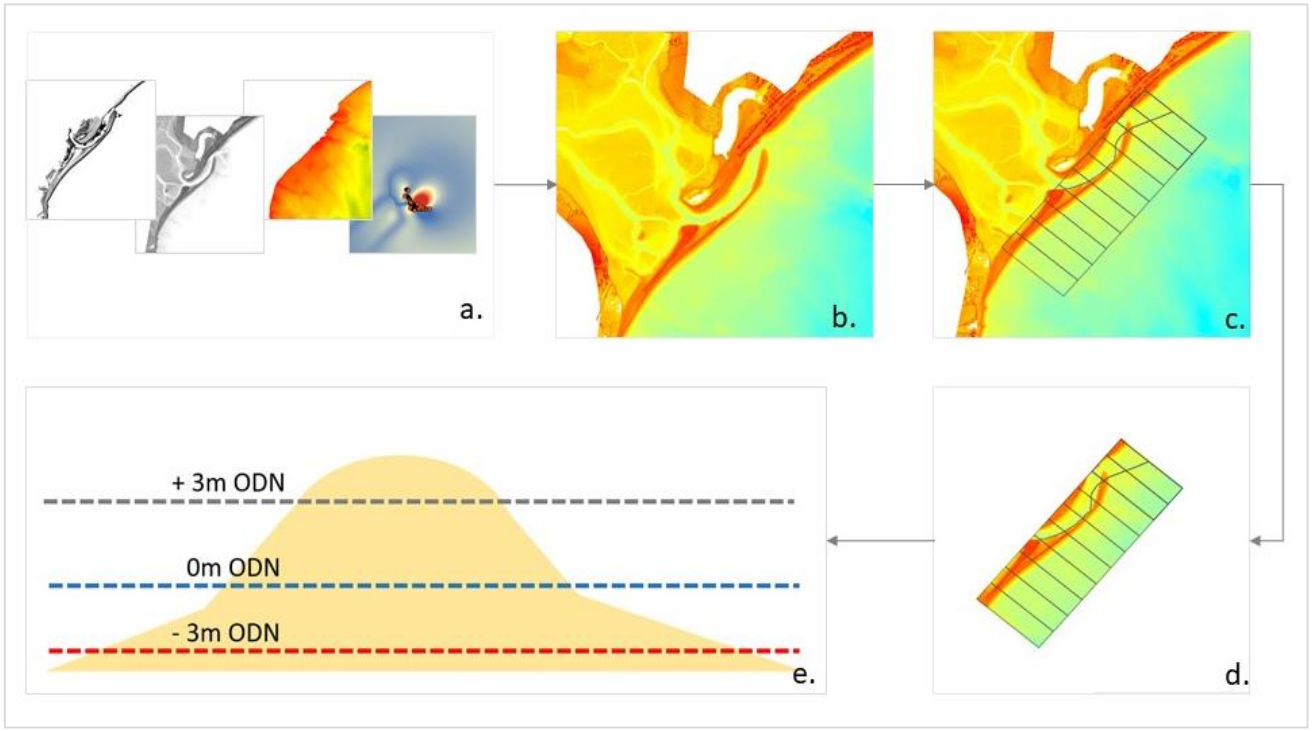
3. Importance of study

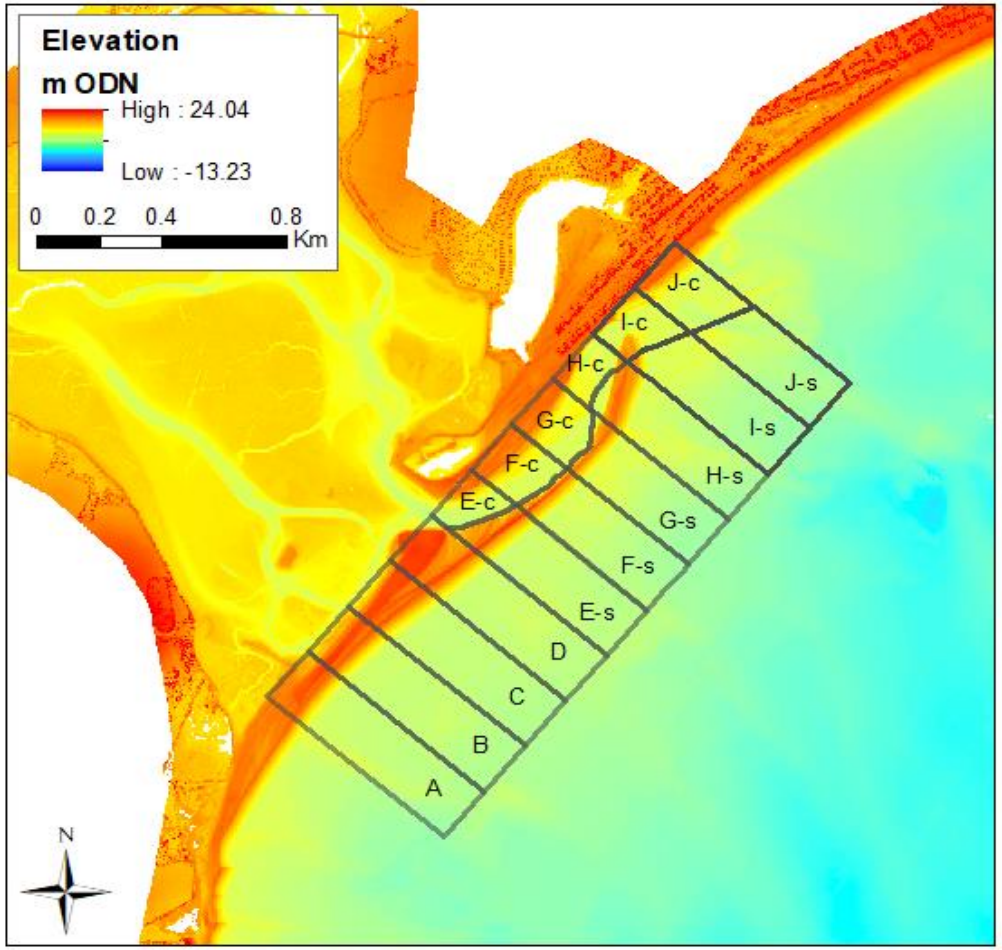
- Extensive morphological changes over the past 10 years.
- Limited success with management inventions (Training wall)
- Implications on the shingle supply to Pagham frontage.
- Erosion threat to properties situated along Pagham beach.



4. Methodology

1. GIS analysis:
   - 27/01/2015 to 03/03/2017





4. Methodology

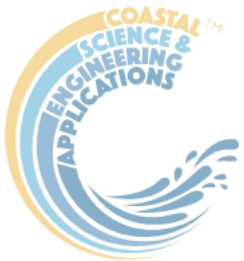
2. Wave climate analysis
   - Rustington and Bracklesham Bay wave buoys.
   - Period from 01/01/2012 to 31/05/2017.
   - Significant wave height, wave period, wave direction and inshore wave energy flux.

3. Baseline profile analysis

4. Longshore drift model

5. Overtopping and overwash model

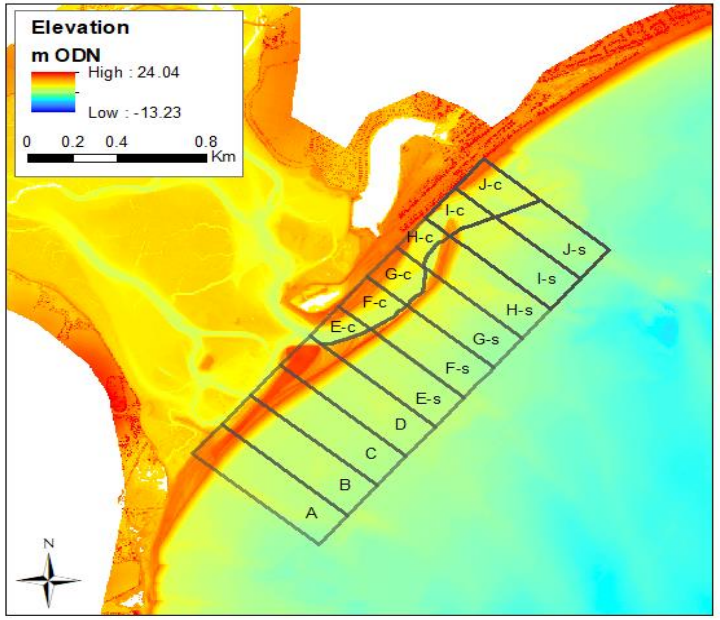
CoastalTools

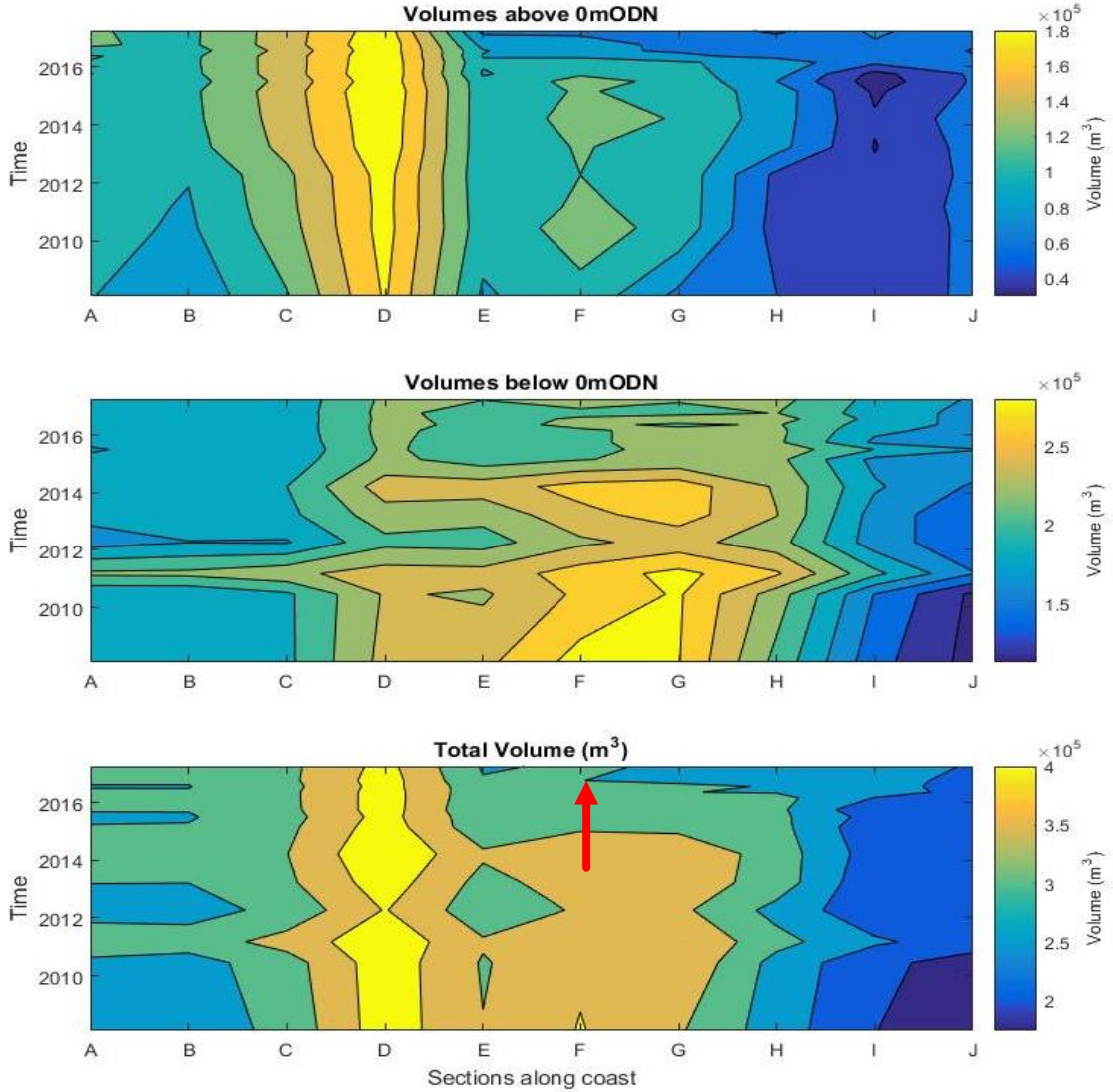


5. Results – Volumetric analysis

- **Decrease** in the total sediment volume in **cells E**, **F** and **G** above -3 m OD since 2014.

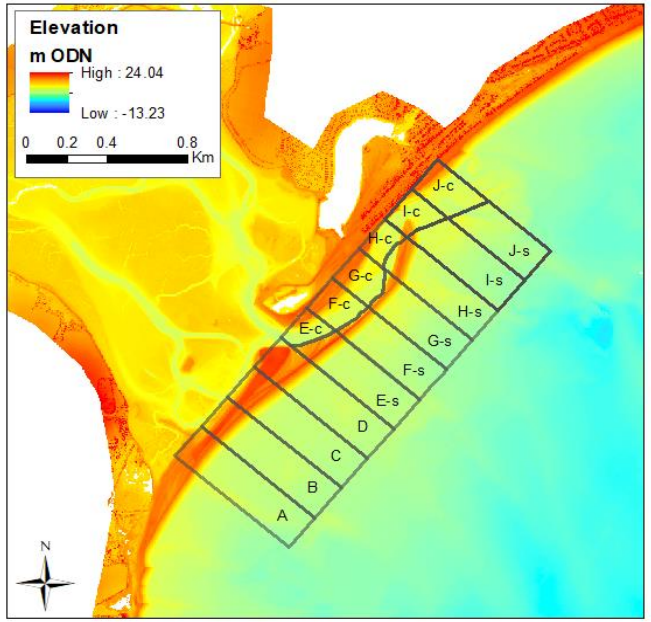
- No significant volume changes observed across cells A to D since 2014.

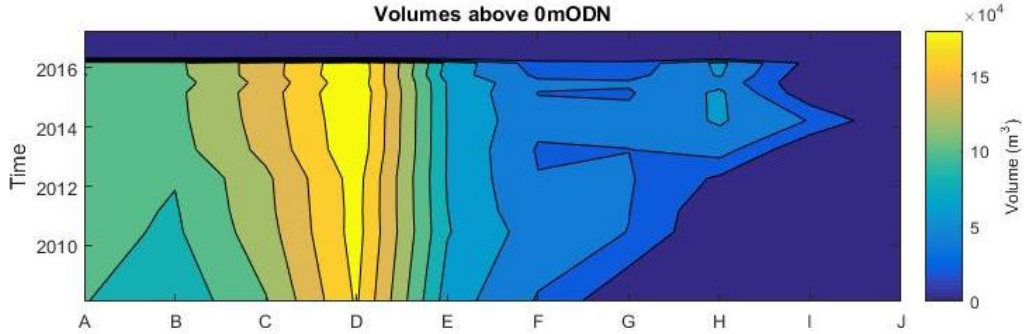


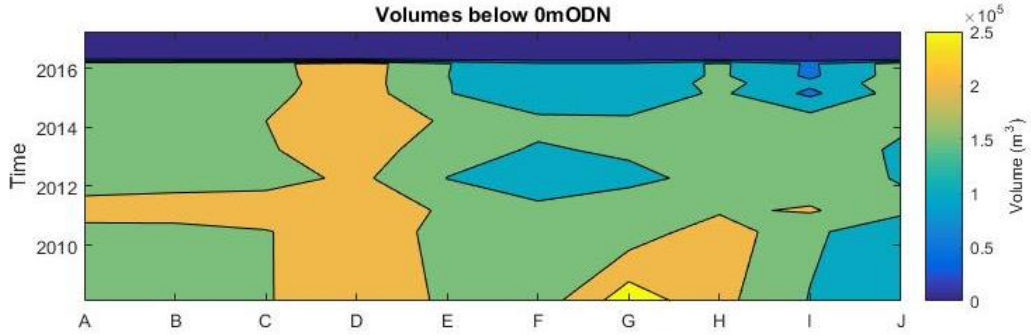


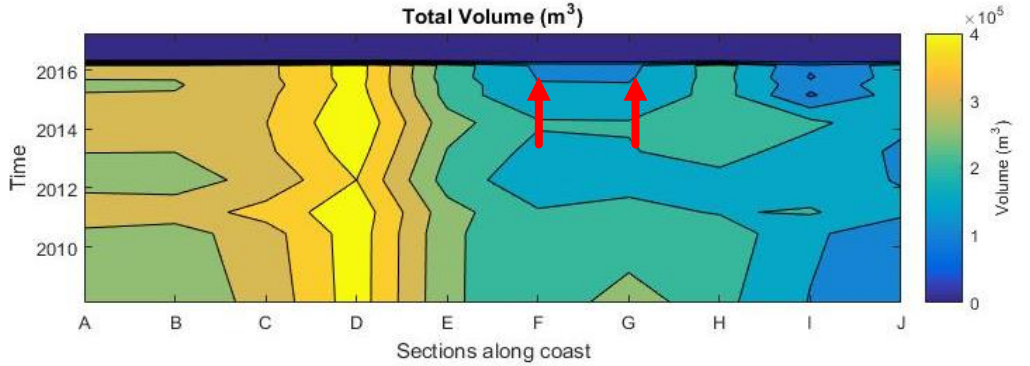
5. Results – Volumetric analysis

- **Reduction** in spit **sub-cells F** and **G** prior to the breach event.



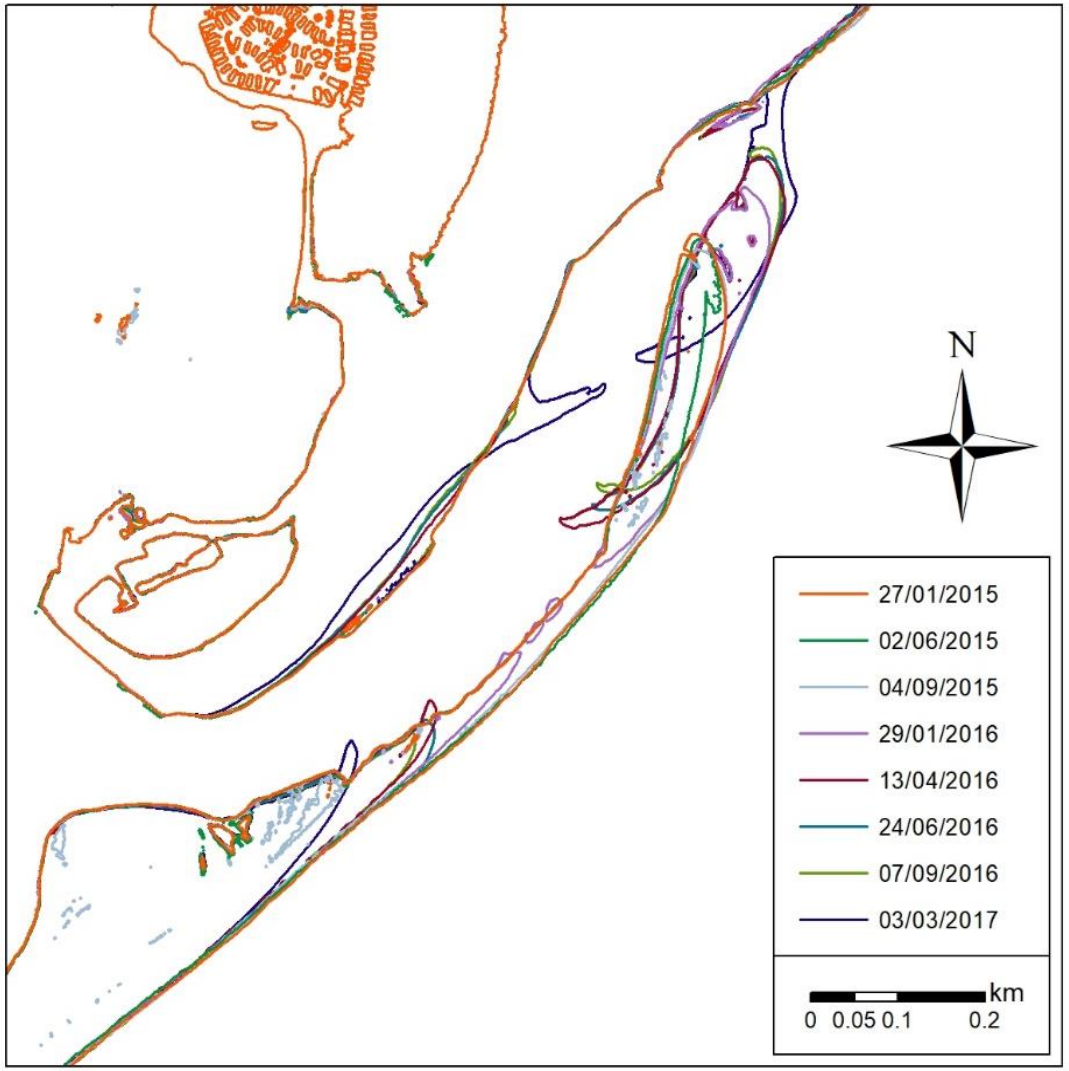




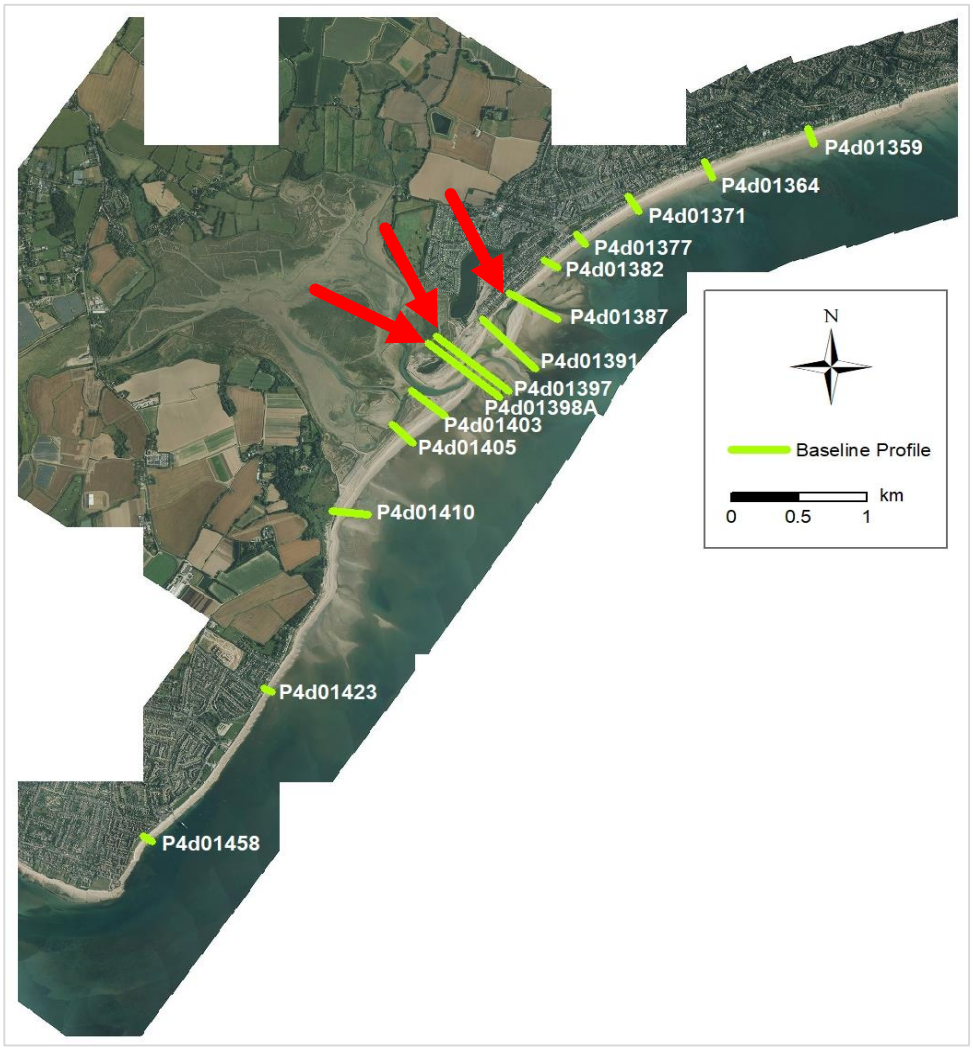


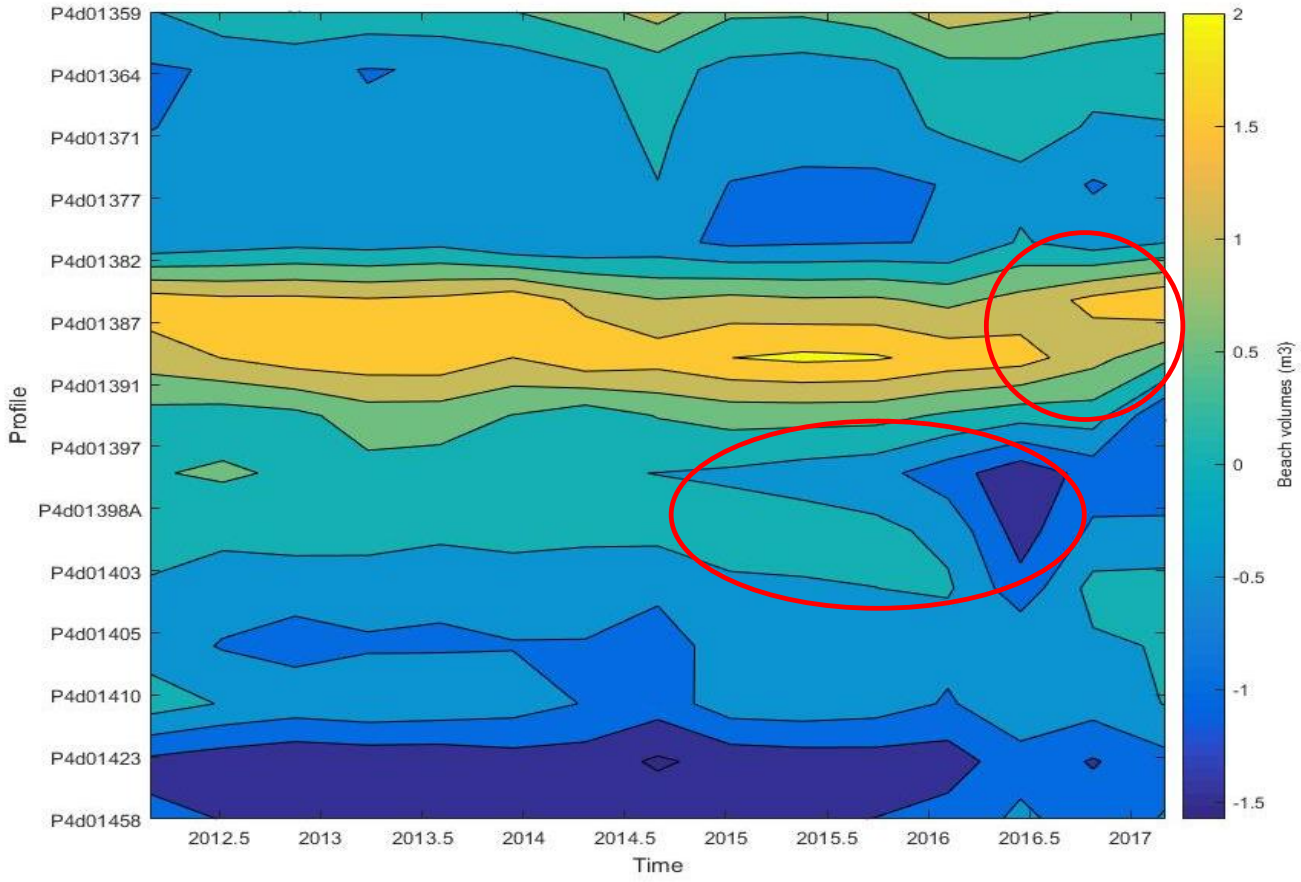
5. Results – Contour migration

- Narrow 3m contour present leading up to breach event.
- By **29/01/2016**, 3m contour became discontinuous.
- By **03/03/2017** the 3m contour of detached spit had fused to downdrift shoreline.



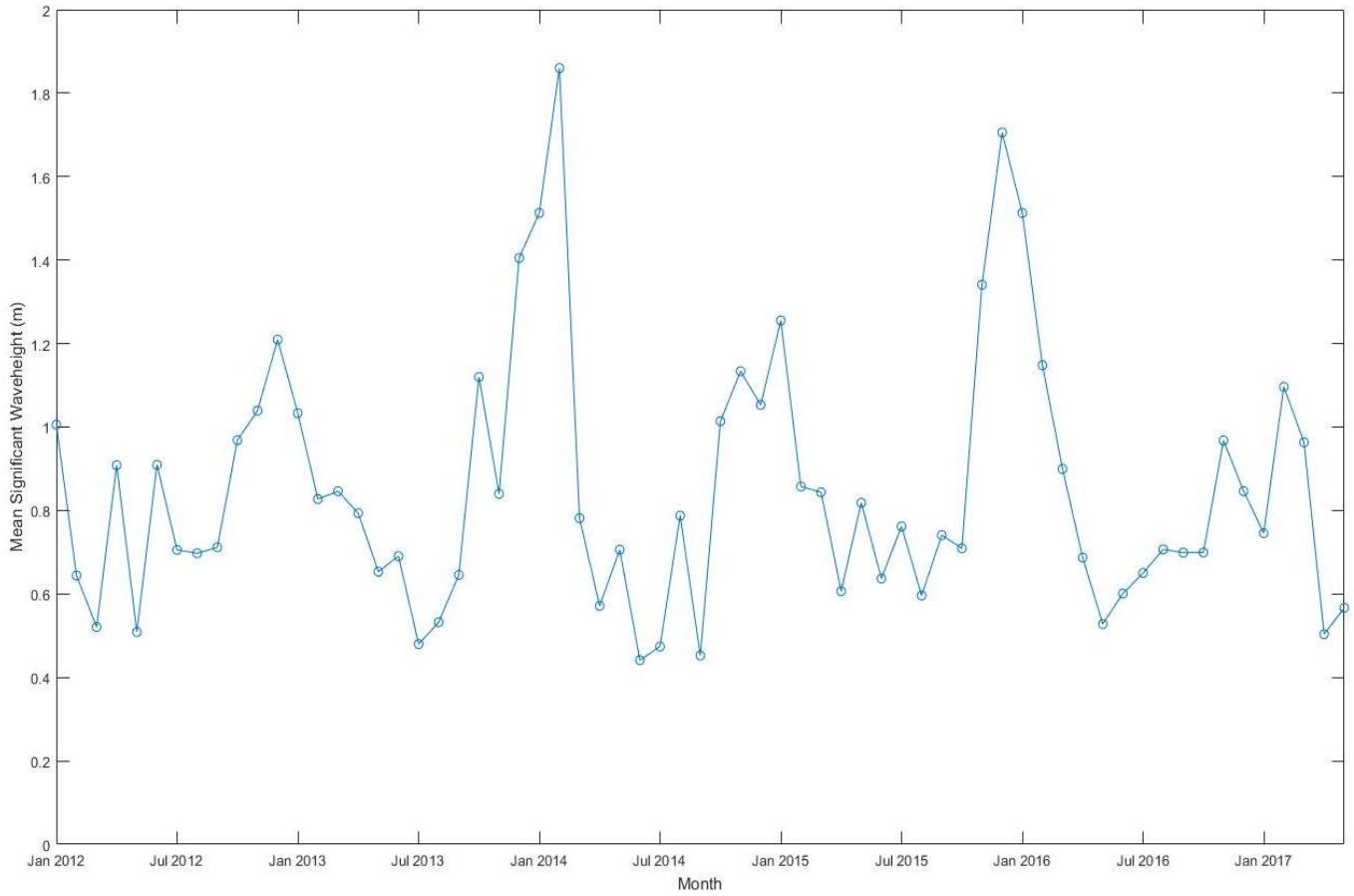
5. Results – Baseline profiles





- Reduction in profiles **P4d01397** and **P4d01398A** since 2014.
- Increase in profile **P4d01387** immediately downdrift post-breach.

5. Results – Wave climate



Mean significant wave height:

- Winter 2013/2014: **1.61 m**
- Winter 2015/2016: **1.46 m**

Mean inshore energy flux:

- Winter 2013/2014: **5.85 x 10 ^{3} J/ms**
- Winter 2015/2016: **4.31 x 10 ^{3} J/ms**

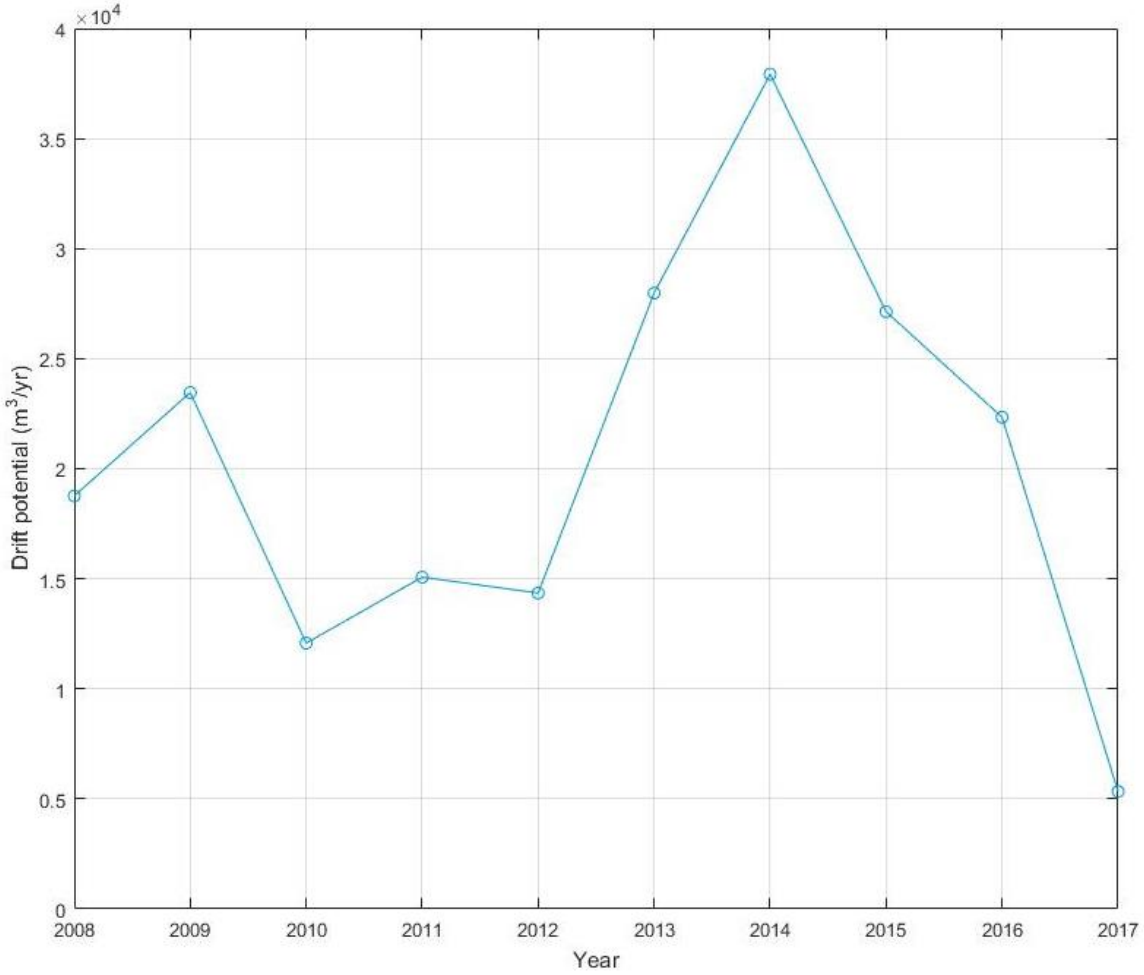
Mean wave direction was similar for winter 2013/2014 and 2015/2016.

5. Results – Littoral drift potential

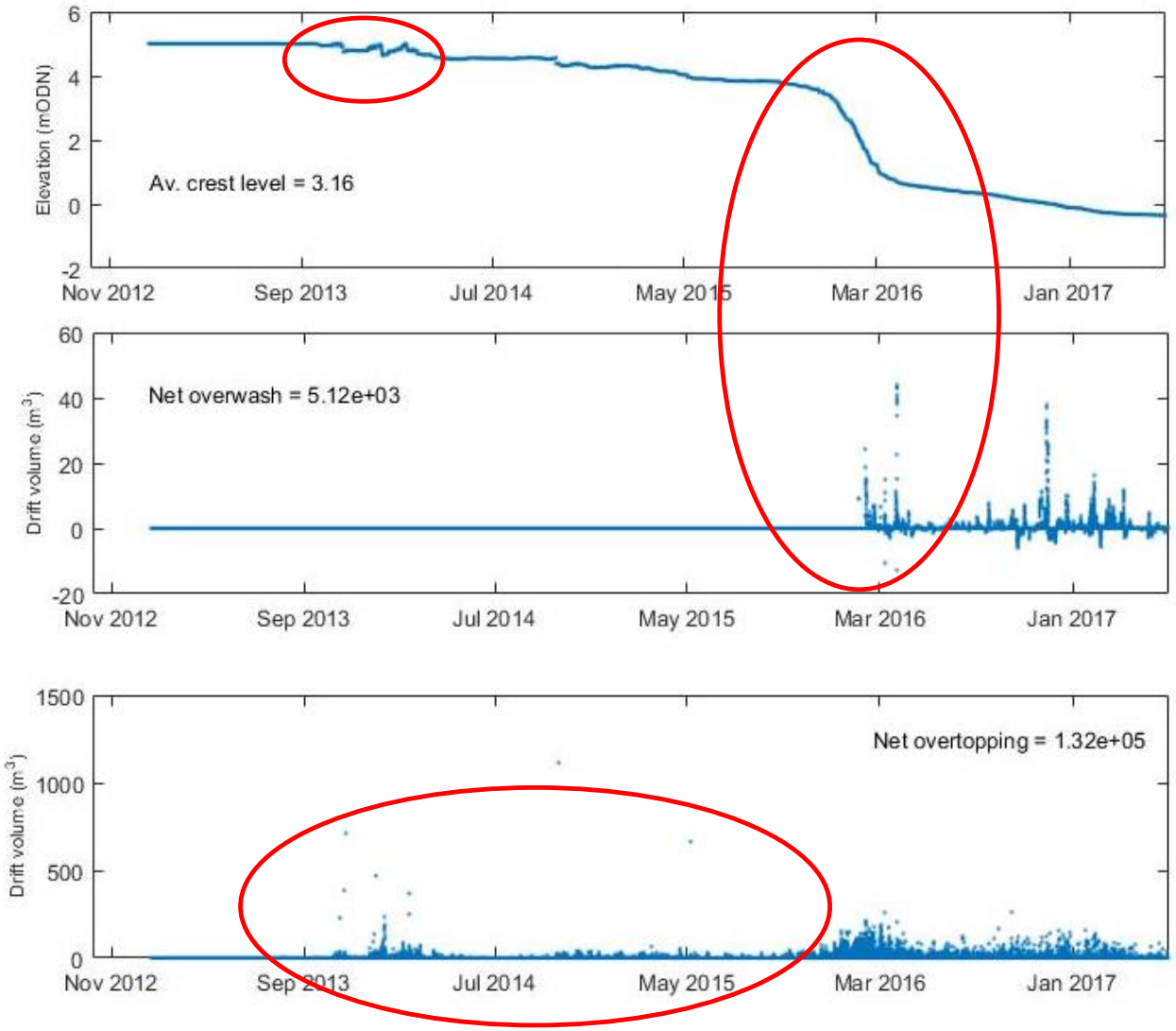
- Largest total annual drift volume was shown in 2014 measuring **3.79x10^4 m^3/yr**.
- Reduction in drift potential since 2014.

Year	Total Annual Drift Volume (m^3/yr)
2008[x]	1.88 x 10^4
2009[x]	2.35 x 10^4
2010[x]	1.21 x 10^4
2011[x]	1.51 x 10^4
2012	1.44 x 10^4
2013[x]	2.80 x 10^4
2014	3.79 x 10^4
2015	2.71 x 10^4
2016	2.23 x 10^4
2017*	5.34 x 10^3

* January to May only; x value obtained from Townend (2015)



5. Results – Overtopping and overwash model



- **Progressive barrier breakdown** and **barrier pre-conditioning** ahead of Winter 2015/2016.
- Overtopping events indicated throughout 2014 and 2015.
- Positive feedback system.
- Overwashing events occurred once the critical crest level threshold reached.

6. Key findings

- A decrease in volume over a central section of the spit since 2014.
- The detached Church Norton spit migrated downdrift and supplied the immediate Pagham area with shingle.
- No evidence of southern spit reforming yet.
- Winter storm events of 2013/2014 appeared to act as a trigger to the breach in 2016.
- Overtopping events throughout 2014 and 2015 left spit in vulnerable morphological position ahead of winter 2015/2016.
- Crest unable to recover due to low littoral drift rates indicated after 2014.

7. What happened next..

ABPmer (2017)


Thank you
Any questions?