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8th GLOBAL NITROGEN CONFERENCE
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Nitrogen & The UN Sustainable Development Goals
Precising target NO$_3$ concentrations to limit green algae blooms in Brittany

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Project funded by PLAV2 : 2nd remediation plan for green tides (Plan de Lutte contre les Algues Vertes)
Introduction

Green Tides (GT): Macroalgal blooms (*Ulva* sp.)
Closed bays with shallow waters enriched in N,P, usually from river loads
Introduction (2)

Western France suffers from GT since the 1970’s, mainly due to intensive agriculture. Large variations of beached biomass since 2000.
Introduction (3)

Beaching areas for 2 contrasting years

**Initial pool:**
Antecedent autumn pool, Winter storms

**Spring growth:**
Sea temperature, light

**Late summer growth**
N supply

**Autumn residual pool**
Light, temperature, storms

**Agricultural practices**
Spring rainfall
Hypotheses and questions

1. Does NO₃ decrease responsible for increasing variations of GT, or only climate variations?

2. Would further NO₃ decrease avoid large GT when other factors favorable for algal growth?

3. Would future climate scenarios increase or decrease the risk of GT?
Study site

Bay of St Brieuc: Largest GT in Brittany.
Contributing catchments: 825 km²
Climate: oceanic temperate
Rainfall: 800 mm/year
Mean temperature: 9°C
Mean N-NO₃ ~ 6mg/L
Methods (1)

P, PET, T°  DTM, soils  Crops, fertilization...

TNT2

Stream discharge  Stream NO₃, NH₄ concentrations

ECO-MARS-ULVES
Methods (2)

Step 1: Simulation of observed period : 2008-2018

Step 2: Simulation of reduced N loads with same climate

Step 3 : Simulation of past (higher) N loads with same climate

Step 4: simulation of present and reduced N loads with climate projections
Results

N fluxes vs. area of beach covered by algae

% of growth limitation by N
Results

N fluxes vs. area of beach covered by algae

N limitation depends on climate
Impact of 30% N flux reduction

Only 10% biomass reduction:

Bad years would remain bad years…
What if N03 directive and national regulations had not existed?

Probably only one « good » year in the decade

most « good » years would have been bad years…
Climate scenarios

Selected scenario: RCP 8.5 for 2030-2060
Impact of climate scenarios

Summer N flux (kg/ha)

Eco-MARS: very limited >0 impact of increased water temperature
Conclusions

**Results need consolidation:**

- The simulation of (uncertain) low flow/concentration data by hydrological model is difficult.
- Ecological model overestimated biomass in late summer-autumn -> *underestimation of impact of reduced N scenario?*
- Simulation of 7 other bays in progress.

**Main messages:**

- Limited N reduction will not improve « bad » years green tides *other solutions to reduce initial pools and spring growth?*
- No significant impact of climate change in the next decades (probably more impact of other anthropogenic changes)