

# The ICES Foundation and its Mission

Dr. Robert Bishop – President  
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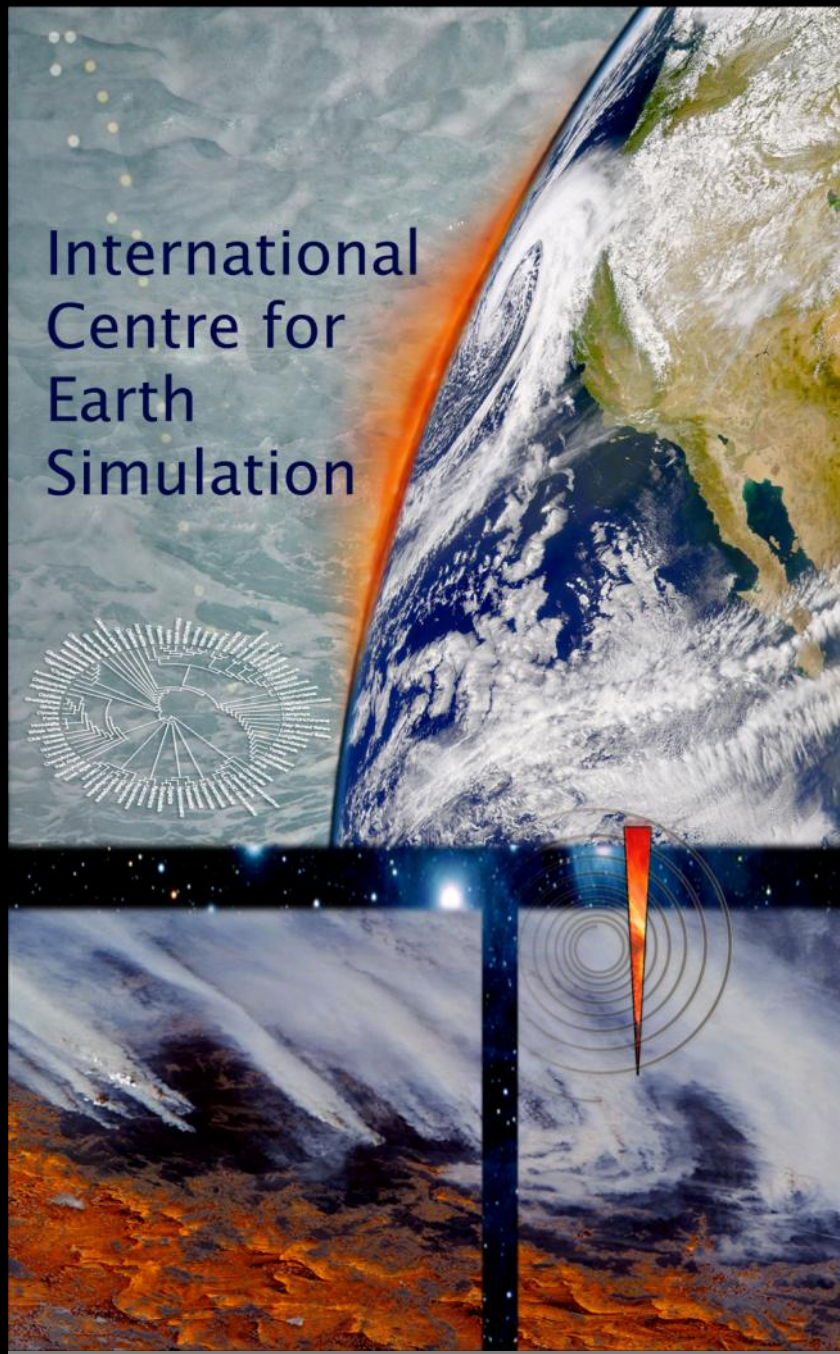
[www.icesfoundation.org](http://www.icesfoundation.org)



**Helping guide the successful transformation of human society  
in an era of rapid climate change and frequent natural disasters.**

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International  
Centre for  
Earth  
Simulation



## Formed in January 2010, the Geneva-based ICES Foundation aims to:

- Improve preparation & predictability for climate change and natural disasters - understand precursor signals, and thereby prevent 'multiple synchronous collapse' in our societies
- Improve our understanding of planet Earth by holistically integrating all sciences, from the natural sciences through to the socioeconomic sciences
- Utilise advanced computing, modelling, simulation and visualisation to create a 'near real-time' high-resolution digital model of Earth, with inputs from sensor networks and the Internet.

# The frequency of recent major disasters indicates that society is ill prepared!

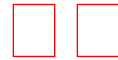
- Japan earthquake, tsunami, nuclear contamination
- Earthquakes in New Zealand, China, Chile & Haiti
- Floods in Queensland, China, Pakistan, Brazil
- Heat-waves in Russia, Europe & the USA
- Wildfires in Australia, Europe & USA
- Ash clouds in Iceland & Chile
- BP oil spill
- Katrina

# Such catastrophes cost \$ billions in damage, repair and reconstruction

- With enormous loss of life
- With little predictability as to when they start or finish
- And no understanding as to when a catastrophe in one domain will create a disaster in other areas of society!

*The frequency of such events will accelerate as the world's population increases from 7B to 10B by the end of the 21<sup>st</sup> Century.*

# Has science become specialized & reductionist?



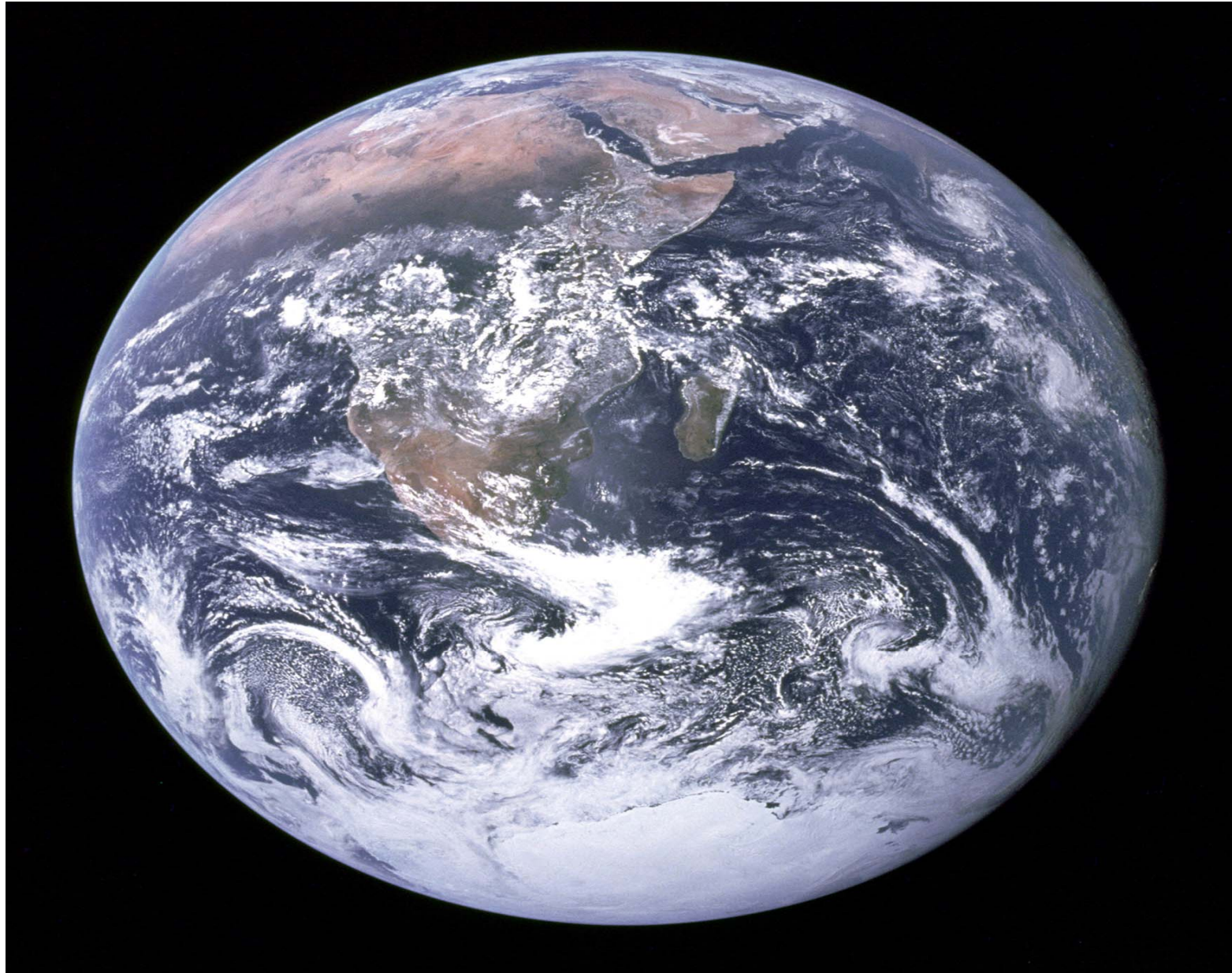
- In Research
- In Research Funding
- In Publishing
- In Peer-review
- In Conferences
- In University Faculties
- In Government Departments & Ministries

*We have been treating the sciences as silos and stovepipes for more than 200 years!*





Whereas Nature is Borderless & Integrated!





From over-specialization, we miss important cues and pre-cursor signals that Nature gives us, and which can help us avert natural & man-made disasters!

## Nature is integrated and built from multiple interlocking sub-systems:

- Risk in any one sub-system spills over into risk in the other sub-systems .... There is a high degree of coupling!
- This 'bleed-over' effect causes feedback loops, reverberation and amplification
- Certain 'tipping points' exist, beyond which multiple synchronous collapse can occur
- And the danger is exacerbated when we treat each sub-system separately; that is, when we over-specialize!

## A recent example is events in Japan:

- M9.0 quake off-shore on 11/3/2011
  - Followed by 10 metre high tsunami
  - Northeast Tohoku coastline totally devastated
  - 500,000 displaced people, 23,000 fatalities, \$285B+ cost
  - Fukushima Daiichi Plant - 4 Nuclear reactors destroyed
    - contaminated air, water, sea, food supply
    - loss of power supply, disrupted supply chain worldwide
    - resignation of Japanese PM - collapse of TEPCO?
    - change in nuclear safety guidelines worldwide
    - change of nuclear energy policy in Germany & Switzerland
- ... Multiple synchronous collapse of interlocking systems!*

# ICES will apply 'global integrative thinking' and advanced technology to this complex problem:

- Based on modelling, simulation, visualisation & optimisation
- And 'near real-time' high-resolution digital models of Earth
- Deploying high performance computing
- Integrating new sensor networks
- Remote sensing
- Satellite data
- In-situ
- Internet

*... using publicly available data, including ACRE data!*

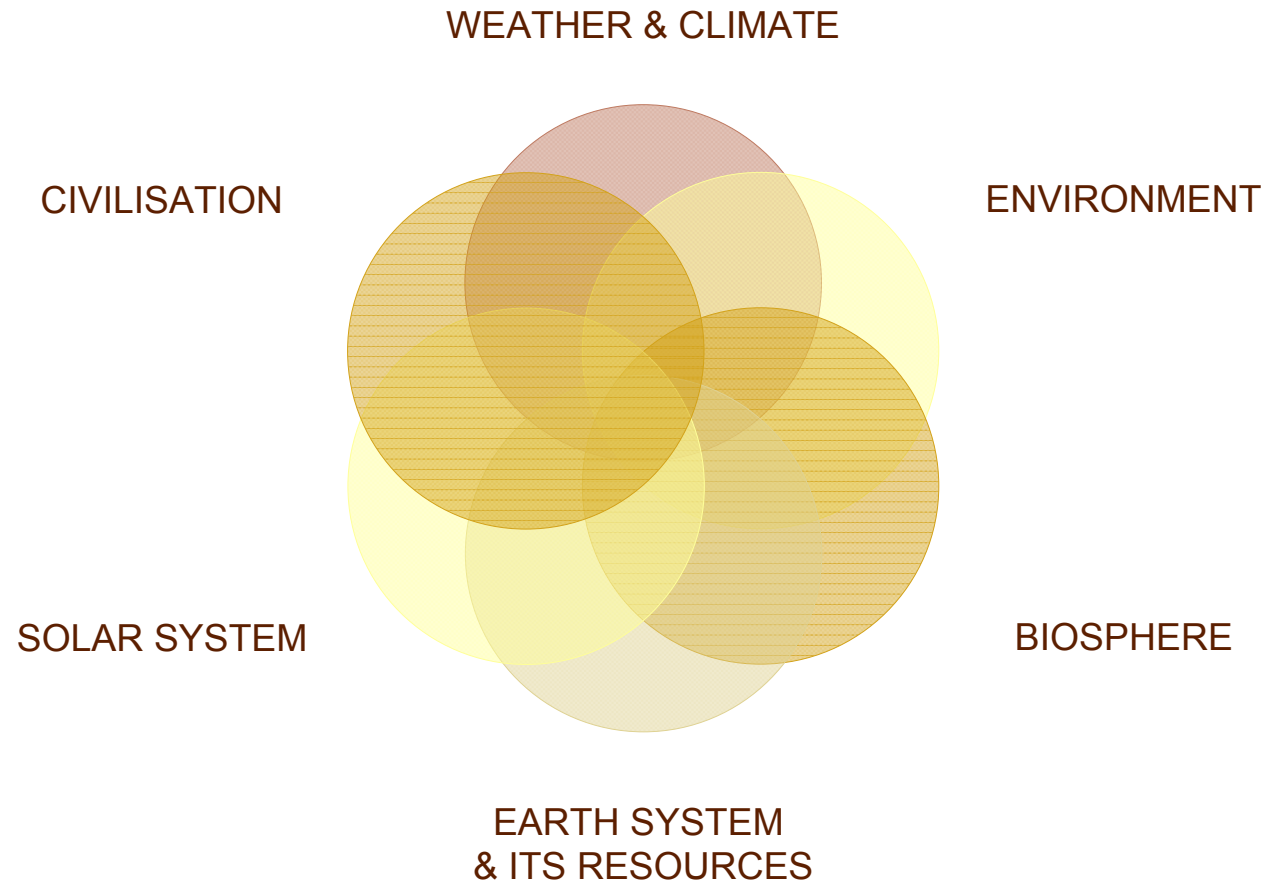
# The ICES Challenge ...

To model the Earth System as a whole - an **Holistic Approach**

- Multi-science (physical, chemical, geo, bio, socio-economic)
- Multi-scale (spectral, spatial & temporal)
- Unitary & seamless

*... to integrate and not just dis-integrate!*

# ICES will focus on the bigger picture





# ICES will extend, embrace & integrate ...

From Natural Sciences to Socioeconomic Sciences

Weather

Food

Climate

Water

Environment

Health

Solar, Planetary

Education

Cosmology

Energy, Transport

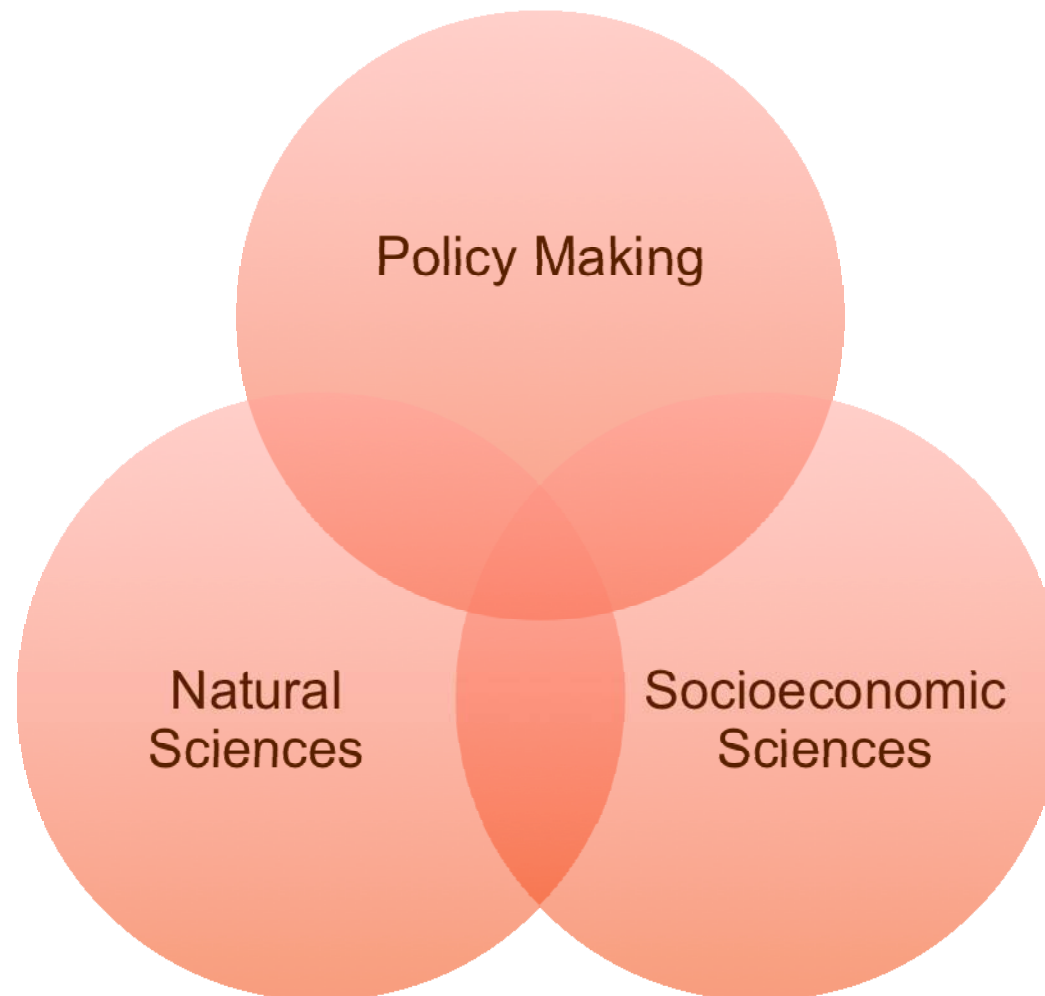
*... a 10-year path to understanding the planet, and generating a unitary knowledge system leading to better & safer policies and governance – a CERN for the Climate!*

# Modelling, Simulation, Visualisation, Optimisation are tools which can provide a number of answers

- They can answer difficult 'what if' questions
- They can integrate the multiple technologies
- They can help integrate the multiple scientific bodies
- They can help educate the public & our policy makers
- They can supply visualization of very complex processes
- They demand a 'real-time' high-resolution digital model of Earth

*... using inputs from partners & collaborators worldwide!*

Even so, it is a big challenge to bridge from scientific understanding to policy creation!



# ICES Organisation Structure

- Geneva based
- Not-for-profit Foundation
- **Public-Private Partnership**
- Broad Scientific Participation
- Inter-disciplinary Governance
- Participation by Int'l Organisations
- **Experts Committee, Ethics Committee**

# ICES Experts Committee

- **Dr. Ghassem Assrar:**

*Director, World Climate Research Programme, WMO, Geneva*

- **Professor Martin Beniston:**

*Chair for Climate Research & Director, Institute of Environmental Science, Uni Geneva*

- **Professor Marc Palange:**

*Dean of the School of Architecture, Civil & Environmental Engineering, EPFL*

- **Dr. Michael Rast:**

*Head of the Programme Planning Office, Directorate of Earth Observations, ESA*

- **Professor Jagadish Shukla:**

*President, Institute of Global Environment and Society, USA*

# Why Public-Private Partnership?

- Fast
- Agile
- Simple
- Flexible
- Responsive
- Non-political
- Independent
- Private sources of funding
- Using publicly available data, ideas, & publications



# Why Geneva?

- History of international humanitarianism
- Global city in a neutral & trusted country
- Science literate, educational infrastructure
- Proximity to global policy bodies:

WMO (*WCRP*, *WWRP*), IPCC, GEO

WHO, UNHCR, ICRC, UNISDR

UNEP, IUCN, WWF, WBCSD, R20

WTO, WEF, UNCTAD, ILO, ITU, EBU, ISO

- **Partnerships:** CERN, ETH, Canton Universities
- **Corporates:** Reinsurance, pharma, energy, food, etc
- **Networked** into national and global research centres

# ICES Top Priorities

- Drive **next generation** modelling & simulation by integrating weather, climate, bio, geo, space & social-economic sciences
- Support training of next generation **'holistic thinkers'**
- Develop **world-class** HPC leadership and consultation skills
- Supply **HPC consultation support & thought leadership** to national and regional centers worldwide (especially in the developing countries)
- Leverage education, media and communications through **Geneva-based International Organisations & NGOs**

# ICES Phase 1 Plan

- Form core team of 3 System Engineers & 2 Scientists
- Build IT tools for trans-disciplinary model development
- Create real-time high-resolution digital Earth model
- Begin 3-year program & create proof of concept
- Establish legal framework and governance
- Establish financial sources for the future
- Establish global network of partners
- Prepare for major step-up in Phase 2:
  - Global centre of excellence
  - Install supercomputing
  - Scientific staff ~ 100 (including secondments)
  - Annual budget ~ chf 50m

# The ICES 10-Year Challenge Roadmap

- Extend forecasting ability to seasonal, annual & interannual (since weather factors into 90% of all natural disasters)
- Improve global-local coupling of weather/climate models
- Incorporate aerosols, cloud physics & convection activity
- Incorporate advanced land usage and vegetation models
- Incorporate seismology, volcanology & models of the mantle
- Include solar dynamics, space weather & Sun-Earth coupling
- Integrate all these factors into a better understanding of Earth's climate, water cycle, energy & resource dynamics
- Outreach to international & socioeconomic policy setting bodies



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