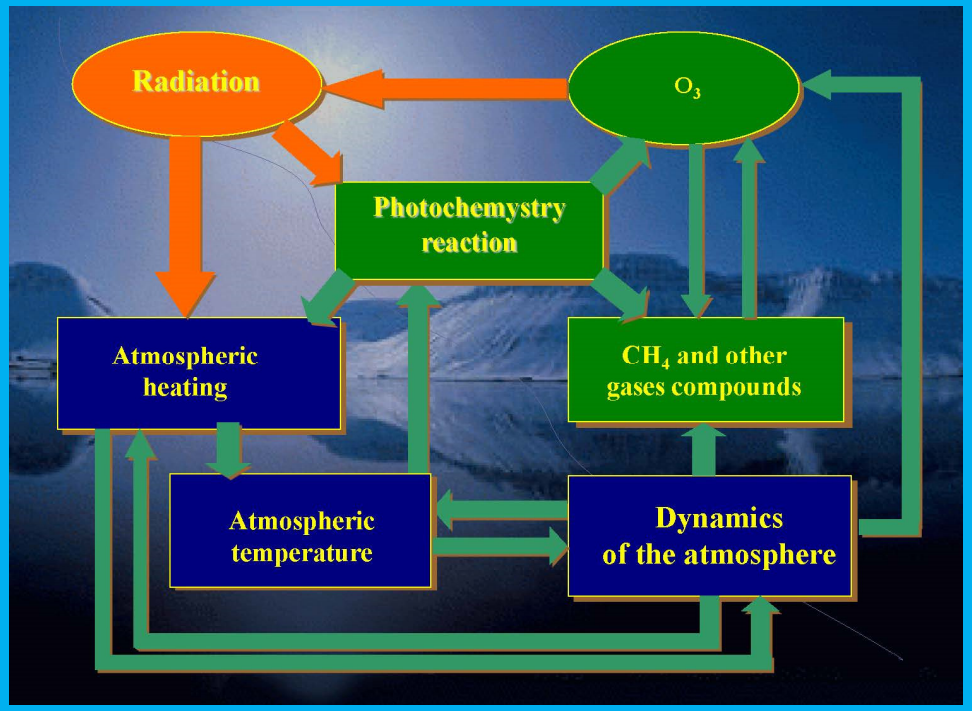
Numerical simulation of the Arctic methanehydrates influence on the climate variability and gas composition of the atmosphere

Maria Cherepova, Sergei Smyshlyaev

Chemistry Climate Model (CCM)

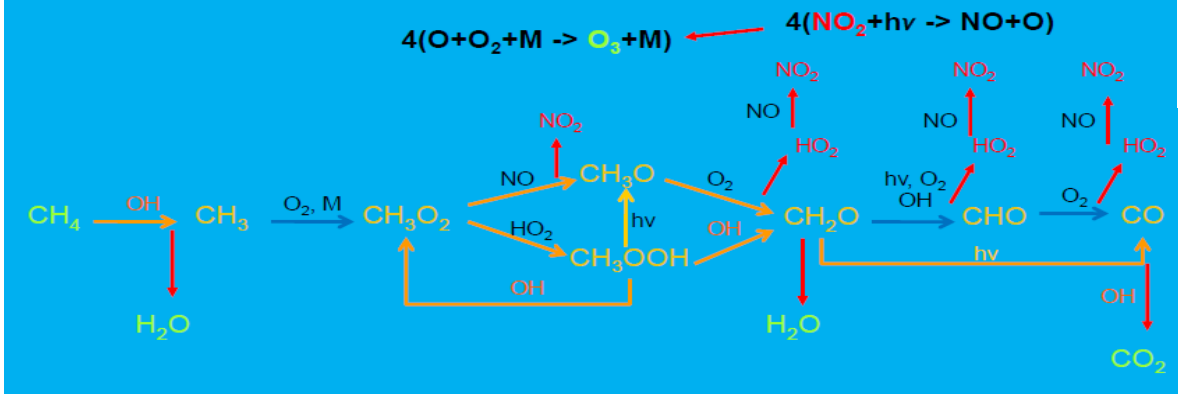


Boundary Conditions

[IPCC, 2007]

Methane sources

Natural sources	**145–260 Tg/a**
Wetlands	100-231
Termites	20–29
Oceans	4–15
Hydrates	4–5
Geological sources	4–14
Wild animals	15
Wildfires	2–5
Anthropogenic sources	**264–428 Tg/a**
Energy & industry (fossil fuels)	74–106
Landfills & waste	35–69
Ruminants	76–92
Rice agriculture	31–112
Biomass burning	14–88
Total sources	**503–610 Tg/a**

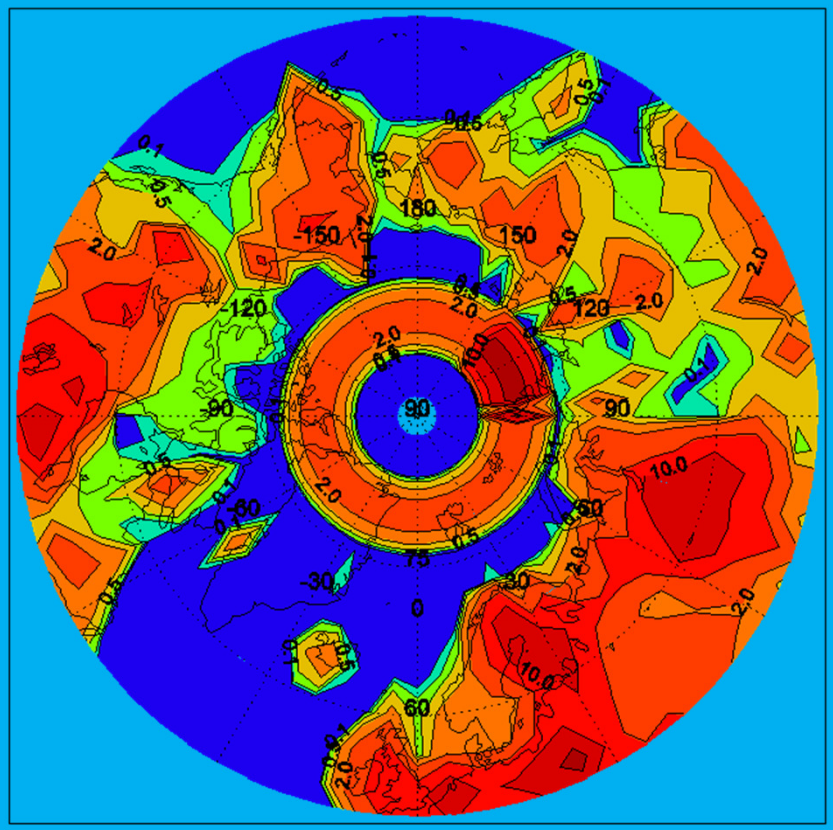


Methane hydrates reserves is 540 Pg (10^5 Tg) in Arctic (Russian)*[Shakhova et al.,2010]*

INM-RSHU CCM

- Spatial resolution 4°×5°
- 39 σ-levels, from surface to 0.1 hPa
- 74 gases
- aerosols, polar stratospheric clouds
- denitrification
- 174 of chemistry reactions
- 51 of photochemical dissociation processes
- Surface emissions (EDGAR, GISS NASA, GEIA, GEIA):
  - biogenic
  - antropogenic
- scenarios modern methane emissions from gas hydrates

Methane emissions [GISS NASA]



Conclusions and discussions

- We analyzed numerical modeling results with increased methane hydrates emissions(5,10, 20 times).
- Increase methane hydrates emissions results in increase concentrations CH_4
- We estimated influence of methane on OH content (there are positive feedback).
- We estimated O_3 in the lower layer of the atmosphere.
- We got temperature fields and compare fields for each of the increased emissions scenario.
- Methane hydrates emissions will increase with climate change.

Percent change in response to 5 times increased Arctic methane emissions