Siberian forests and Arctic Ocean as sources of aerosol particles?

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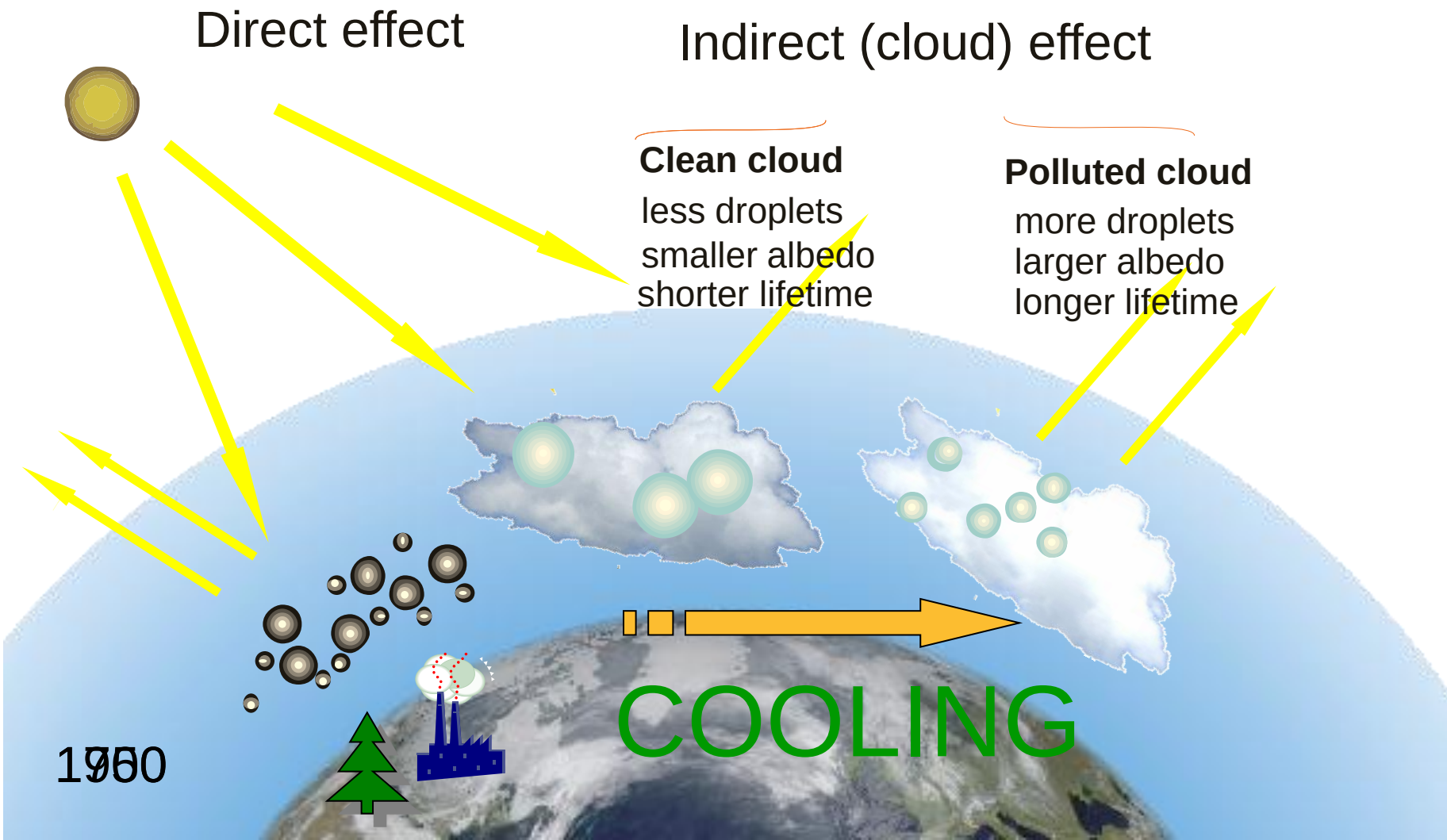
Direct and indirect aerosol climate effect



Aerosols in the Arctic

- **Important issue – poorly understood**
- **Long-term measurements are “the must” for understanding aerosol climate effects, feedbacks and changes in the Arctic**
- **List of unknown questions is long, here is a start:**
  - **Aerosol climate forcing in summer / winter Arctic?**
  - **Particle sources and transport?**
  - **Effects of BC now and future?**
  - **Aerosol effects on Arctic clouds?**
  - **Natural vs anthropogenic influences?**
  - **Validation for satellite retrievals and global models!**
  - **…..**

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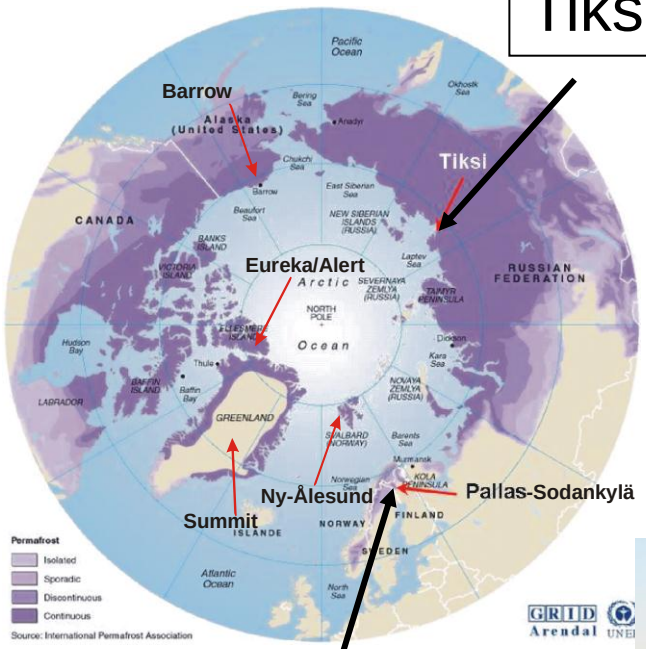
Long-term observations of aerosols in the Arctic

Tiksi (71°36'N; 128°53'E)



Pallas (68°00'N; 24°14'E)
FMI GAW station, operated since 1994

Quality control and pre-examination of the data

- **Instruments have been carefully calibrated prior to measurements**
- **Measurement system monitors automatically all the important operational parameters to assure the data quality (e.g. flow, temperature, RH, pressure, etc..) – results are corrected for these**
- **Results are corrected for losses in inlet lines**
- **All the data are cleaned from local pollution by careful pre-examination (using WD, WS, manual checking)**
  -> regional aerosol properties

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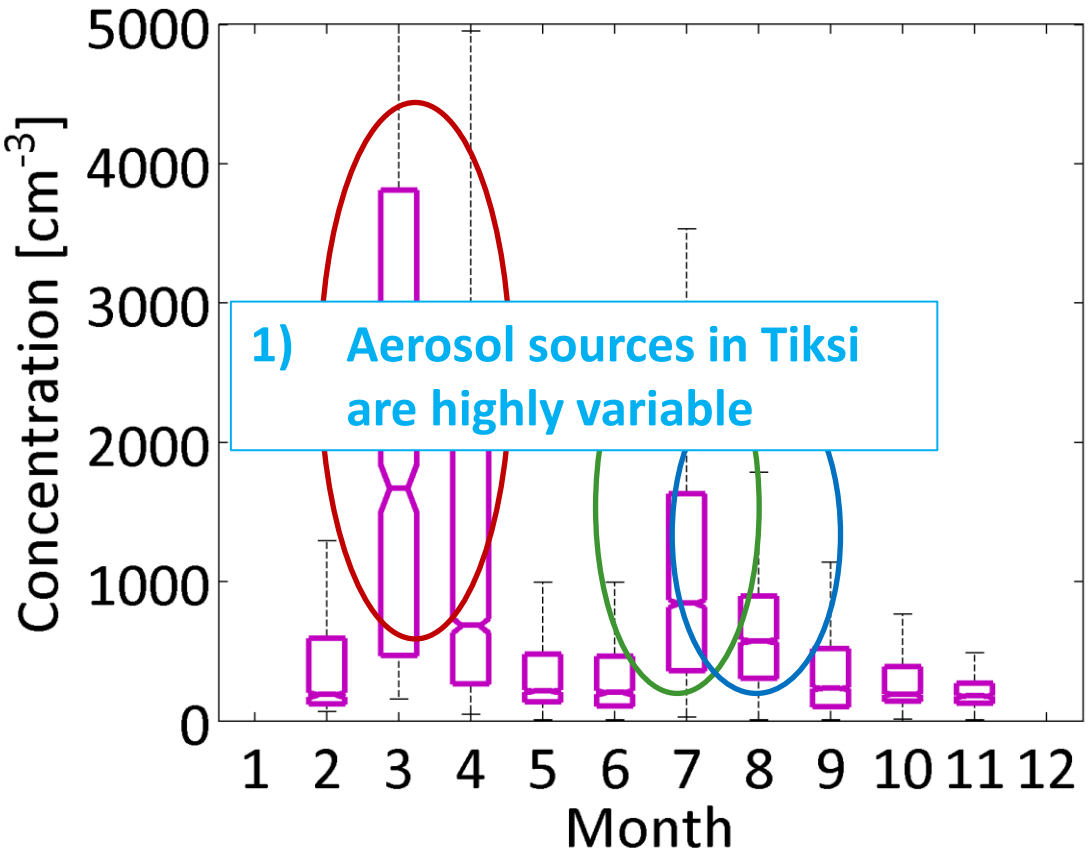
Aerosol seasonal variation

Arctic haze episodes in early spring?

Biogenic emissions in summer?

Open ocean – marine emissions in autumn?



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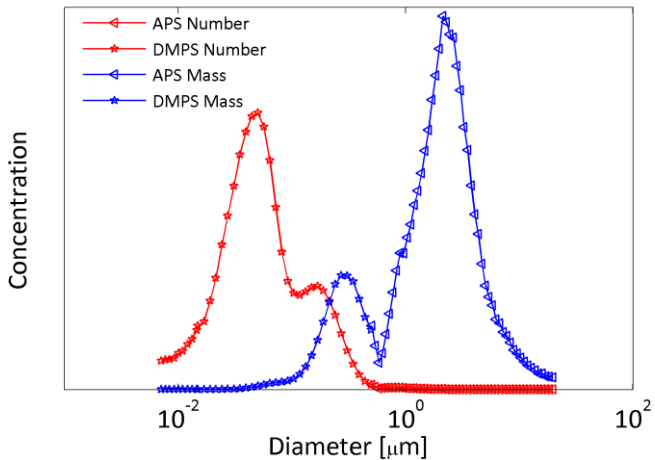
Aerosol size distribution measurements in Tiksi

Instruments:

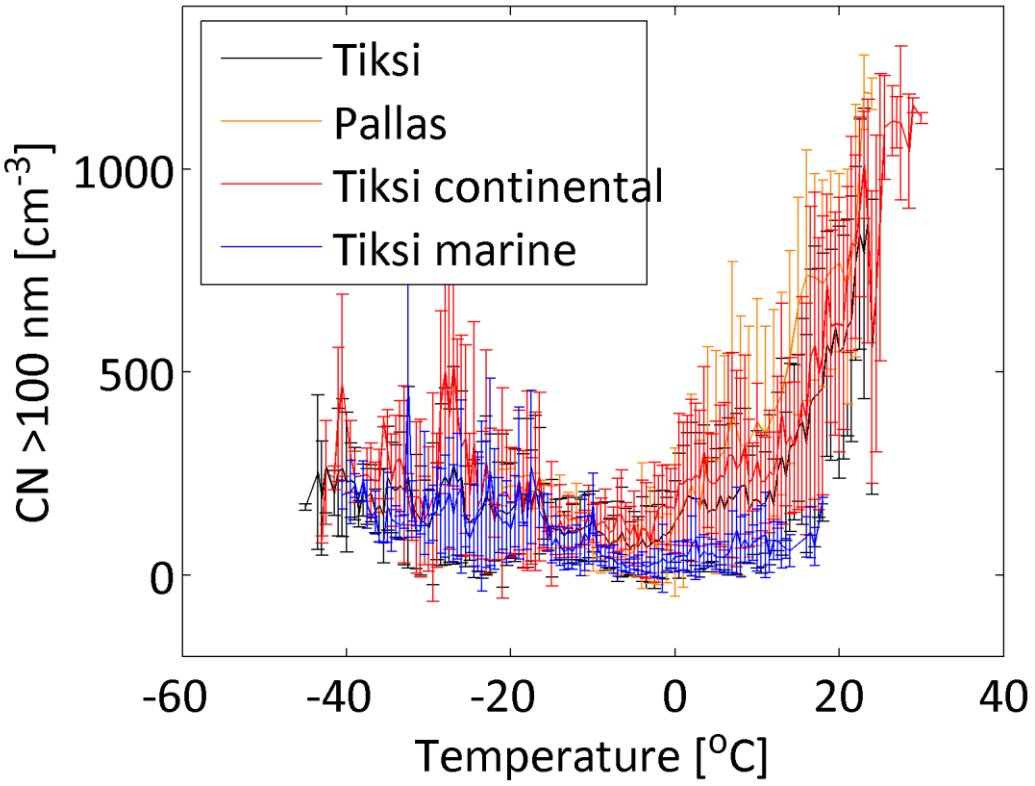
DMPS (7-600 nm)

APS (>500 nm)

Measurements started in July 2010

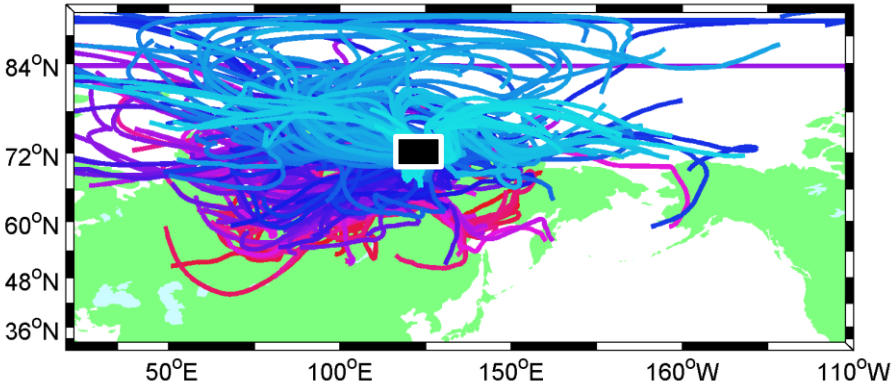


The particles with the biggest climate impact: > 100 nm concentration with temperature



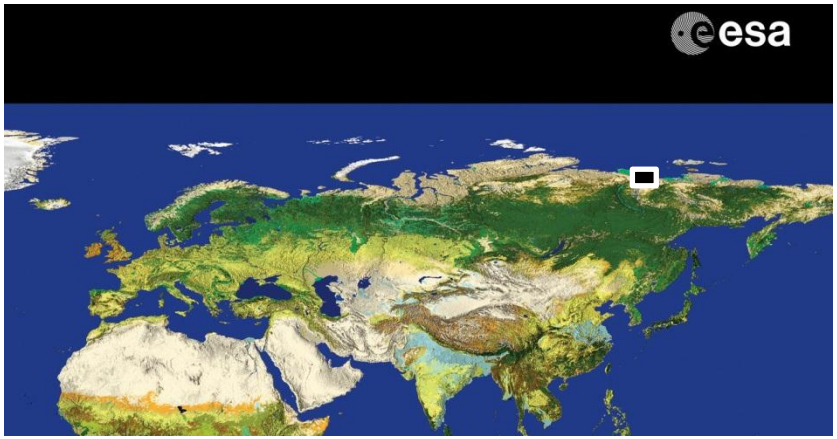
Air mass back trajectories in summer (July-August)

Back trajectories for July-August

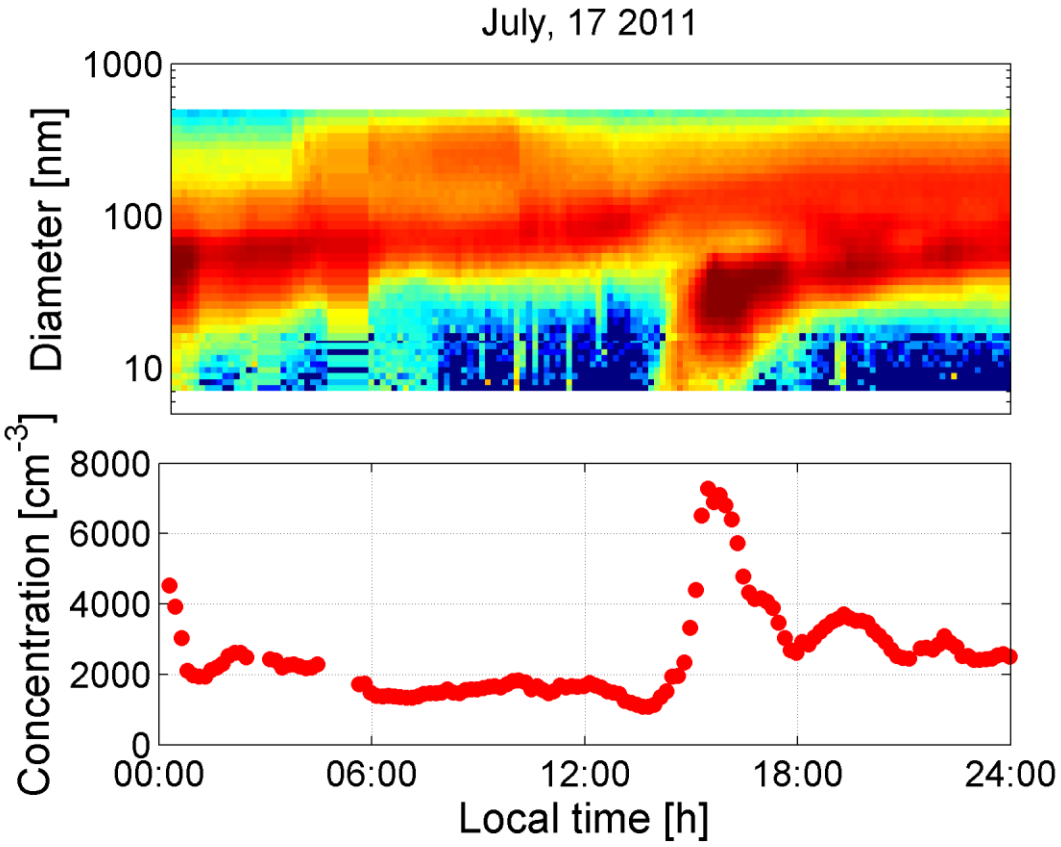


> 100 nm concentration

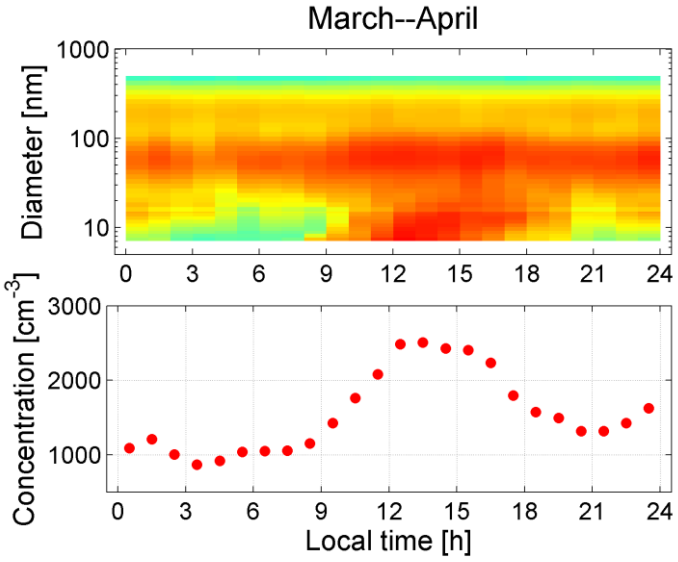
2) Siberian nature is a significant source for climatically important aerosol particles!

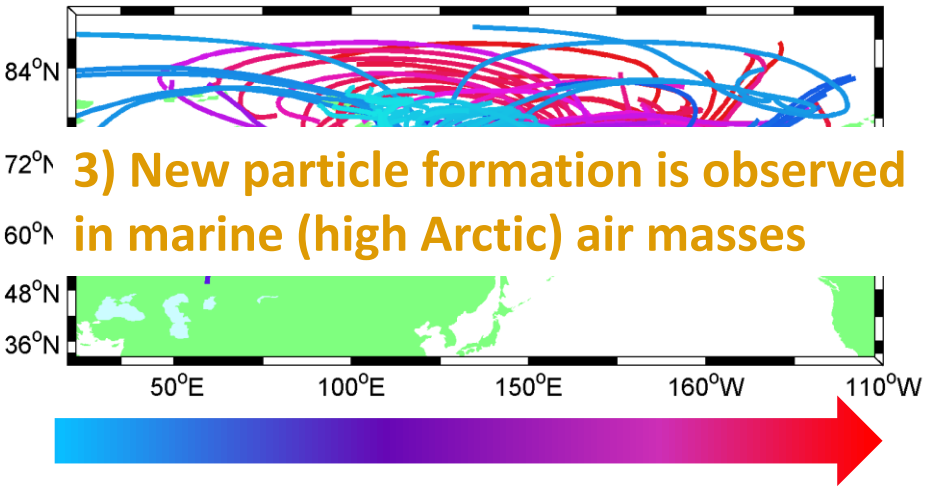


Particle formation and growth: the small particles are the seed for the big particles



Particle formation frequent in early spring





3) New particle formation is observed in marine (high Arctic) air masses

Where do these particles come from in a place like Tiksi?

Conclusions and future plans

- **Aerosol size distribution properties in Tiksi vary strongly between seasons and air mass types – comparison to other Arctic datasets is needed!**

- **High aerosol mass in summer connected with Siberian boreal forests and tundra temperature dependent (BVOC) emissions – what happens when climate gets warmer?**

- **New particle formation is frequent (!) and starts early in the spring. It seems to be favoured in marine (high Arctic) air masses – why?**

- **Measurements for detailed characterisation of aerosol optical and CCN properties are needed to better understand the results obtained and to convert them to climate impacts! (these are planned to initiate year 2012/2013)**

Thanks to all the contributors from Finland, Russia and USA and special thanks to our colleagues in Tiksi!

большое спасибо!

Thanks for your attention!

Kiva kun jaksoitte kuunnella!