The Ice Sheet Mass Balance Inter-comparison Exercise

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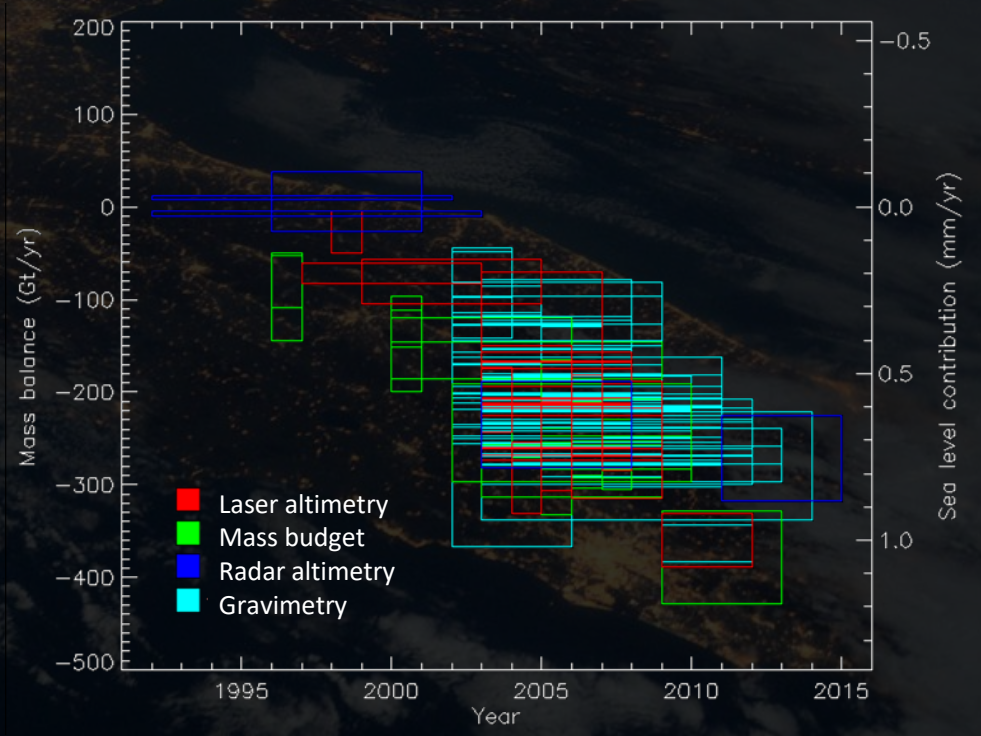
Objectives

- Ice sheets are a major contributor to global sea level rise
- Future contribution is least certain component of sea level projections
- > 150 individual estimates of ice sheet loss
- Based on 3 satellite techniques
- **imbie** is community assessment
- Coordinated by ESA and NASA
- Involves CCI Antarctica & Greenland
- >100 participants



Satellite detection of ice sheet mass balance

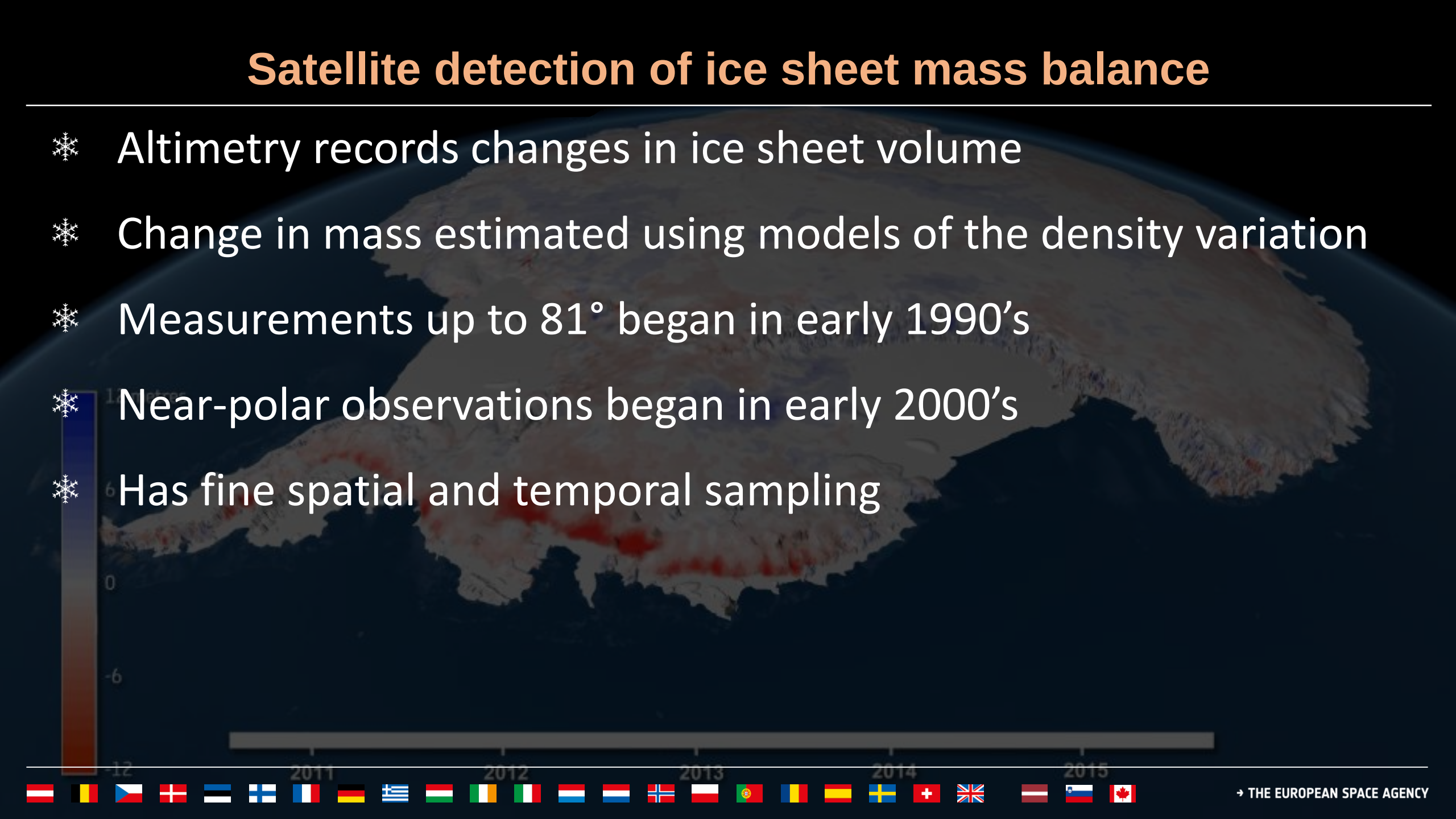
- Mass budget balances snowfall and ice discharge
- Snowfall is determined from regional climate models
- Ice discharge is determined from satellite observations of ice flow
- Comprehensive measurements began in early 1990’s
- Provides a direct measurement of ice dynamics

Satellite detection of ice sheet mass balance

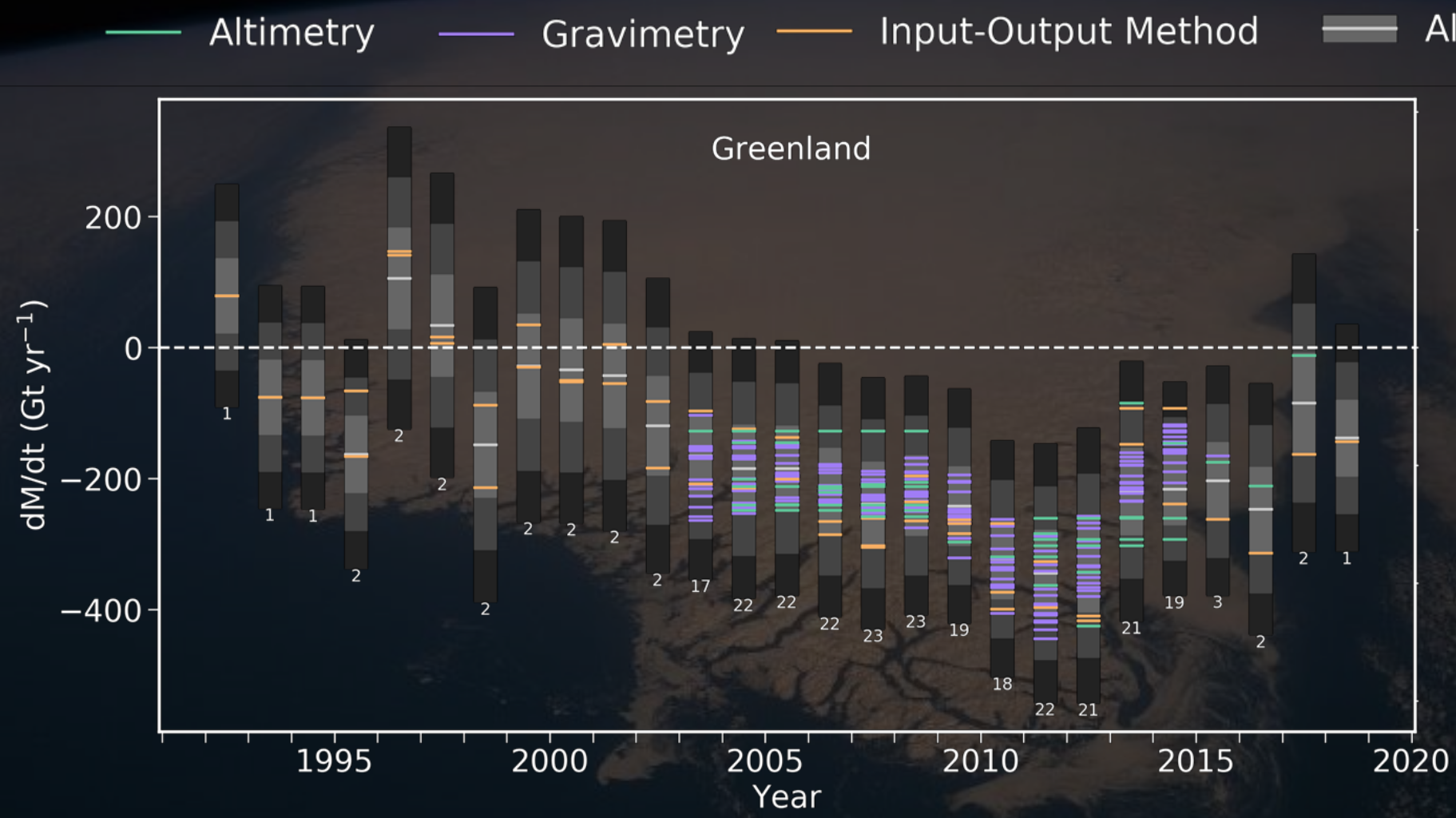
- Gravimetry weighs changes in the ice sheet mass
- Uses GRACE satellite measurements of Earth's gravity field
- Measurements began in early 2000's
- Records sum of snow and ice mass change with coarse resolution
- Provides most direct measure of mass change

Satellite detection of ice sheet mass balance

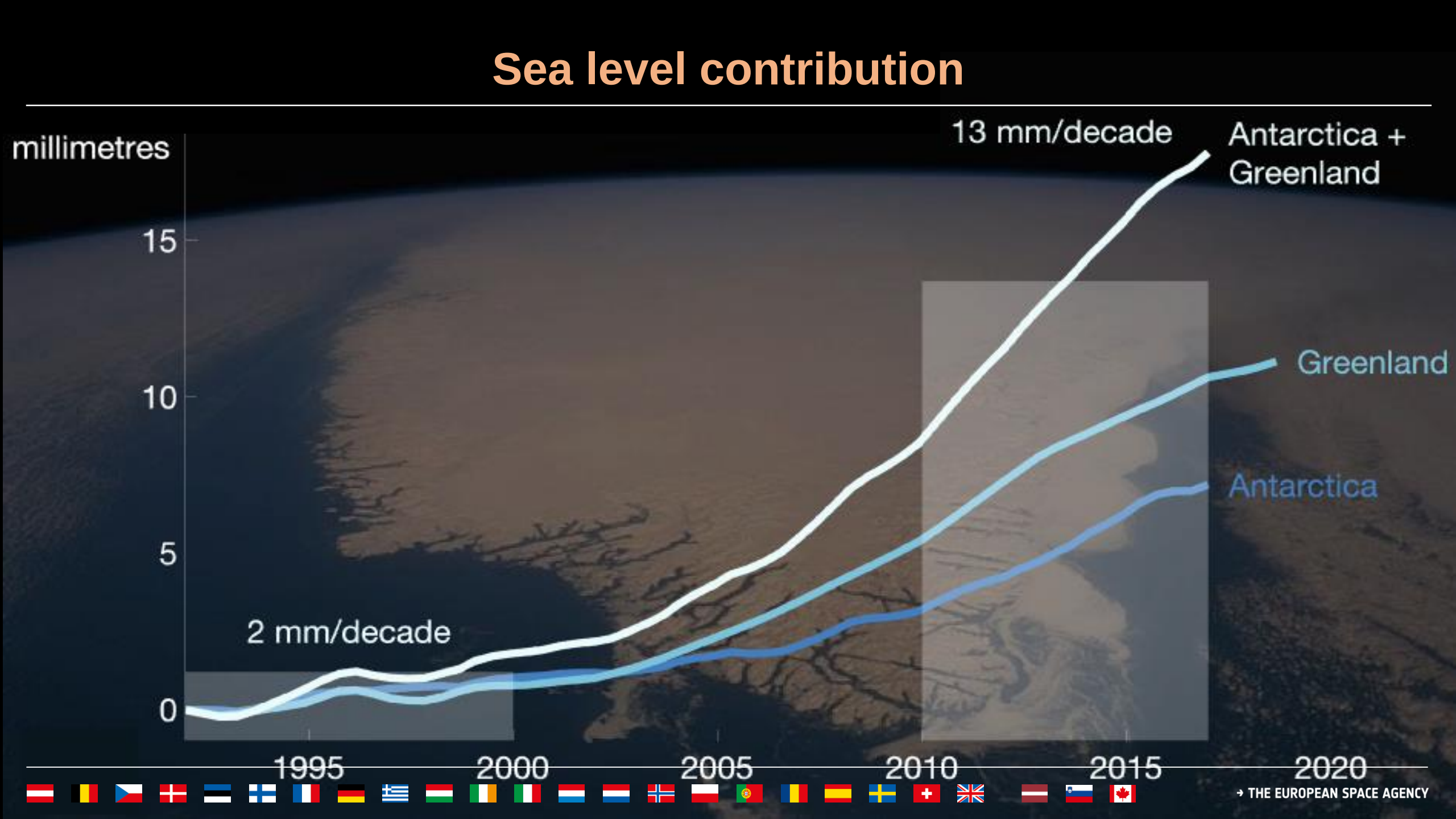
- Altimetry records changes in ice sheet volume
- Change in mass estimated using models of the density variation
- Measurements up to 81° began in early 1990’s
- Near-polar observations began in early 2000’s
- Has fine spatial and temporal sampling



Individual estimates of ice sheet mass balance



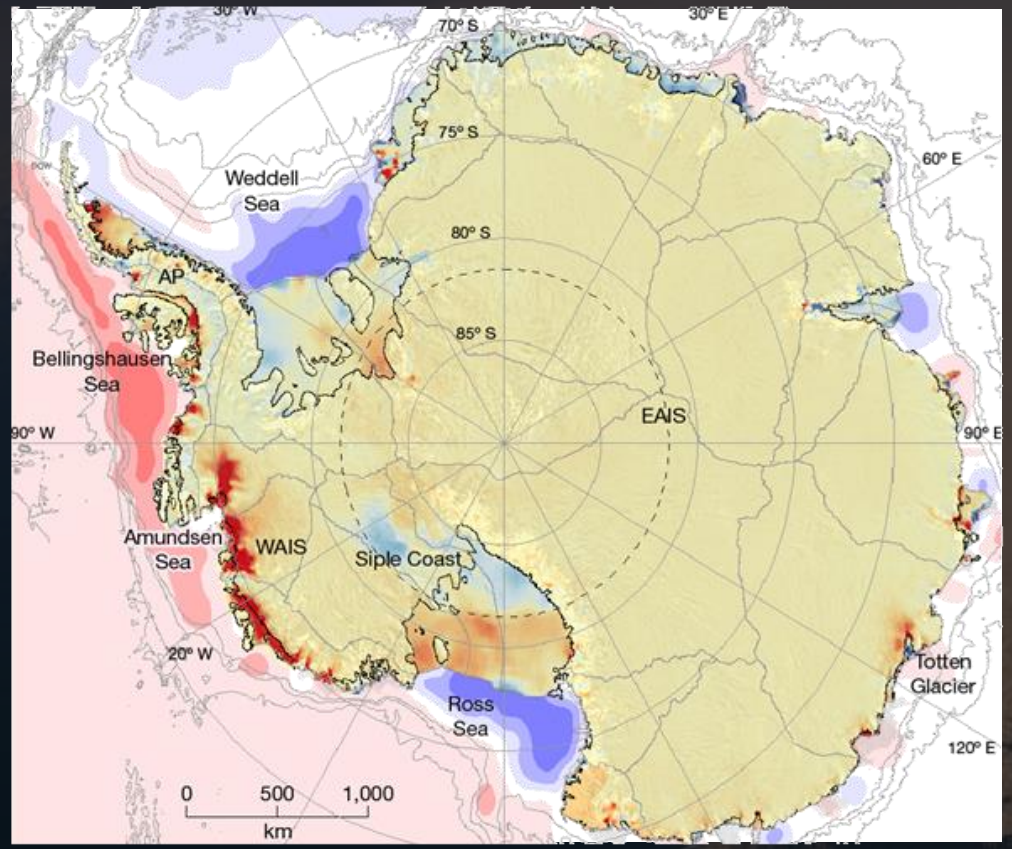
Sea level contribution

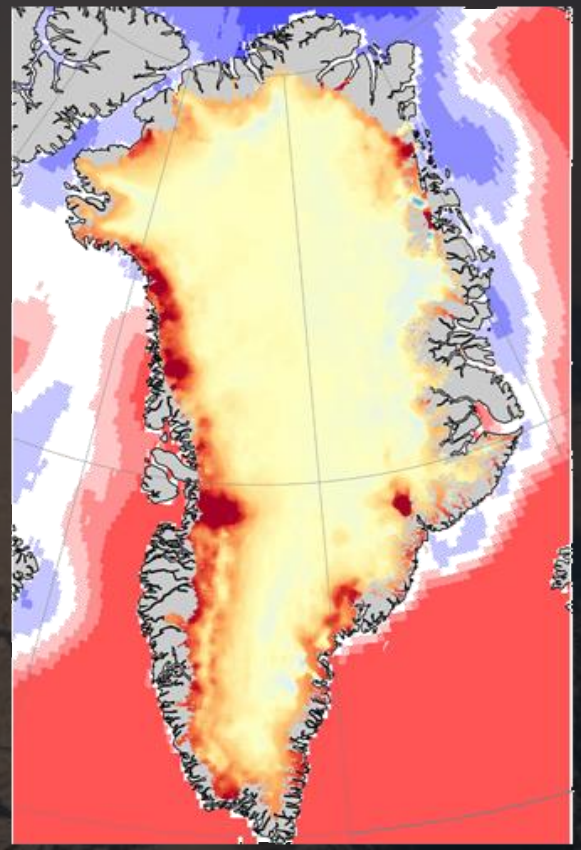


Climate forcing

Ocean temperature (°C)

-2 +1



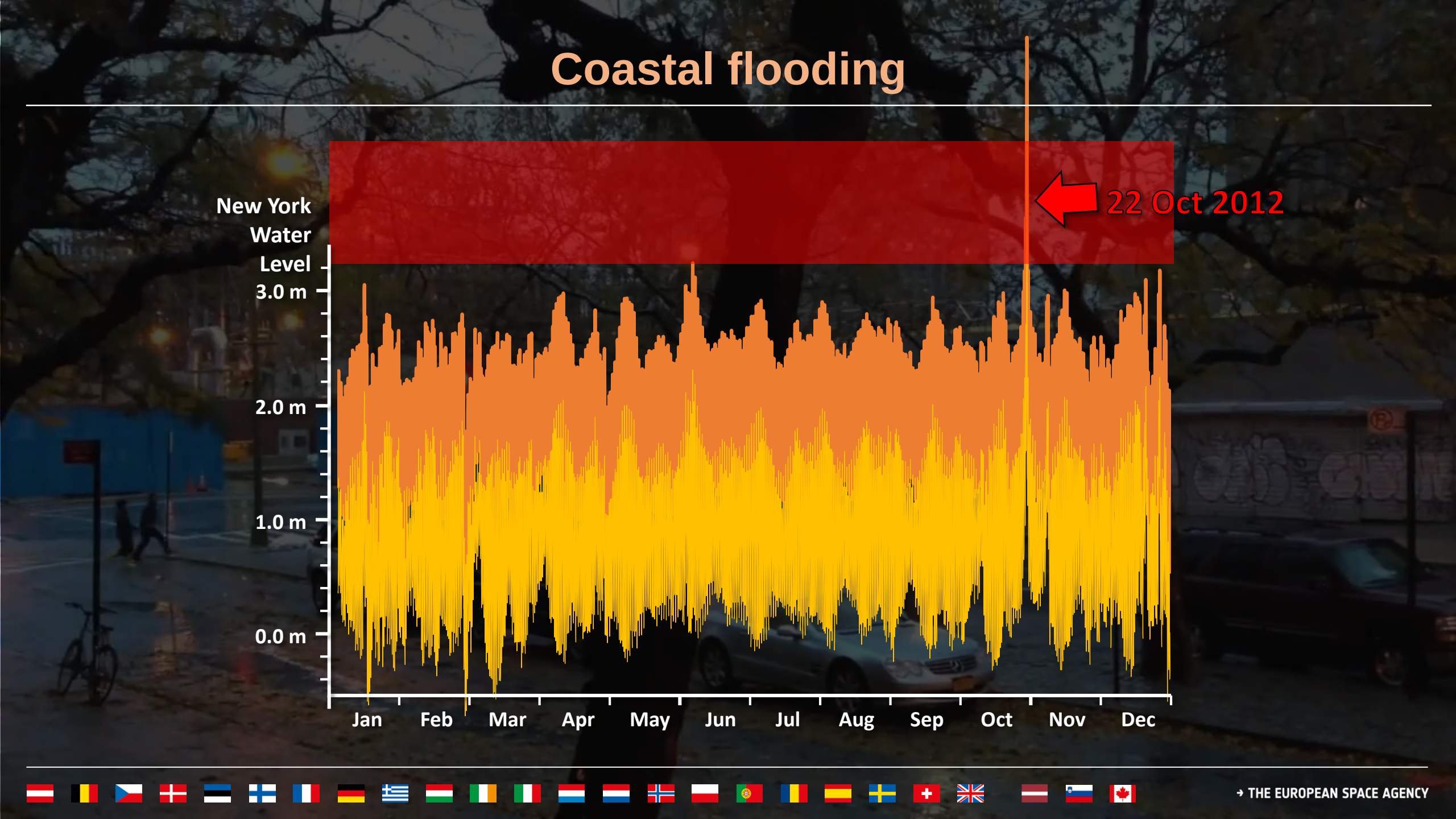


Elevation change (m/yr)

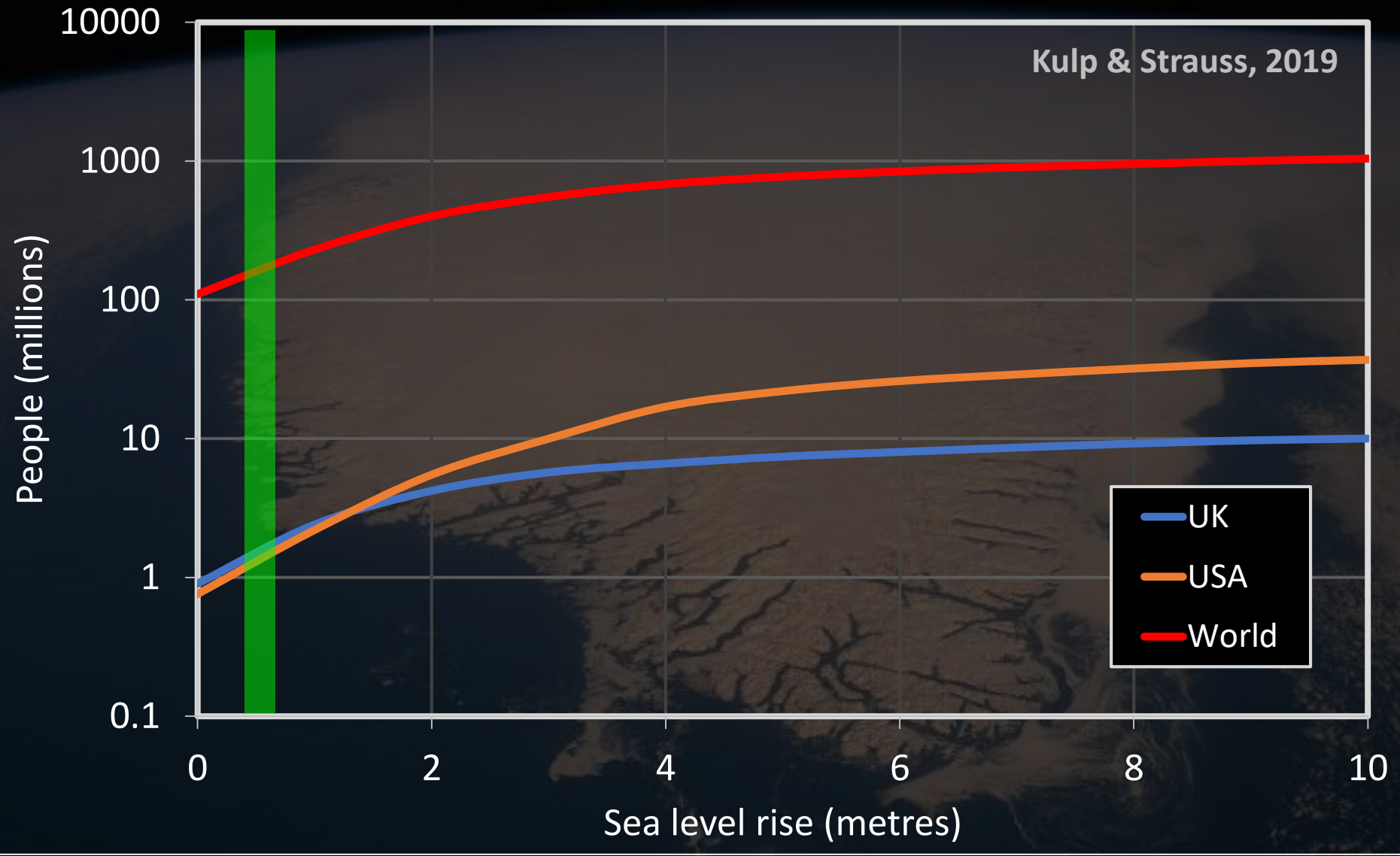
-1 +1

Satellite observations vs climate projections

Coastal flooding



Coastal flooding



Summary

- **imbie-2** has 92 partners, 26 EO, 11 GIA, 10 SMB
- Antarctica & Greenland have lost 7 trillion tons of ice
- Due to ocean and atmospheric warming
- Has caused 18 mm of global sea level rise
- Six-fold increase in rate of ice loss
- Tracking IPCCs worst-case scenario, +17 cm by 2100
- Raises annual flood risk to 400 million people
- **imbie-3** begins soon
- Objectives are to separate snow & ice, use new missions, and produce annual assessments