Using 3D models to inform Coastal Change and its Impact

Jim Hansom¹, James Fitton¹ & Alistair Rennie²

(¹ University of Glasgow, ² SG / SNH)

jim.hansom@glasgow.ac.uk
Drivers of coastal erosion and flooding in Scotland?

- Sea level rise
- Enhanced storm impact
- Reduced sediment supply
- Increased “management”
National Coastal Change Assessment (NCCA) outputs: a national coastal erosion/accretion GIS for each 50m of coast

www.dynamiccoast.com
NCCA is a useful planimetric tool, using time series Maps Charts Aerial Photos LiDAR Terrestrial Laser Scanning (TLS)…

…to track MHWS and MLWS…..

BUT…..
with Hi Res 3D surfaces as time series (ie 4D) from Aerial Photos, LiDAR, DGPS, Terrestrial Laser Scans (TLS)...

we can ID changes in landforms and volume of natural coastal defences to assess resilience and vulnerability to in-combination flood and erosion events.
Time series DGPS DTMs, North Uist

Appendix C - Height Changes at Baleshare 2005-2009

Appendix D - Volume Changes at Baleshare 2005-2009

Volume changes at Baleshare 2010-2014
Baleshare 2010-14: Longshore cell volumetric change partitioned by process zone for each longitudinal zone
St Cyrus height change 1973-1996
DTM 2-DTM 1 draped over DTM 2 topography
red=loss, green=gain

St Cyrus height change 1973-1996
DTM2-DTM1 draped over DTM2 topography
red= volume loss, green= volume gain
Impact of recent enhanced frequency of wave events (2010, '11, '12, '13 & '14)


Golspie Links Renourishment Engineering Scheme in prep with planning permission.
Growing interest (SG, SEPA, SNH) in erosion exacerbated flooding eg Golspie, Sutherland (2010, ‘11, ‘12, ‘13 & ‘14)
Golspie 2013 Feb surface showing eroded sediments (red) and gains (green)
Golspie 2014 Oct surface showing eroded sediments (red) and gains (green)

http://www.dynamiccoast.com/golspie_model/test2.html
2013 Feb (pre storm) .......................... 2014 Oct (post storm)
(Indicative still flood level of 3.0mOD for illustrative purpose only)
2013 Feb (pre storm) ....................... 2014 Oct (post storm)
(Indicative still flood level of 3.0mOD for illustrative purpose only)
False assumption 1: Magnitude of future coastal change can be accommodated within the present littoral.

False assumption 2: Strategies that fix the shoreline (rather than allow shifts) are sustainable.

- Beaches and dunes are equally important in coastal defence as artificial seawalls.
- Planimetric erosion rates are key to planning for change.
- Quantifying volumetric change identifies sediment sources and destinations for accurate sediment budgets.
- 3D is essential for quantifying flood and erosion resilience of natural coastal defences.
- 2D/3D/4D data better informs us to buy time/opportunity to ID accommodation space for sustainable adaptation.