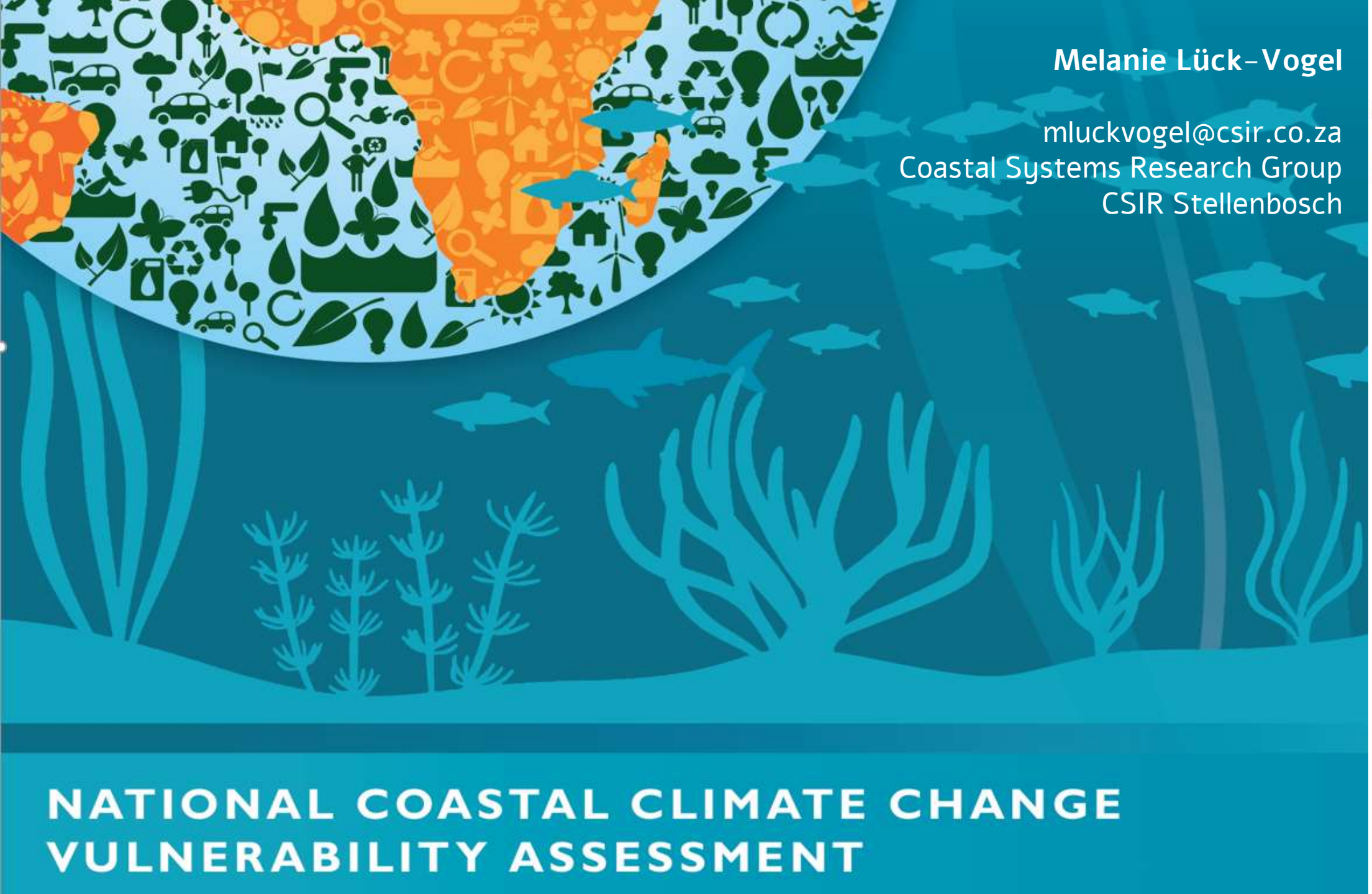

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NATIONAL COASTAL CLIMATE CHANGE VULNERABILITY ASSESSMENT

environment, fores
& fisheries
Department:
Environment, Forestry and Fisheries
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für Internationale
Zusammenarbeit (GIZ) G

On behalf of:

Federal Ministry
for the Environment, Nature Conserv
Building and Nuclear Safety

of the Federal Republic of Germany

Strategic background

- ICM Act established the legal baseline for integrated coastal and estuarine management in South Africa.
- White Paper for Sustainable Coastal Development makes provisions “to plan and manage coastal development to avoid increasing incidence and severity of natural hazards and to avoid exposure of people, property and economic activities to significant risk from dynamic coastal processes”.
- DEFF is developing the coastal climate change adaptation strategy, guided by Objective 2 of the National Climate Change Adaptation Strategy: Promote the integration of climate change adaptation response into development objectives, policy, planning and implementation.
- The Threat: Climate change → expected increase in storm frequency & severity PLUS projected sea level rise PLUS population → exacerbated expected damage to infrastructure & coastal population through coastal flooding and erosion.
- However, National Coastal Management Programme from 2015 points out significant knowledge gaps related to these factors.

Previous work at national level

Coastal Vulnerability Index Assessment (DEFF, 2011-2014)

- 500m resolution, based on Delft hydrodynamic modelling and literature. Conducted for all coastal areas inhabiting ports, harbours and major urban developments, i.e. for about 70% of the South African coast line. Output: wave run-up for five defined storm scenarios and two future sea level rise scenarios assigned to the the coast line.
  - Disadvantages:
    - the inland inundation area in the case of these storm events was not assessed;
    - 30% of coast were not assessed
    - Relatively coarse resolution of outputs

Previous work at national level

National Coastal Assessment (DEFF, 2017-2020)

- Interdisciplinary status-quo assessment of the SA coastal space as relevant to ICMA, i.t.o. physical, chemical, biological and socio-economic aspects.
- Coastal flood and erosion were assessed using simplistic GIS methods, expert input and previous experience
- Whole SA coastline was assessed
  - Disadvantages:
    - No hydrodynamics considered
    - Status quo, i.e. not looking forward i.t.o. climate change and population dynamics
    - Flooding was modelled using only sandy-shore conditions (sub-optimal for rocky shores
    - Estuaries were not assessed (scale issues)

Previous work at Provincial and local level

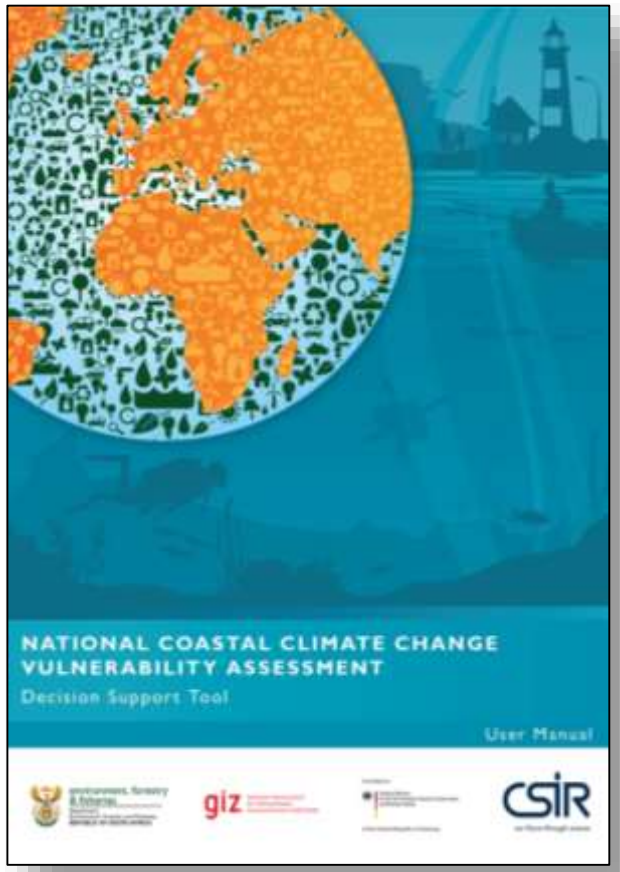
- Higher resolution at local level
- Potentially different methods between areas
- Covering only parts of the coast

Aims of this project

1. To **develop a geospatial index** for the vulnerability of SA's coasts in terms of climate change impacts. These are impacts primarily associated with flooding (through storm surge, wave runup and sea level rise) and shoreline erosion;
2. To **develop an interactive decision support tool (DeST)** that allows the users, primarily government officials in all spheres of government, to view and assess the various aspects of coastal risk and use of the spatially explicit information for spatial planning and climate change adaptation, and
3. **To integrate that DeST with existing tools or platforms**
4. **To capacitate government officials to use these tools.**

→ **Respond to the urgent need for a National Coastal Spatial Vulnerability Index** to inform coastal spatial management in response to the national climate change adaptation strategy**.**

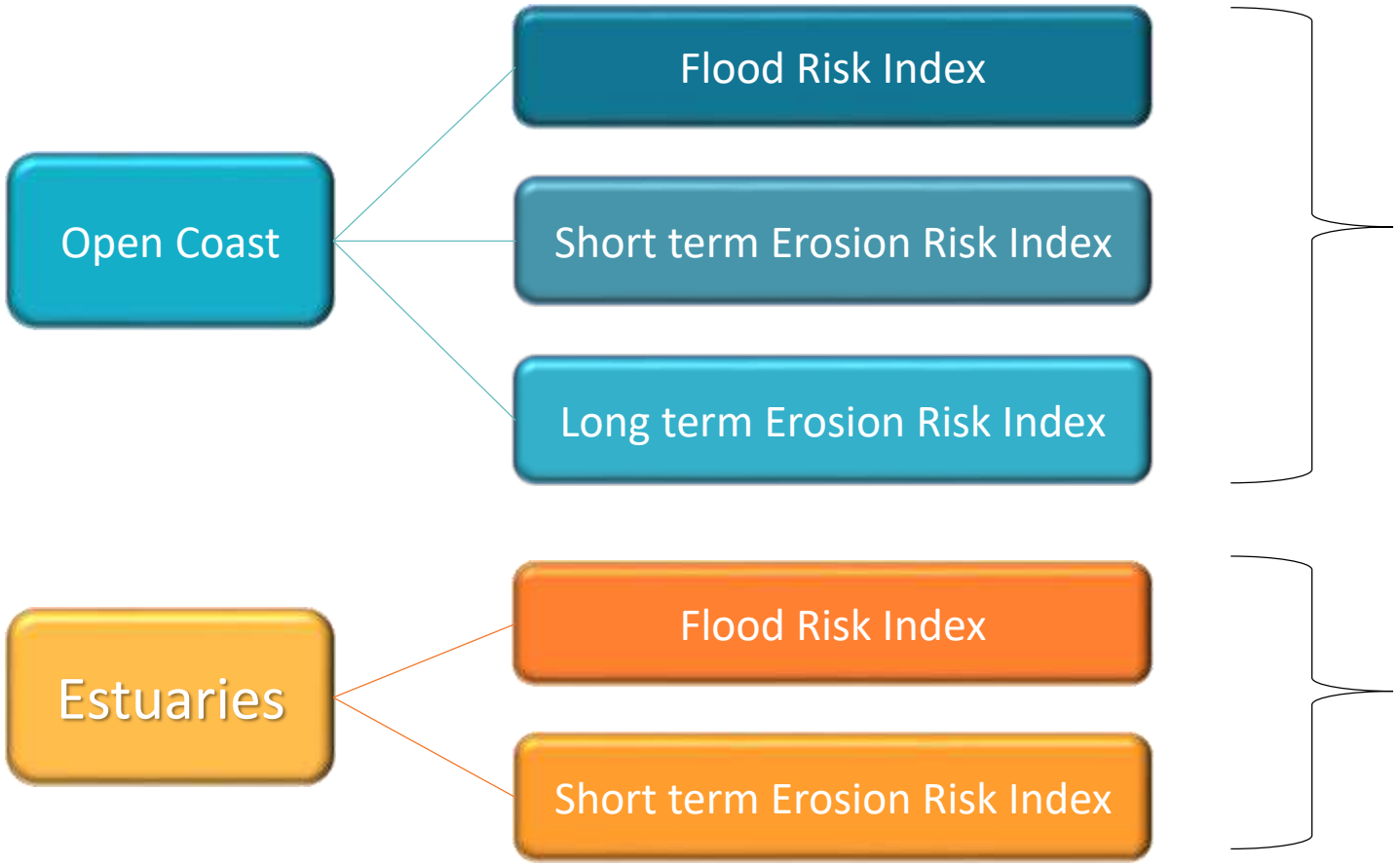
Interactive decision support tool (DeST)



PDF version

5 minutes video instruction

Technical background on indices



Development adopted methods and input data from previous work

Development is a first-ever and more “conceptual”

Key input parameters

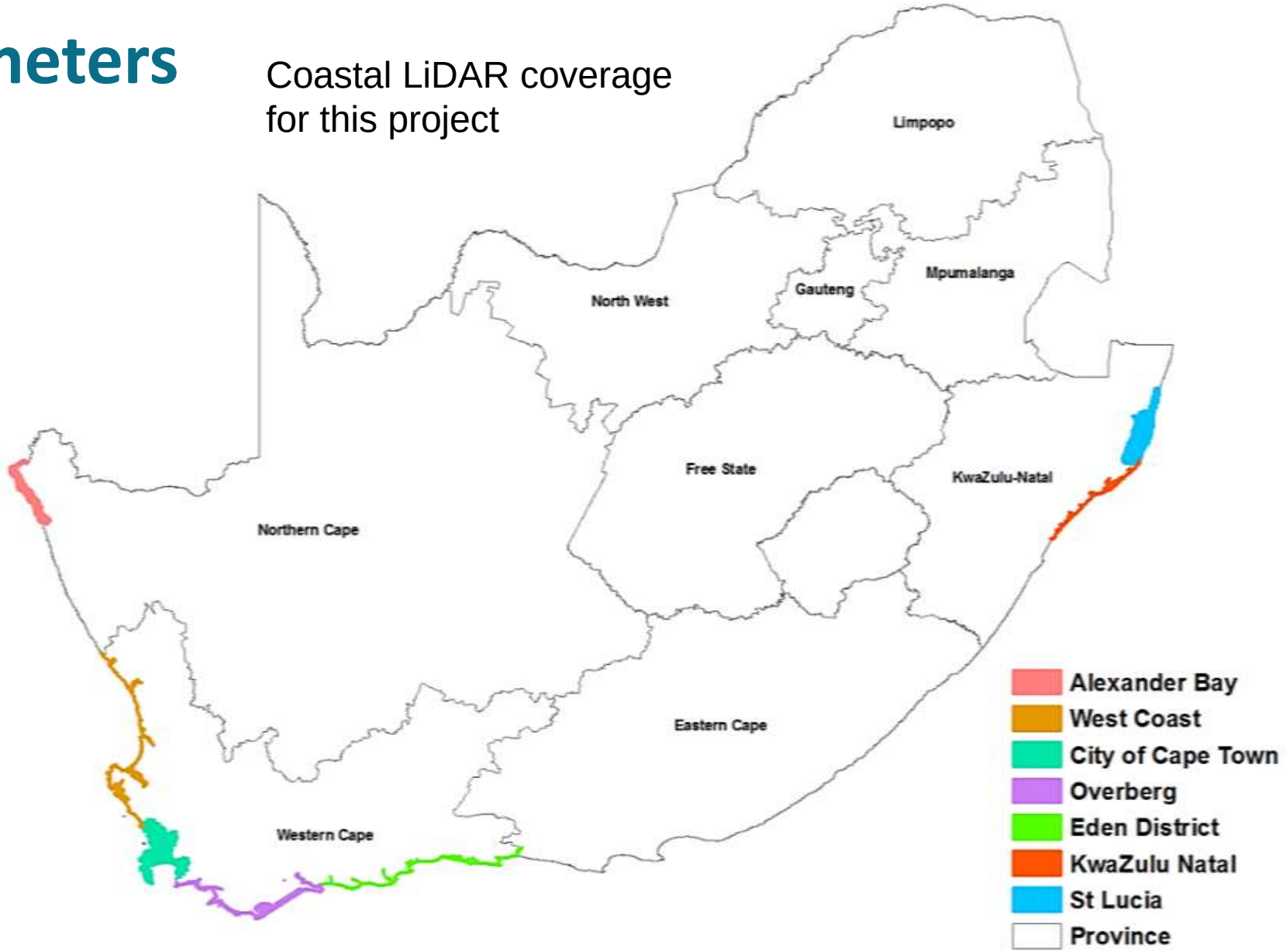
- **Reference coast line**
  National_Coast_Types.shp from NBA 2011

Key input parameters

- Reference coast line

- **Topographic elevation:**
  LiDAR & SUDEM fusion
  5x5 m pixel size

Coastal LiDAR coverage
for this project



Key input parameters

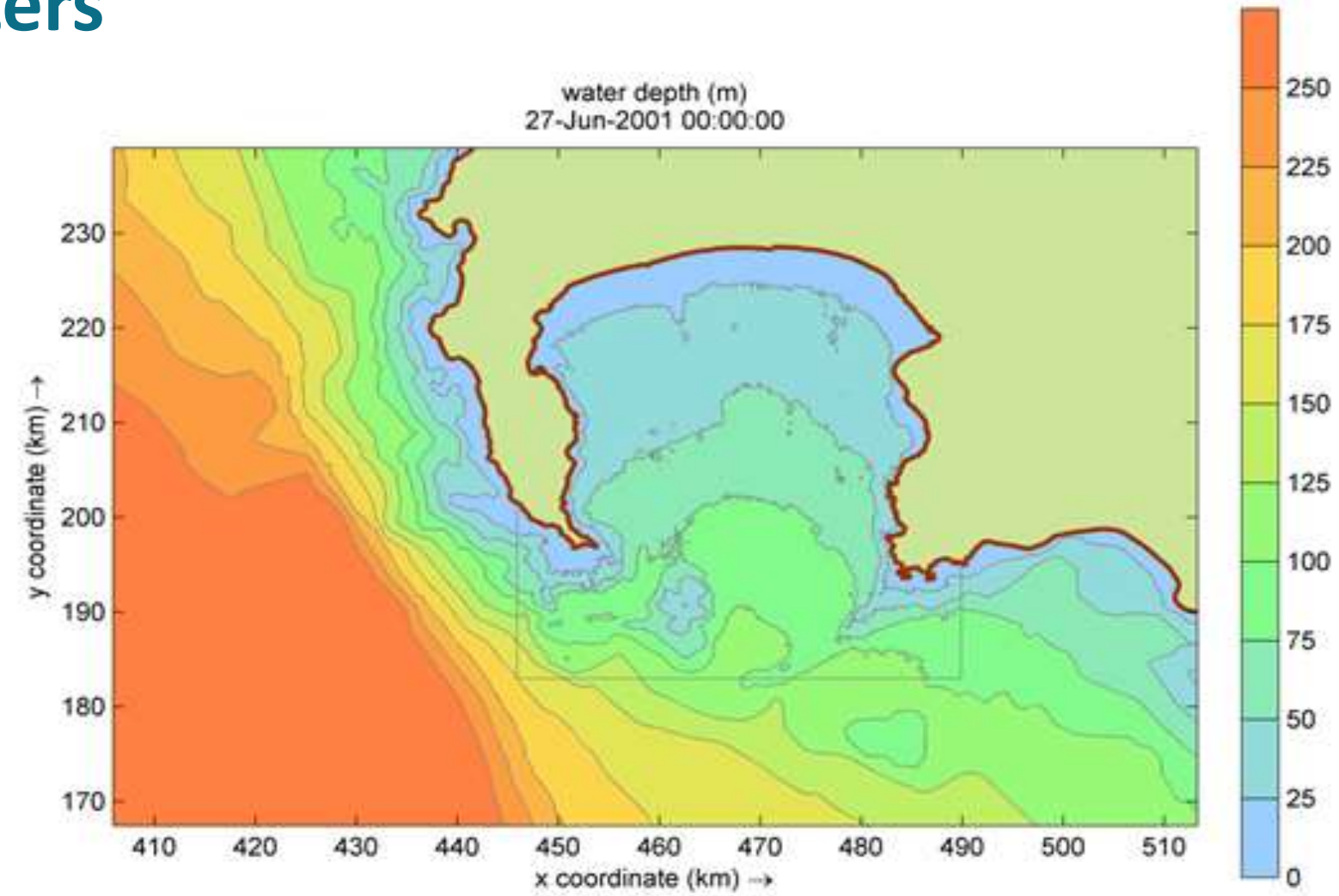
- Reference coast line
- Topographic elevation
- **Sea level rise scenarios**

SLR scenario (m)	Expected by year*
0.15	2030
0.35	2050
0.5	2070
1.0	2100
2.0	2200

**according to projections for RCP8.5 at 50%; Kopp et al. (2017).*

Key input parameters

- Reference coast line
- Topographic elevation
- Sea level rise scenarios
- **Bathymetry**
  nearshore bathy interpolated from 15 m bathy contour from nautical charts



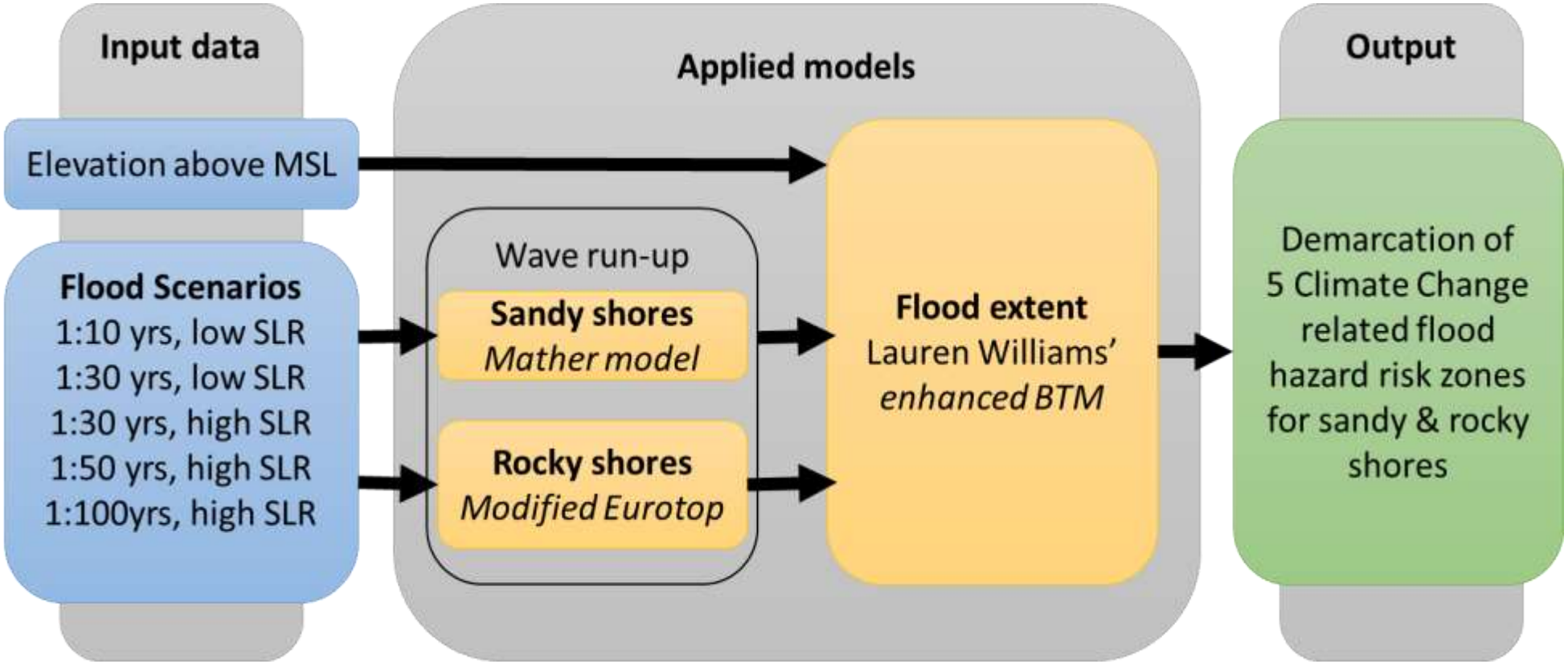
Key input parameters

- Reference coast line
- Topographic elevation
- Sea level rise scenarios
- Bathymetry
- **Wave modelling & return periods**

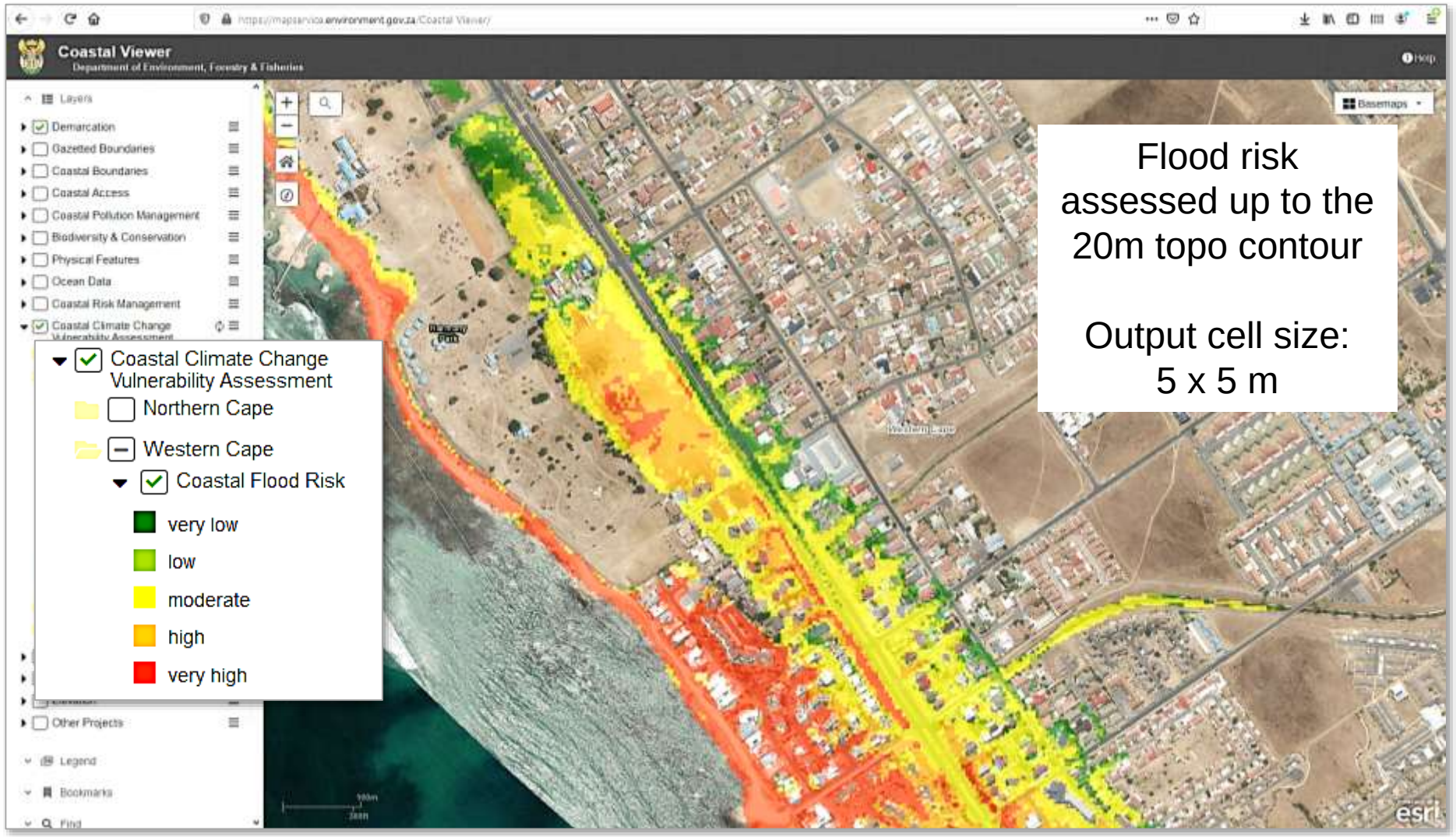
Extreme events

1:10 yrs, 0.3 m SLR
1:30 yrs, 0.3 m SLR
1:30 yrs, 1.0 m SLR
1:50 yrs, 1.0 m SLR
1:100yrs, 1.0 m SLR

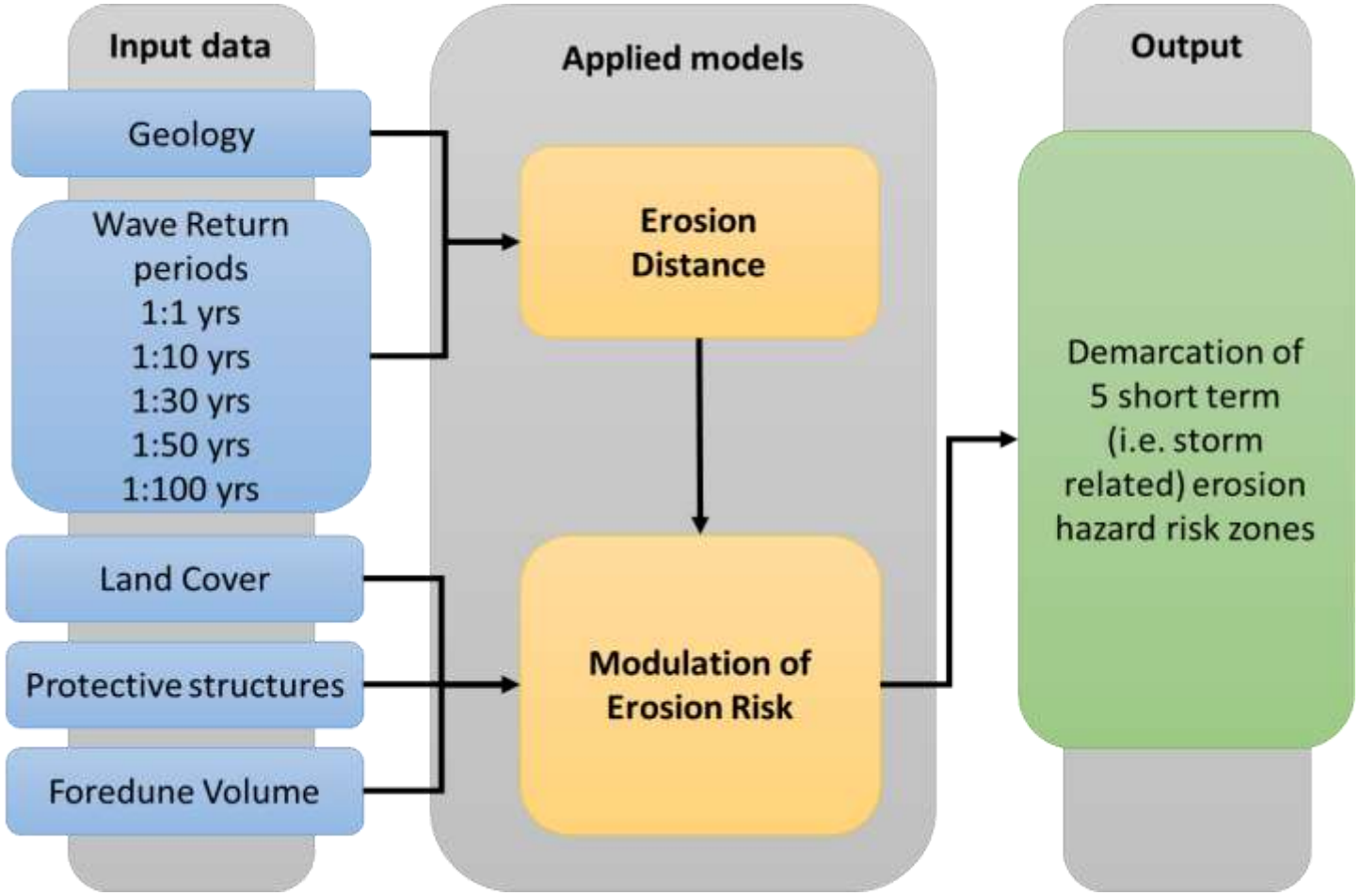
Open Coast Flood Risk Index



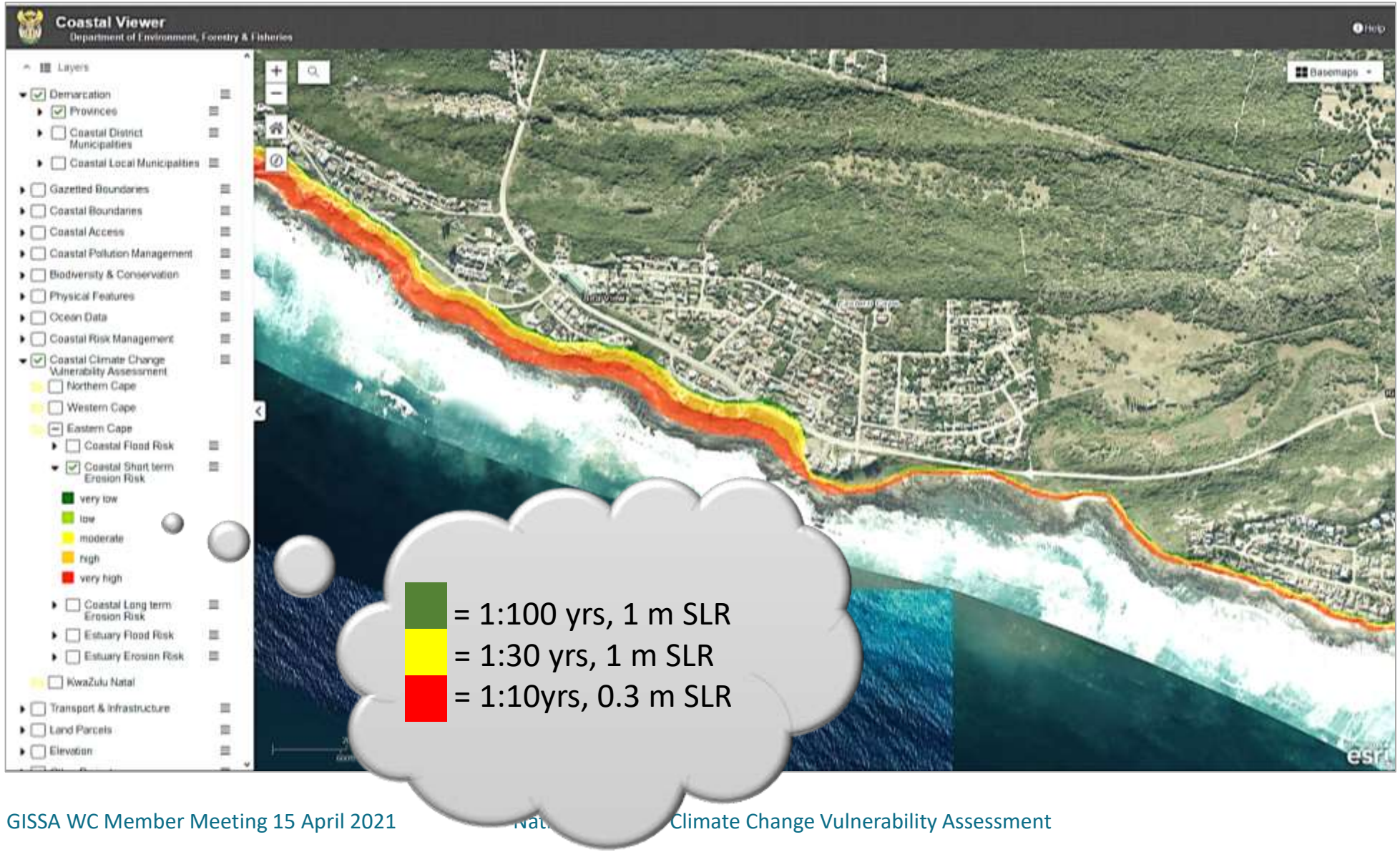
Open Coast Flood Risk Index



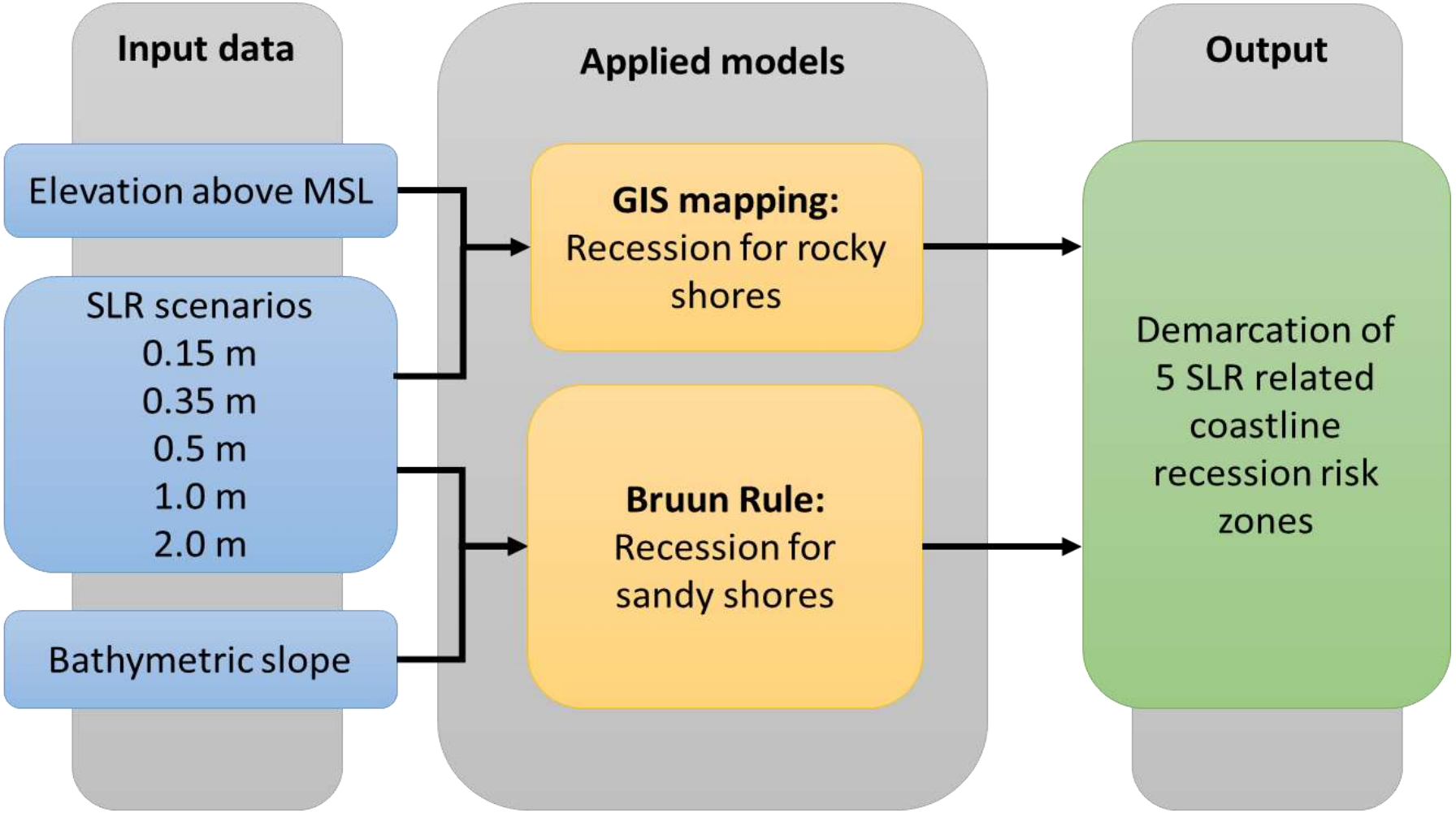
Open Coast Short Term Erosion Risk Index



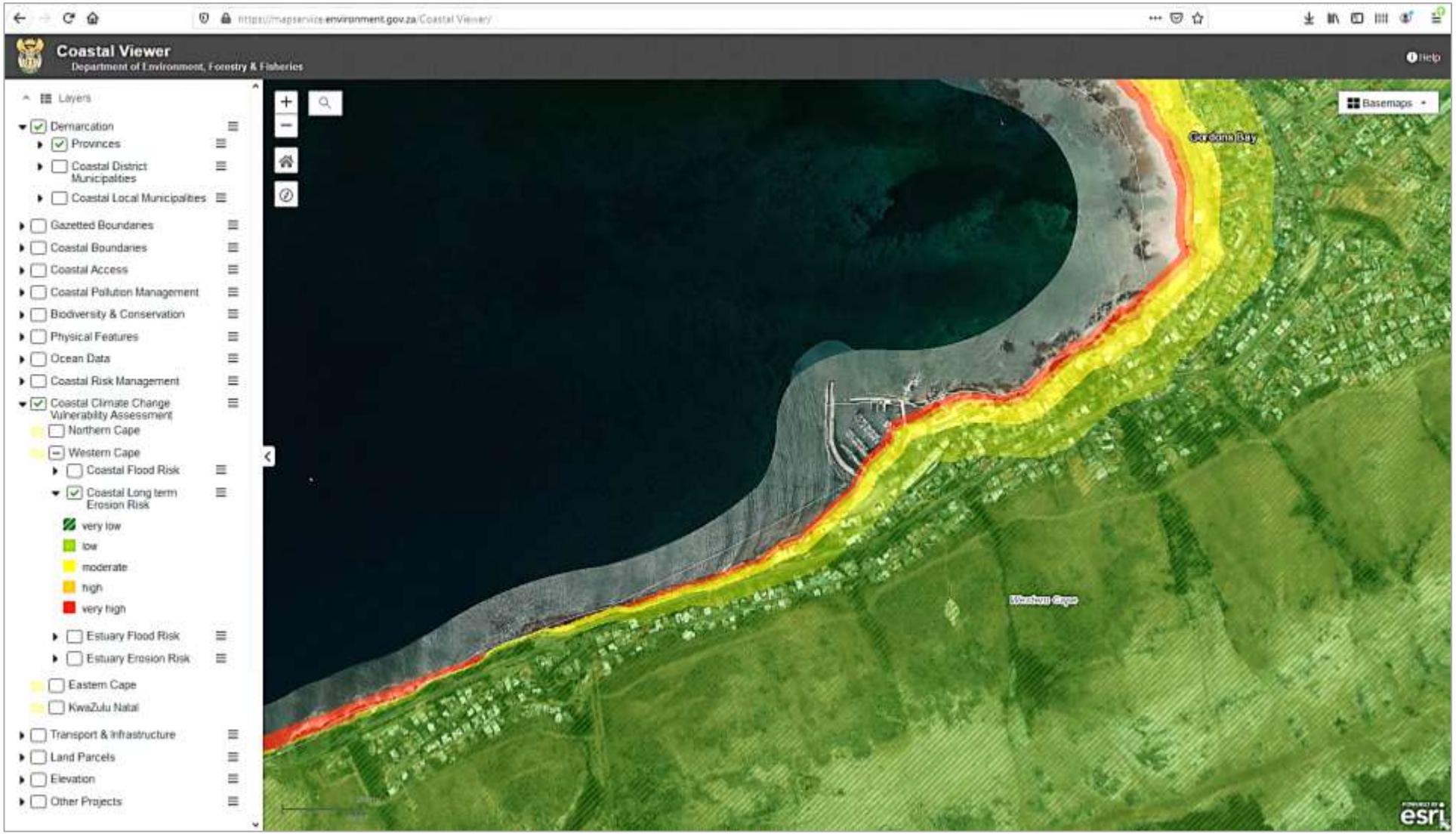
Open Coast Short Term Erosion Risk Index



Open Coast Longterm Erosion Risk Index



Open Coast Longterm Erosion Risk Index



Estuaries Flood Risk Index

This index assesses flood risk originating from the inland

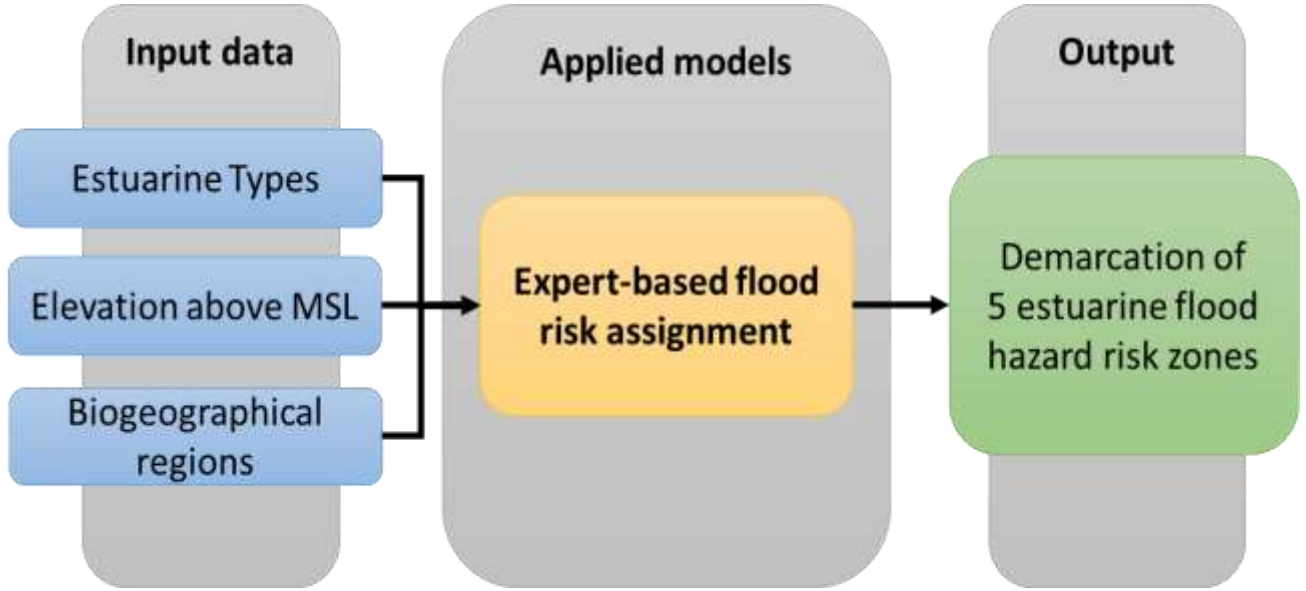


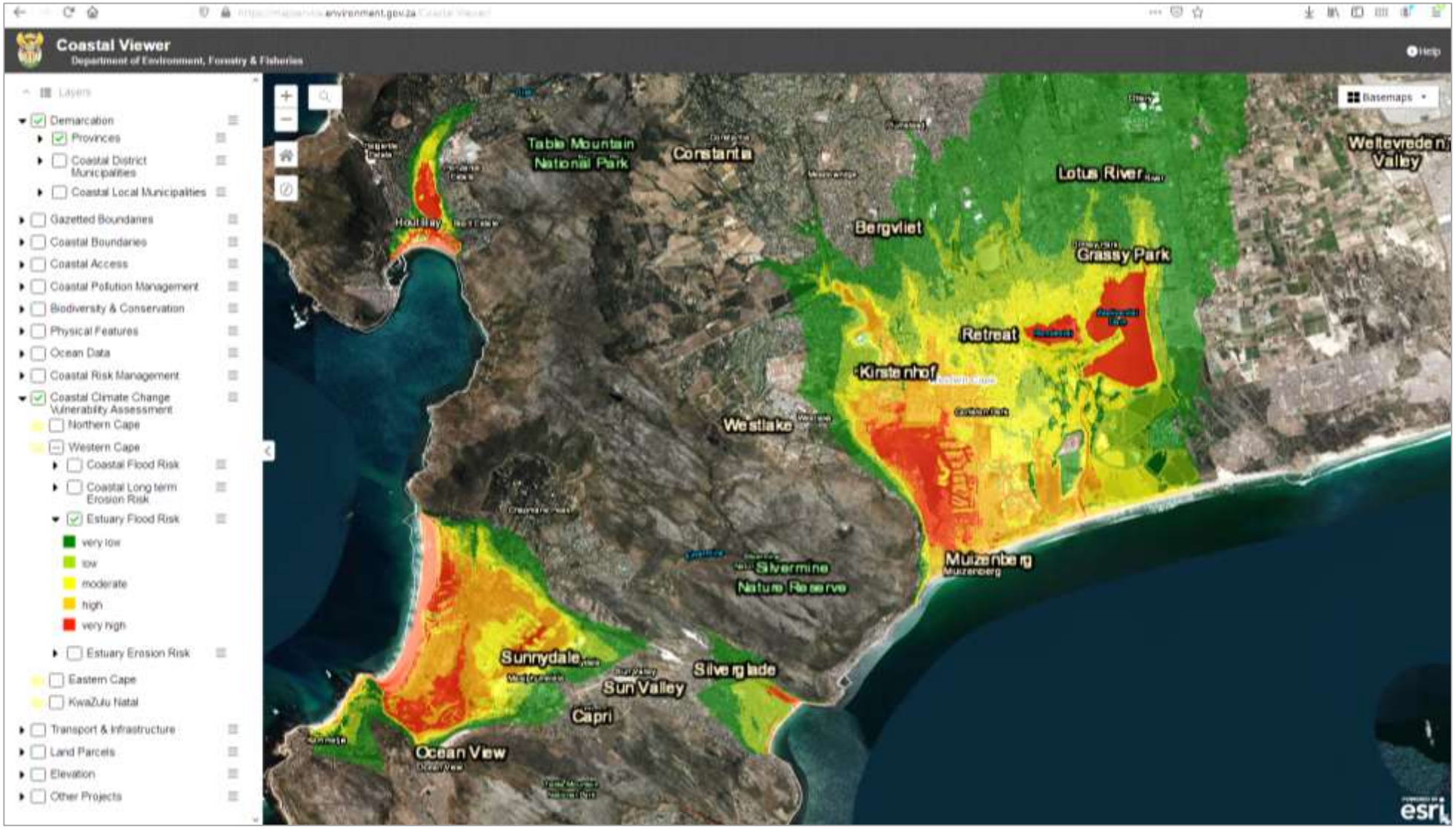
Table 11: Flood hazard risk categories allocated to Estuarine Lagoon type estuaries

Contour level (m)	Cool Temperate	Warm Temperate	Subtropical	Tropical
0 - 2.5	Very High			
2.5 - 5.0	Low			
5.0 - 7.5	Very Low			
7.5 - 10.0	Very Low			
10.0 - 12.5	Very Low			
12.5 - 15.0	Very Low			
15.0 - 17.5	Very Low			
17.5 - 20	Very Low			

Table 10: Flood hazard risk categories allocated to Estuarine Bay type estuaries

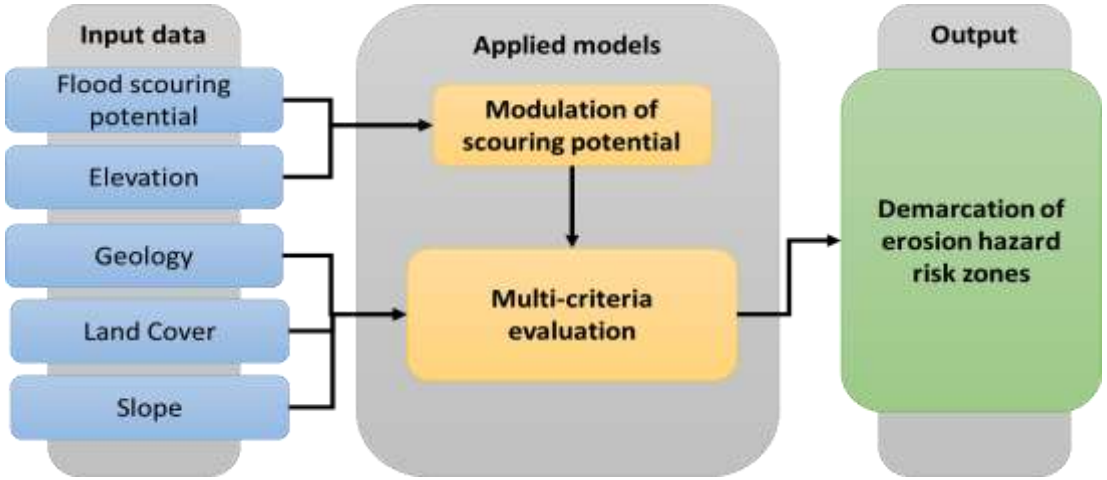
Contour level (m)	Cool Temperate	Warm Temperate	Subtropical	Tropical
0 - 2.5		Very High	Very High	
2.5 - 5.0		Medium	Medium	
5.0 - 7.5		Very Low	Very Low	
7.5 - 10.0		Very Low	Very Low	
10.0 - 12.5		Very Low	Very Low	
12.5 - 15.0		Very Low	Very Low	
15.0 - 17.5		Very Low	Very Low	
17.5 - 20		Very Low	Very Low	

Estuaries Flood Risk Index



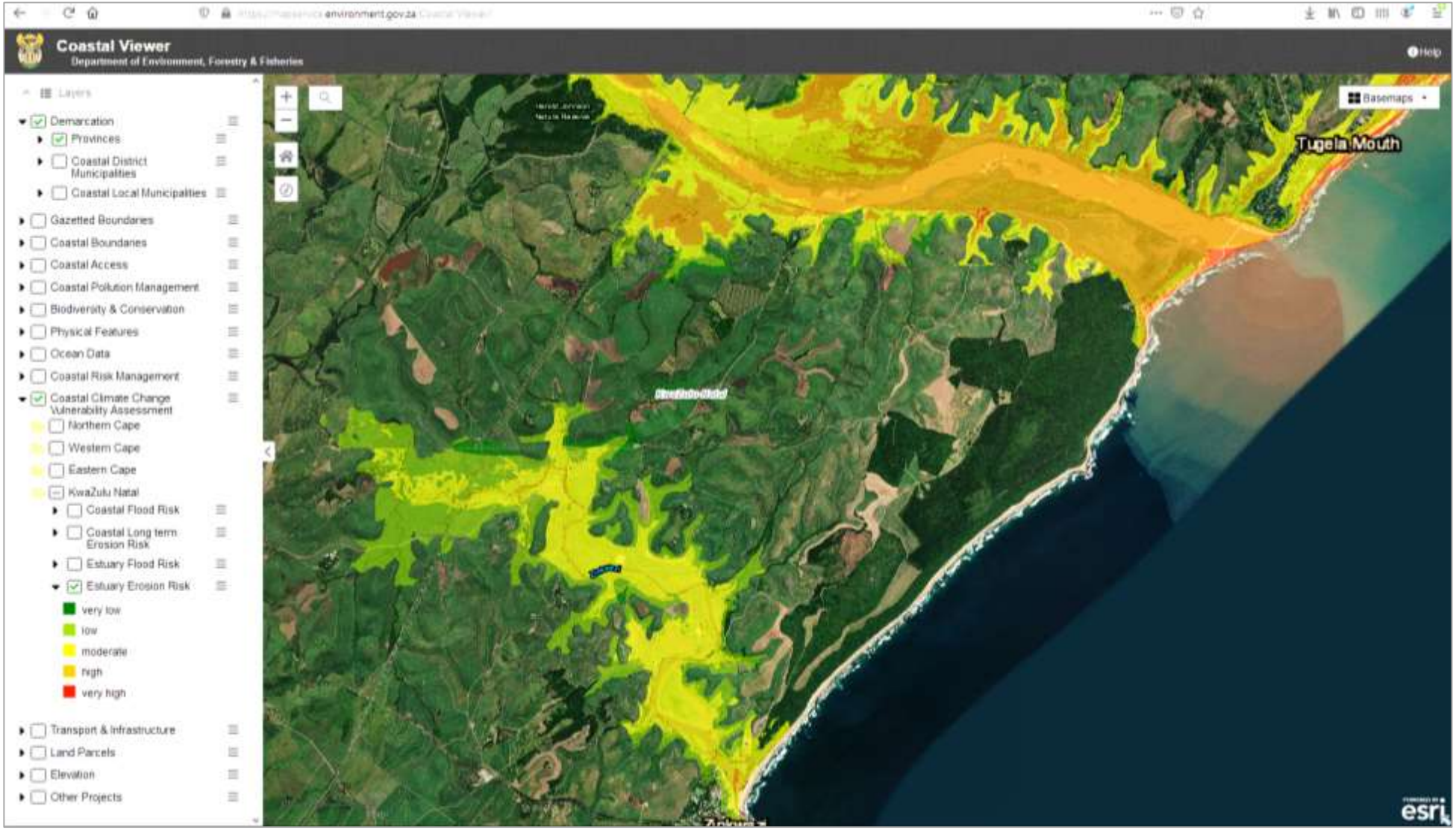
Estuaries Erosion Risk Index

This index assesses erosion risk caused by inland waters



	Flood Scouring Potential				
	Very Low	Low	Medium	High	Very High
	1	2	3	4	5
Conceptual	**Low MAR / Large channel storage area**	**Low - moderate MAR / Large - medium channel storage area**	**Moderate MAR / Medium channel storage area**	**Moderate - high MAR / Medium - small storage area**	**High MAR / Small channel storage area**
MAR (m^3x10^6) / Channel volume (m^3)	0 - < 20	20 - < 50	50 - < 200	200 - < 400	400 – 10,000

Estuaries Erosion Risk Index



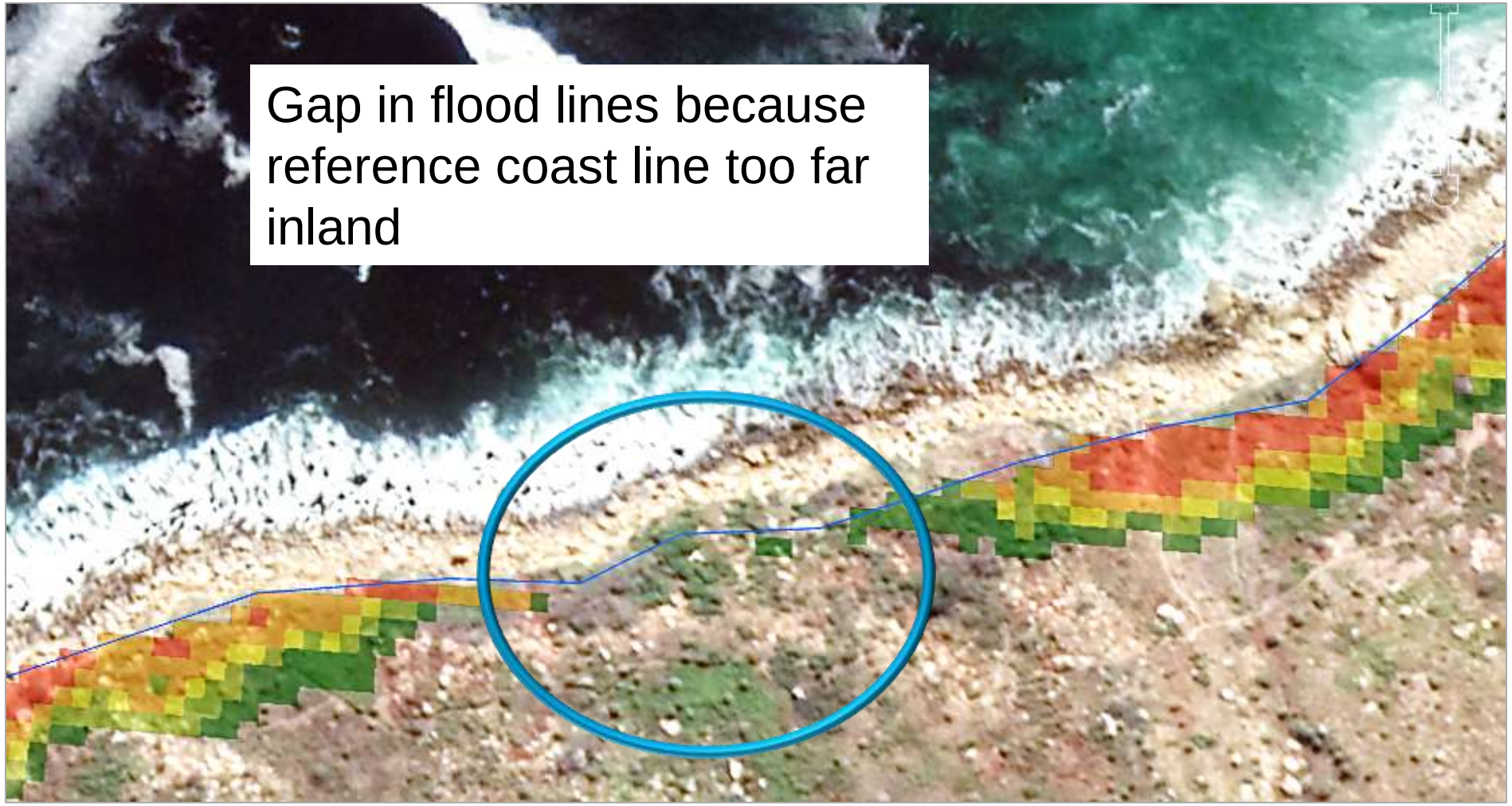
Implications of the used methods for the Index usage

- Quality of model outputs is dependent on model input:

  → sub-optimal input → suboptimal outputs

- Methods used affect output characteristics

Discrepancies between mapped flood lines and Google Earth



Discrepancies between mapped flood lines and Google Earth

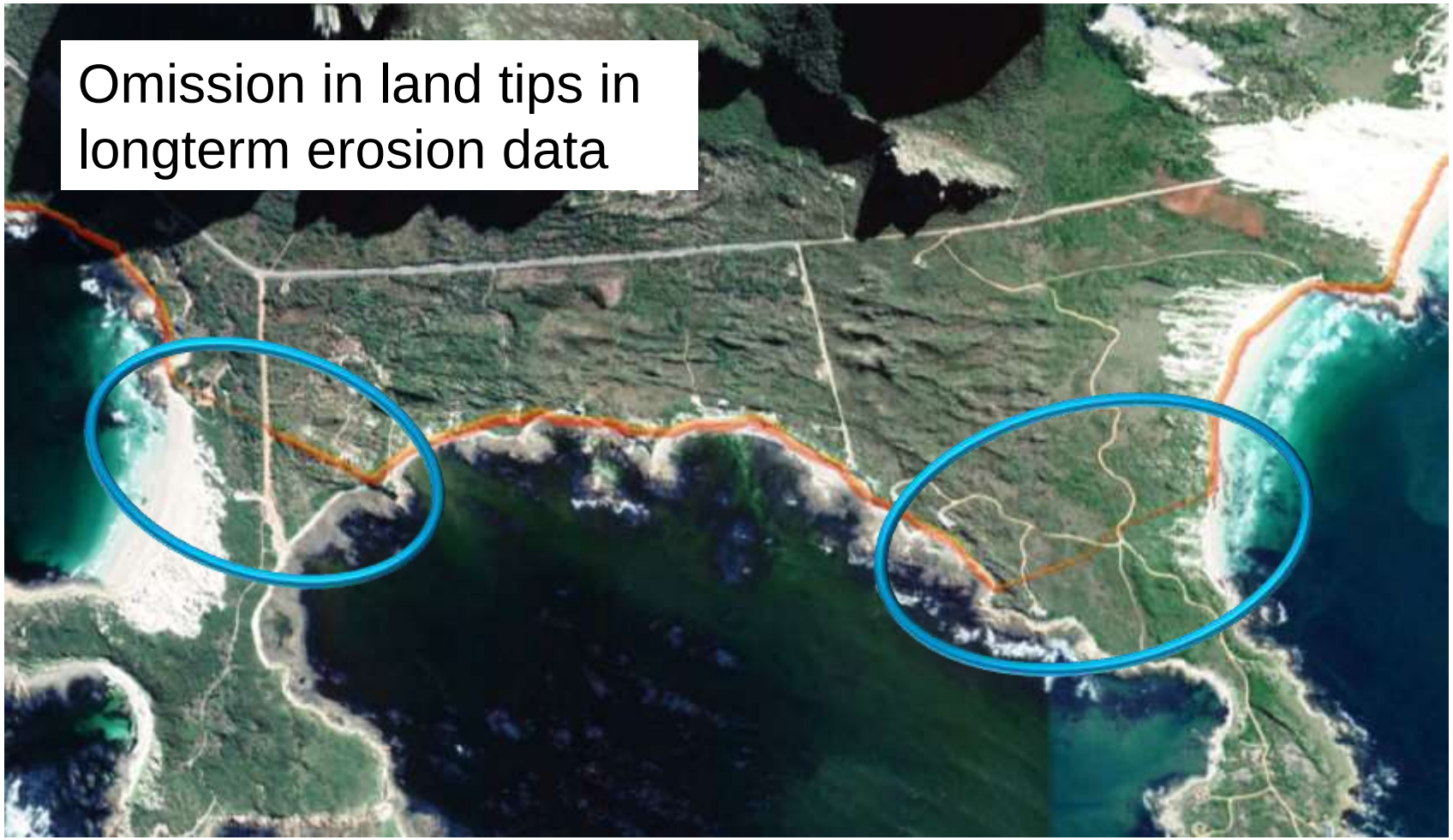
Discrepancies between mapped flood lines and Google Earth

Topography does not match what is on the ground, e.g. due to development.

Discrepancies between mapped flood lines and Google Earth

Topography has changed naturally

GIS related artefacts on land tips



How to access the Index GIS data?

- CoVu Offline DeST:
  - available for download (about 12 GB per Province)
  - Provided by DEFF on USB stick to government instances (full package for all 4 Provinces)
  - Allows offline viewing of 5 index layers and simple map export
- DEFF Coastal Viewer:
  - https://mapservice.environment.gov.za/Coastal%20Viewer/
  - Allows overlay of 5 risk layers with a large variety of ICM-relevant GIS data & multiple GIS functions
- Download of SHP files of 5 Risk layers
  - Allows data integration in user's own GIS environment
  - Will be possible from DEFF MIMS soon (data still in DEFF auditing process)
  - In the interim from CSIR
- Download of KMZ files for use of 5 layers in Google Earth
  - Will be possible from DEFF MIMS soon (data still in DEFF auditing process)
  - In the interim from CSIR
- DEFF Environmental Screening tool
  - 5 layers will be embedded there as input for EIA processes
- New module in OCIMS Coastal Flood Hazard Tool (in discussion)

NATIONAL COASTAL CLIMATE CHANGE VULNERABILITY ASSESSMENT

Thank you

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All experts, municipal, provincial and national stakeholders consulted during this process.

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