We conduct research in order to assemble and disseminate scientific knowledge with the aim of finding solutions to various climate change problems.

We implement research with an emphasis on observing the global variation in greenhouse gases in the atmosphere, clarifying historical climate change and predicting future change, as well as assessing the global impact of climate change risks. We also study international adaptation and mitigation policies.

**Project 1**: Observations

**Sub-theme 1: Estimations of global flux distributions**

- Top-down estimations of GHG fluxes
  - Integrating atmospheric data
  - Improving inverse modeling
  - Improving the accuracy of flux distribution estimates
  - Estimating carbon fluxes from natural and anthropogenic sources
  - Improving terrestrial and oceanic carbon flux models

- Bottom-up estimation of GHG fluxes

**Sub-theme 2: From field observation to modeling**

**Project 2**: Climate Change Risks

- Expertise on greenhouse gas cycles
- Expertise on climate change risks
- Expertise on society and policies

**Project 3**: Low-carbon society

- Low-carbon society in Asia
- Mid-term policies in Japan and around the world
- International institution

Domestic and international research community

**Characteristics of the variation of greenhouse gas concentrations and projections for the future**

**Sub-theme 1: Estimations of global flux distributions**

- Top-down estimations of GHG fluxes
  - Integrating atmospheric data
  - Improving inverse modeling
  - Improving the accuracy of flux distribution estimates
  - Estimating carbon fluxes from natural and anthropogenic sources
  - Improving terrestrial and oceanic carbon flux models

- Bottom-up estimation of GHG fluxes
**Sub-theme 1:** Interpretation of projections
- Understanding the mechanisms of climate change
- Uncertainty assessment

**Sub-theme 2:** Development of a global spatial distribution model
- (climate, ecosystem, land use, water, agriculture)

**Sub-theme 3:** Risk management policy studies
- Cost-effectiveness
- Assessment of climate impacts, adaptation and cost-effectiveness

**Overall objective:**
proposing comprehensive risk management strategies

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**Project 2**
Through clarifying the actual climate change conditions and improving the accuracy of future projections, as well as assessing the risks of global climate change impacts, we provide scientific knowledge which will contribute to the drafting of climate change policies.

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**Project 3**
We provide scientific knowledge to promote the implementation of international climate change mitigation and adaptation policies by performing integrated assessment of various measures for the limitation of global GHG emissions and climate change impacts, and by proposing possible policy options which take into consideration the current international negotiations on climate change.

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**Climate change and global risk assessment**

**Projections of climate change and its impacts**

**Sub-national level**

**National level**

**Asia**

**The world**

**Low-carbon society**

**Steps of the leading countries towards LCS**

- **IPCC AR5**
- **Third mid-term plan**
- **End of the first commitment period of the Kyoto Protocol**
- **RIO+20**
- **COP17**
- **2011**
- **2012**
- **2013**
- **2014**
- **2015**
- **2020**
- **2030**
- **2050**

**Collaboration with other research projects**

- Research on adaptation
- Research on sustainable development
- Research on climate change risks
- Research on the Asian region
- Information and risk communication
- Database on GHG emissions

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**Comprehensive climate policy assessment and development of visions and scenarios towards a low-carbon society**

**Sub-theme 1:** Scenarios and implementation strategies for a low-carbon society in Asia

**Sub-theme 2:** Quantitative assessment of climate change mitigation policies in Japan and around the world

**Sub-theme 3:** Comprehensive risk information

**End of the first commitment period of the Kyoto Protocol**
Strategic monitoring of the global environment

**Ground-based monitoring of greenhouse gases**

We carry out long-term, high-frequency observations of greenhouse gases at our Cape Ochi-ishi and Hateruma monitoring stations. Taking advantage of these fixed monitoring platforms, we can concurrently observe various atmospheric components and develop observation techniques.

**Ship-based monitoring of greenhouse gases**

Through monitoring of the partial pressure of CO₂ (pCO₂) in the sea surface water on the Northern Pacific and Japan-Australia routes, we clarify the distributions and long-term variations of the difference in pCO₂ between the ocean and the atmosphere. We carry out simultaneous atmospheric observations of the longitudinal distributions and temporal variations of GHGs and related gases. In addition, on the Asian ship route we investigate the temporal variation and the distribution of atmospheric tracer gas emissions from Asian countries.
**Aircraft monitoring of greenhouse gases over Siberia**

We carry out monitoring of vertical profiles and temporal variations of greenhouse gases and their isotope ratios in the free troposphere over Siberia in order to understand the role of terrestrial ecosystems in the global carbon cycle.

**Carbon balance monitoring in forest ecosystems**

We conduct monitoring of CO₂ and other greenhouse gas fluxes in larch forests at the Fuji Hokuroku, Teshio and Tomakomai monitoring sites in Japan. We also monitor the carbon sequestration processes in forest ecosystems by means of direct observation from observation towers and by indirect means using spectral reflection. Furthermore, by standardizing observation methods and facilitating data distribution, we contribute to the strengthening of the Asian monitoring network.
Through the analysis of monitoring data collected by the Greenhouse gases Observing Satellite (GOSAT) called Ibuki, we work to refine the global distribution and seasonal and annual variation of CO2 and CH4 concentrations as well as terrestrial GHG sources and sinks in sub-continental regions.

Monitoring project for global warming effects on marine environment and alpine zone

Through monitoring of the water temperature and the distribution of reef-building coral and its symbiotic microalgae zooxanthellae, whose northern latitudinal limit is Japan, we assess the impact that rising water temperature, caused by global warming, has on marine life. Furthermore, with the help of automatic cameras placed in alpine areas, as well as aerial pictures, we monitor and assess how climate change affects the seasonal change and the spatial distribution of alpine flora. We also engage in standardizing observation methods and providing data to the general public.

Rising sea surface temperature around Japan in the past 100 years in winter (source: Japan Meteorological Agency) and northward range expansion of corals

Seasonal change on Mt. Tateyama photographed from a fixed spot (2010)
In addition to developing and maintaining databases comprised of data from natural sciences such as global environmental monitoring, as well as social and economic sciences related to climate change, CGER is engaged in developing analysis tools and improving the support system in order to facilitate the efficient use of these databases.

As well as operating various offices and secretariats for global environmental research and supporting research carried out at NIES and other research institutes using the supercomputer system, CGER promotes collaboration among researchers. CGER also facilitates the efficient dissemination of research results, and contributes to raising awareness about environmental problems among the public.

NIES GOSAT Project Office
The NIES GOSAT Project Office carries out routine processing of monitoring data from the Greenhouse gases Observing SATellite (GOSAT) “Ibuki”, performs data validation in order to assess and improve the quality of data, and provides data products to registered researchers and to the public.

http://www.gosat.nies.go.jp/index_e.html

Global Carbon Project (GCP) Tsukuba International Office
The GCP is engaged in developing an international research network and program on carbon cycle research and carbon management.

http://www.cger.nies.go.jp/gcp/

Office for Coordination of Climate Change Observation, Japan (OCCCO)
The OCCCO, the secretariat of the Japanese Alliance for Climate Change Observation (JACCO), supports the activities of JACCO to promote cooperation among organizations, ministries and institutions with the aim of developing a comprehensive climate change observation system in Japan.

http://occco.nies.go.jp/e_index.html

Greenhouse Gas Inventory Office of Japan (GIO)
GIO engages in the preparation of Japan’s national greenhouse gas (GHG) inventory, as well as assists developing countries in Asia primarily by capacity building activities in improving their national GHG inventories.

As well as conducting research aimed at investigating the global environmental system and clarifying the factors which influence climate change, the Center for Global Environmental Research (CGER) performs climate risk assessments and future climate change projections alongside several other related research projects. In addition, CGER conducts research on climate policies for environmental preservation and actively contributes to finding solutions for the protection and conservation of the environment.