The Wadden Sea as seen from ISS; Tuesday 24 May 2016
Photo: Jeffrey Williams

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Enabling Delta Life

Sediment feeds the Wadden Sea.

Rising sea levels, sediment budgets and the future of intertidal flats

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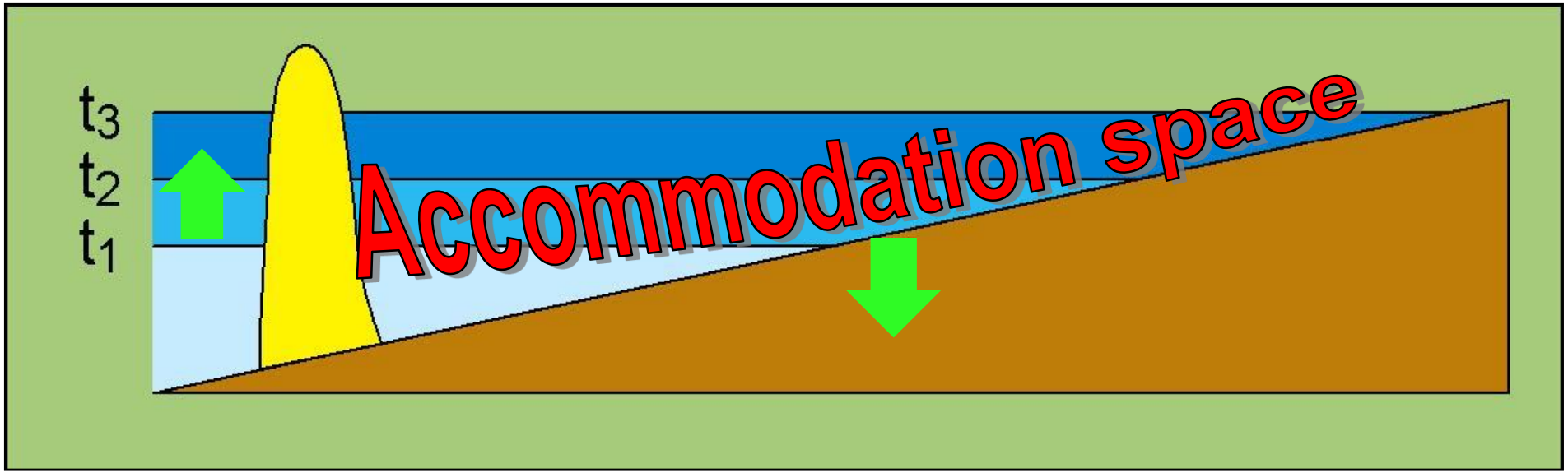
Accommodation space → sediment demand



Sea-level rise + subsidence → land 'drowns'

→ sediment demand → (outside) supply of sediment

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Coastal evolution - ‘demand’ and supply sediment

supply > demand :

surplus ! → **progradation**

supply = demand :

stabile

supply < demand :

deficit ! → **retreat**

after Nichols, 1989.

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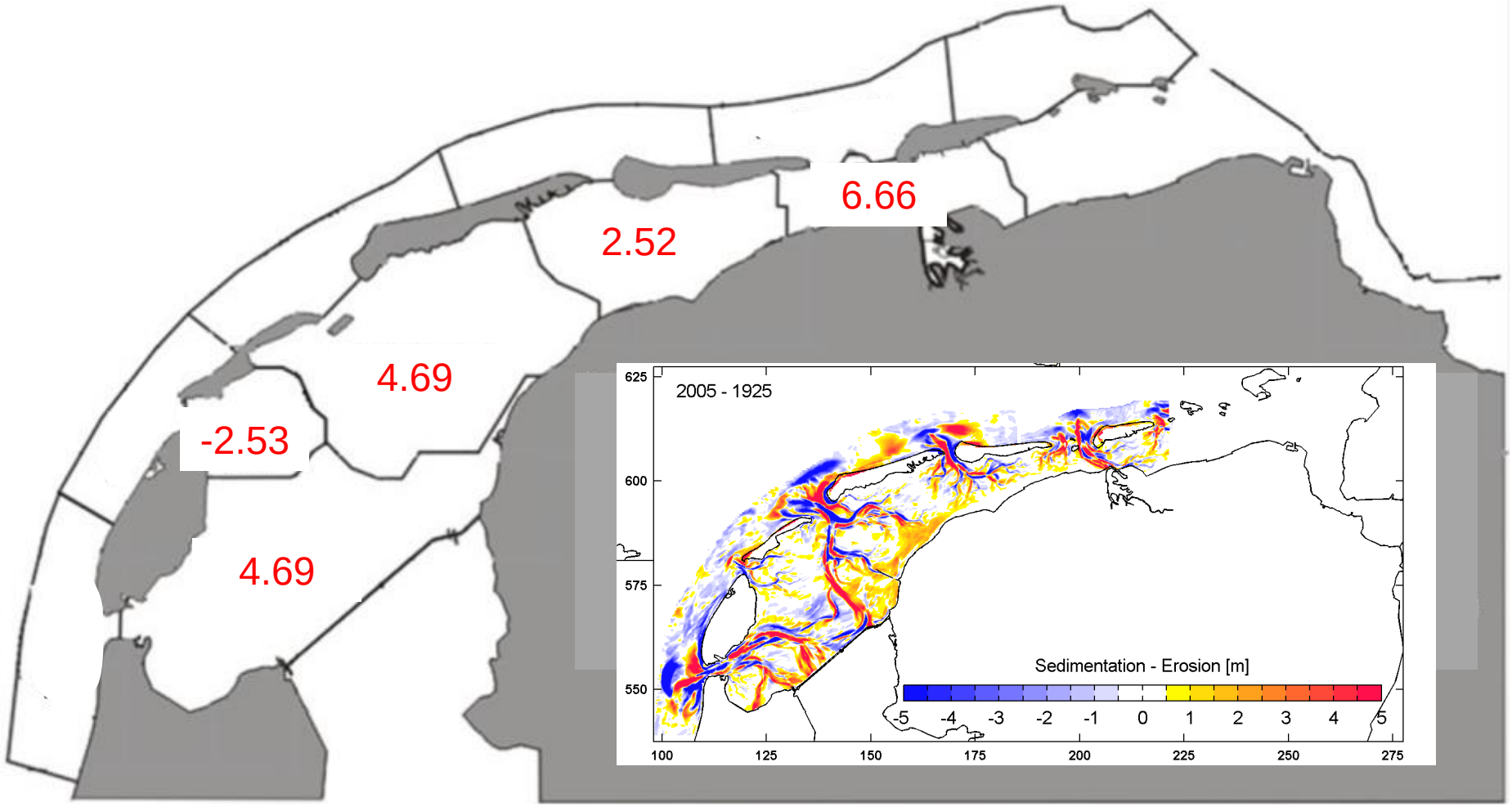
Sedimentation 1935-2005 – *mm per year*



Sedimentation tidal basins > present-day relative sea-level rise !!

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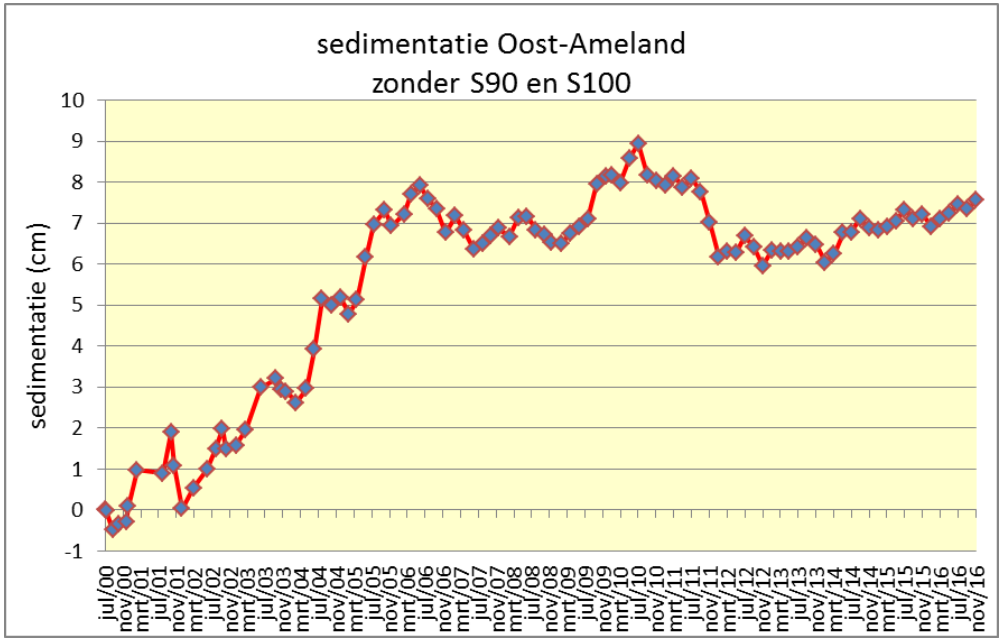
Morphodynamics tidal basins Wadden Sea



Western Wadden Sea:

- ✓ Large basins
- ✓ Large area water
- ✓ Small area tidal flats

Eastern Wadden Sea:

- √ Smaller basins
- √ Larger area tidal flats (≤ 70%)
- √ Rapid compensation subsidence

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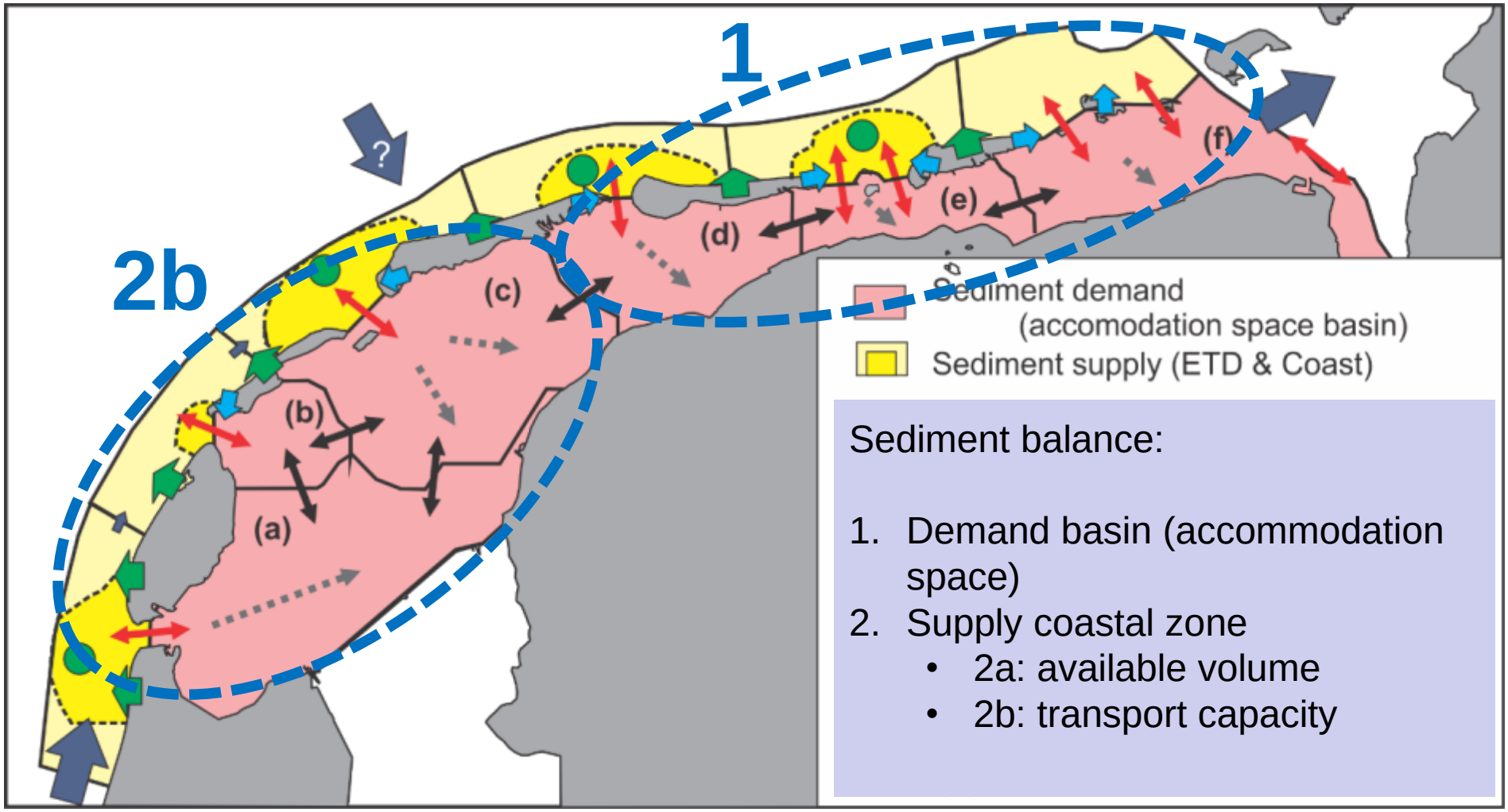
Sediment-sharing system Wadden Sea



Sediment balance:

1. Demand basin (accommodation space)
2. Supply coastal zone
   - 2a: available volume
   - 2b: transport capacity

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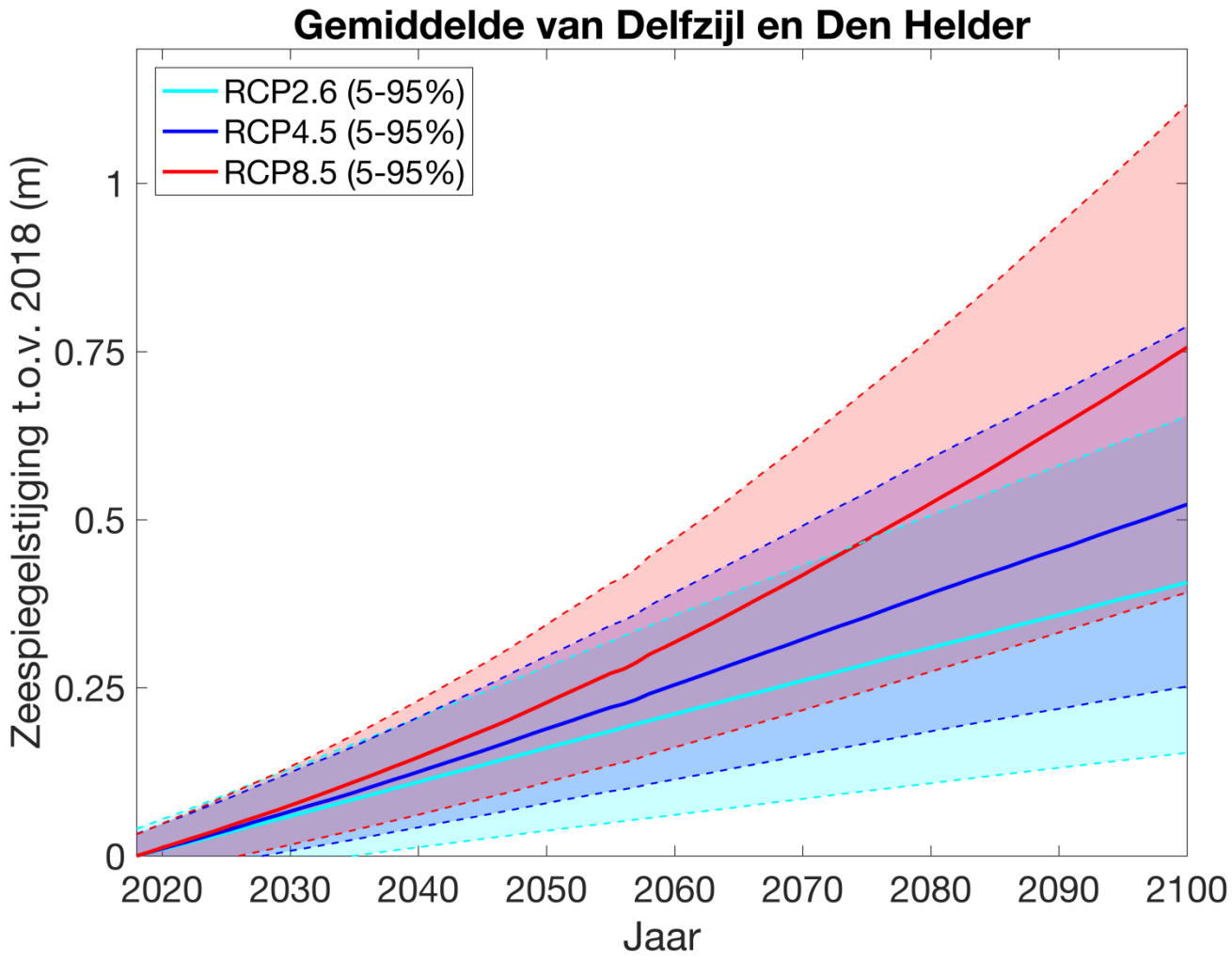
Vermeersen et al., 2018.
Sea-level change in the Dutch Wadden Sea.
Netherlands Journal of Geosciences



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Balance ‘sea-level rise + subsidence’ - sedimentation rate 2030, 2050, 2100

scenario	Texel	Eierland	Vlie	Ameland	Pinkegat	Zoutkamp.
R_c	*7.0*	*18.0*	*6.3*	*10.4*	*32.7*	*17.1*
RCP2.6 - 2030	4.9	4.9	5.9	4.9	6.5	5.8
RCP2.6 - 2050	5.2	5.2	5.7	5.2	6.2	5.5
RCP2.6 - 2100	5.0	5.0	5.0	5.0	5.0	5.0
RCP4.5 - 2030	5.8	5.8	6.8	5.8	7.4	6.7
RCP4.5 - 2050	6.3	6.3	6.8	6.3	7.3	6.6
RCP4.5 - 2100	6.6	6.6	6.6	6.6	6.6	6.6
RCP8.5 - 2030	6.8	6.8	7.8	6.8	8.4	7.7
RCP8.5 - 2050	8.9	8.9	9.4	8.9	9.9	9.2
RCP8.5 - 2100	11.9	11.9	11.9	11.9	11.9	11.9

Critical sedimentation rate exceeded !

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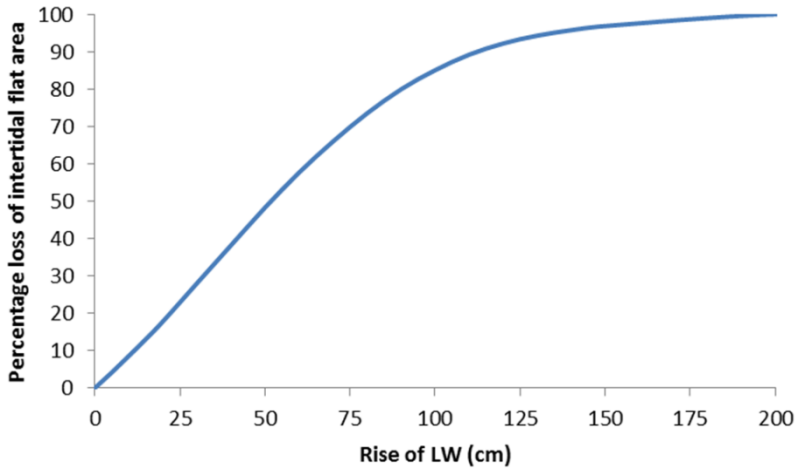
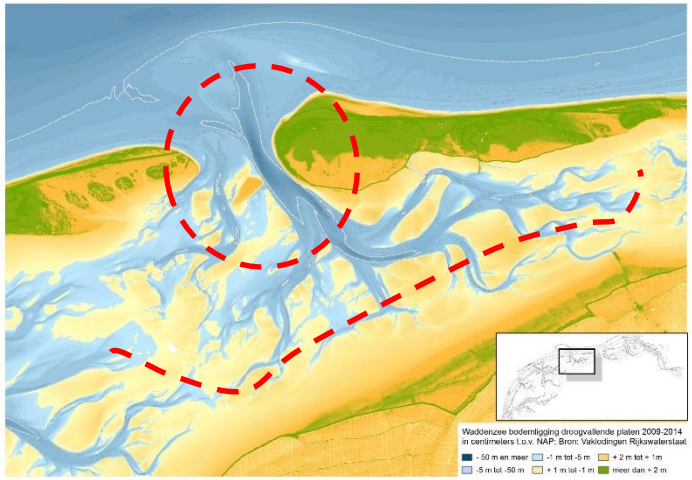
What if relative SLR exceeds critical sedimentation rate?

- Over-depth (cm) and loss tidal-flat area (%)
- Averaged over total Wadden Sea

year	*2030*		*2050*		*2100*	
Scenario	*cm*	*%*	*cm*	*%*	*cm*	*%*
RCP 2.6	0	-	1	1	3,5	3
RCP 4.5	1,5	1,5	5	4	15	13
RCP 8.5	3	3	10	8,5	40	38





Future Wadden Sea

Acceleration sea-level rise:

- Growing sediment *demand*
- Supply by coastal zone via inlet essential
  - ✓*Sediment source* ; nourishment barrier islands, ebb-tidal deltas (?)
  - ✓*Transport capacity*
- Exceeding critical value (basin specific !):
  - ✓Supply < increase in demand
  - ✓Internal redistribution sediment
  - ✓‘Drowning’ is a slow process
- Changing sediment composition ?

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Thank you !