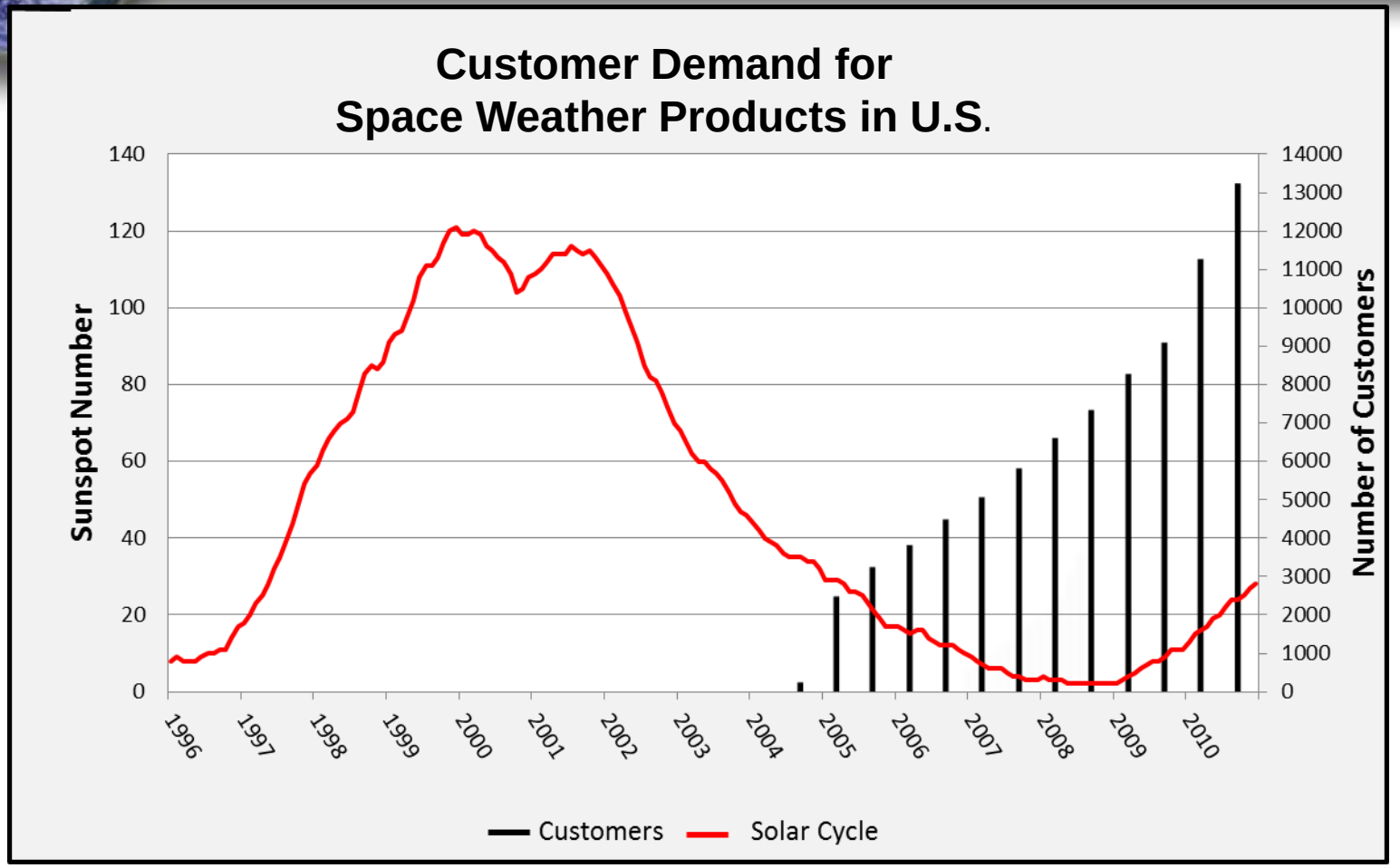
International Space Environment Service and World Meteorological Organization Activities

Terry Onsager
National Oceanic and Atmospheric Administration
Space Weather Prediction Center

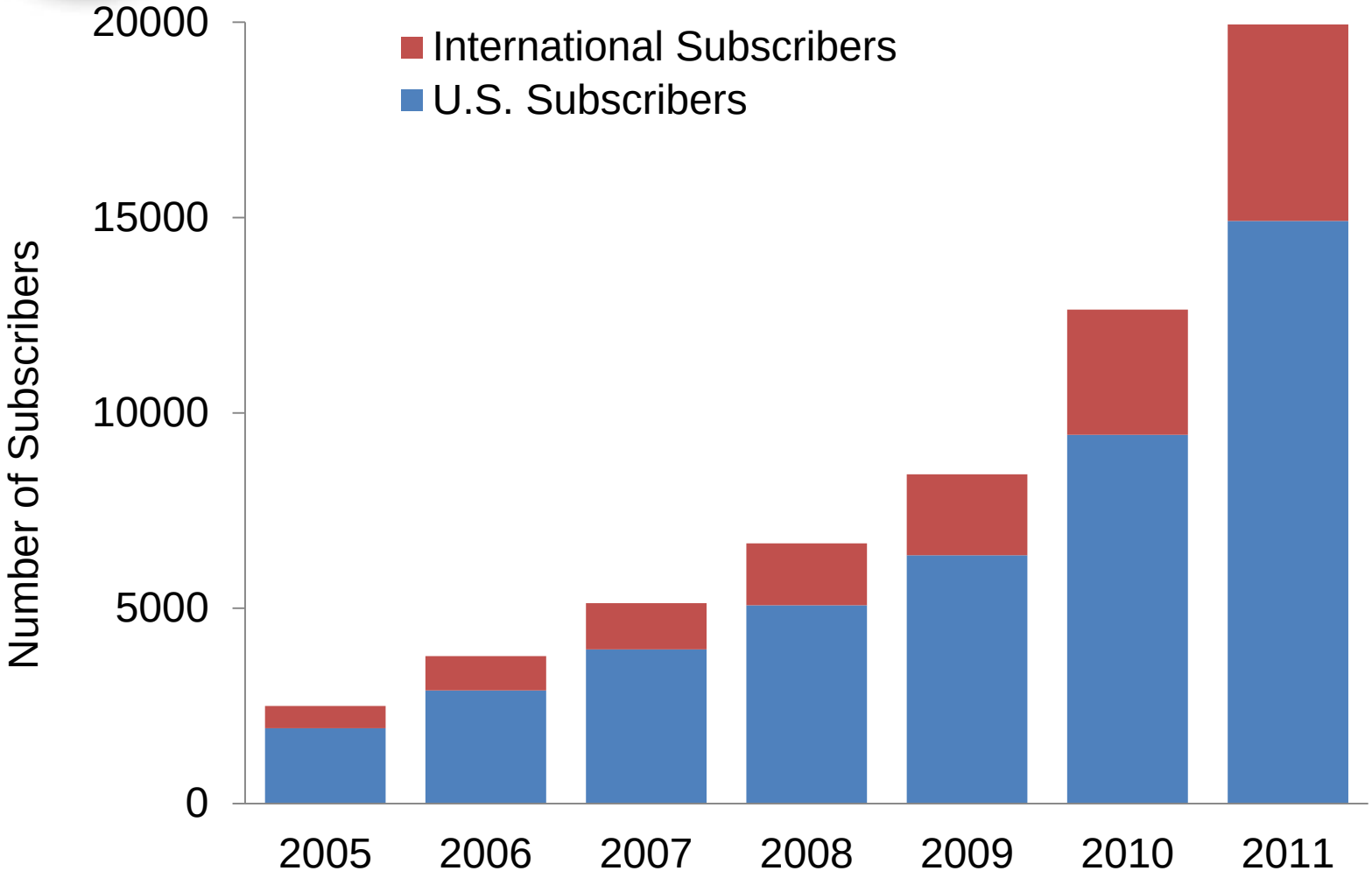
Global Customers for Space Weather Services Continue to Increase



Examples of global airline customers:

Air Canada	Air China	Air New Zealand	American Airlines	British Airways
Cathay Pacific Airway	Korean Air	Lufthansa	Qantas Airways	United Airlines

International and U.S. Subscribers to NOAA Space Weather Products



Global Partners can Accelerate Advances in the Space Weather Enterprise

Benefits of enhanced international participation:

- Integrated system of ground-based and space-based instruments
- Active research on numerical prediction models of the coupled Sun-Earth system
- Shared responsibilities for comprehensive services
- Increase global awareness and advocacy

By fostering the engagement of contributing partners, we put additional resources to work in solving the problems of interest to all of us.

Partnerships Needed to Maintain our Obsering Infrastructure

- Space-based observations of space weather drivers (solar active regions, CMEs, solar wind at L1) can be obtained by a few countries and shared

  - Encourage international organizations (WMO, CGMS, UNCOPOUS) to advocate for a plan among countries with satellite capabilities

- Ground-based measurements of local disturbances require commitment from each individual country

  - Foster the establishment of operational space weather programs within countries to ensure local support for data infrastructure

  - Leverage infrastructure that already exists for weather and climate

Mechanisms for Coordinating our Efforts

- International Space Environment Service
- World Meteorological Organization
- International Civil Aviation Organization
- Coordination Group for Meteorological Satellites
- UN Committee on the Peaceful Uses of Outer Space
- International Space Weather Initiative
- International Committee on GNSS

- 14 Regional Warning Centers plus affiliates
- Primary organization engaged in the international coordination of space weather services since 1962
- Share data and information for consensus forecasts
- Issue forecasts, alerts, and warnings for local region in the local language
- Conduct customer-focused event analyses

International Space Environment Service

14 Regional Warning Centers

MCT/INPE Space Weather Program: EMBRACE

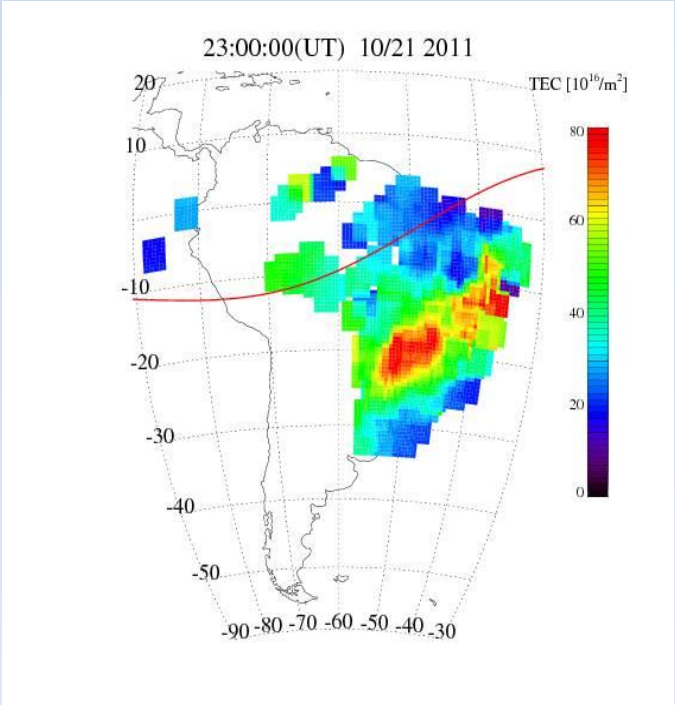
Mission: *To Monitor Solar-terrestrial environment , ionosphere and ground , and to predict possible influence in the technological and economical activities.*

http://www.inpe.br/climaespacial/index.php

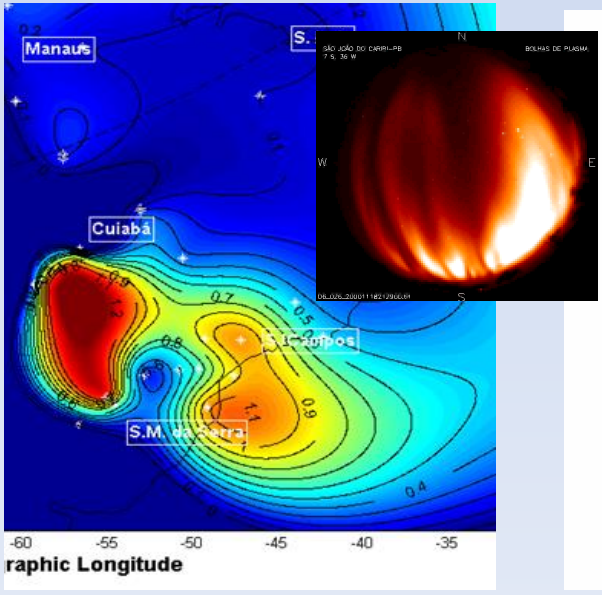
ISES RWC Brazil: On going Space Weather monitoring from ground (some highlights)

SPECM Radio Spectrometer 1-40 GHz

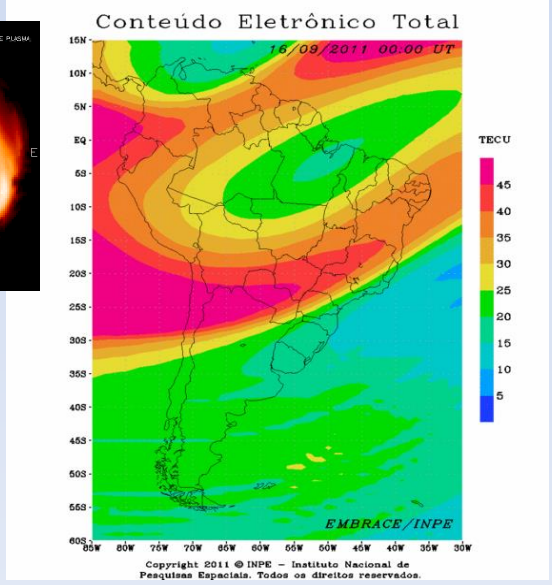
GPS TEC Map over South America (24 hours of delay)



Plasma bubbles and scintillations (realtime)



Ionospheric model (TEC 24 hours)



RWC Tokyo

The 1st AOSWA Workshop

(22-24 February 2012, Imperial Mae Ping Hotel, Chiang Mai, Thailand)

Asia-Oceania Regional Space Weather Workshop

Next workshop is in China.

AOSWA

Asia-Oceania Space Weather Alliance

Approximately 80 people from 30 institutes in 10 countries including the ICAO Asia and Pacific Office, Bangkok, Thailand

Forecasting, Data Preservation
(Application and Stewardship)

Workshop/Collaboration/
Data Exchange

Industrial Use/
Practical Use

Research Works

AOSWA
Asia-Oceania Space Weather Alliance

Four functions

International Activities

Education/
Capacity Building

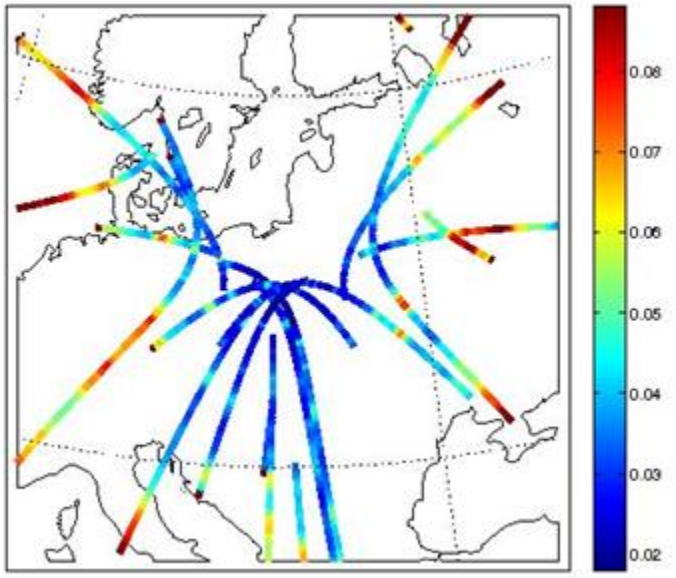
Information Exchange
(Web site/News Letter)

Space Weather School/
Text book & Contents

Regional Warning Center – Warszawa, Poland

- Ionospheric Storm Index developed with Russian Federation colleagues
- New ionosonde on Svalbard Island installed
- Total Electron Content and scintillation (phase and amplitude) being provided from Warsaw GPS stations
- Morphology of scintillation under study

Depressions in Total Electron Content



Hornsund, Svalbard Ionosonde

Regional Warning Center – Jeju, Korea

- Newest member of ISES – November, 2011
- Korea Space Weather Center established and new forecast office opened – November, 2011
- Operational reception of ACE data – Real-time Solar Wind Network – February, 2012

Space Weather in the World Meteorological Organization (WMO)

- Inter-Programme Coordination Team on Space Weather formed in May, 2010
- First version of space weather observing requirements developed (June, 2011)
- High-priority observing gaps considered – Statement of Guidance submitted to WMO Expert Team on Evolution of Global Observing Systems (April, 2012)
- Web-based Space Weather Product Portal initiated (January, 2012)
- Plan to introduce multi-language training on Portal
- Coordinating with ICAO on airline service requirements

WMO Space Weather Product Portal

Ten countries now contribute space weather products on the portal

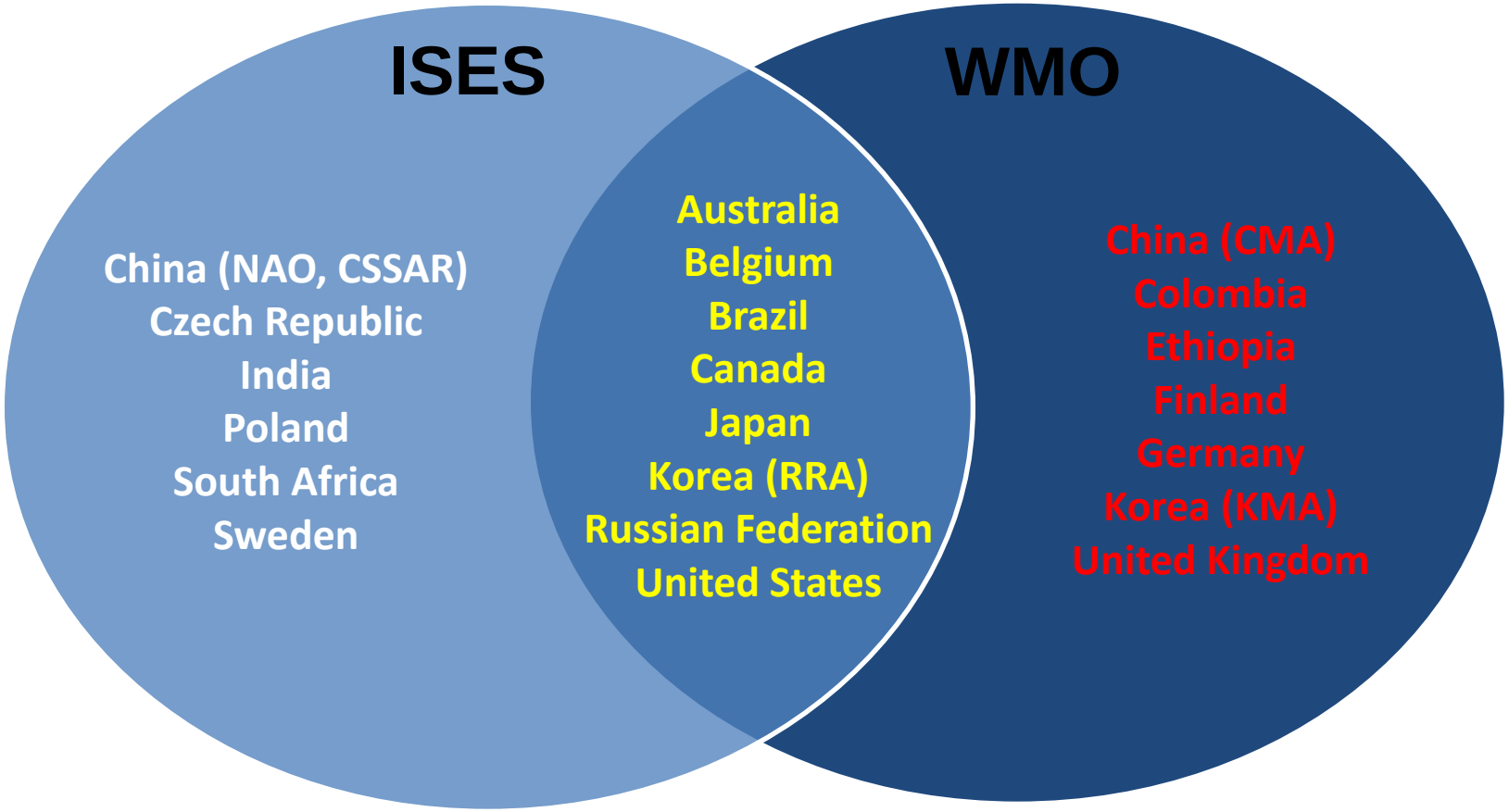
- Enhance awareness of available products
- Enable use by partners at no cost
- Increase global participation in space weather services
- Facilitate intercomparison and coordination of products

http://www.wmo.int/pages/prog/sat/spaceweather-productportal_en.php

WMO Inter-Programme Coordination Team on Space Weather (ICTSW)

No Single Organization Coordinates all Global Space Weather Service Providers

Worldwide Space Weather Service Providers



Space Weather Activities in United Nations Organizations

- International Civil Aviation Organization (ICAO) – WMO Coordination
  - Identify data and service needs to support airline requirements
- UN Committee on Peaceful Uses of Outer Space – Long-Term Sustainability of Space Activities – Space Weather Working Group
  - Document space weather impacts on space utilization (2014)
- International Committee on Global Navigation Satellite Systems (GNSS)
  - Workshop on Interference Detection and Mitigation (June, 2012)
- International Space Weather Initiative
  - Deploy instruments and encourage worldwide research

Summary

- Growing global interest – customers and service providers
- Opportunities exist to improve data, research, and services
- Observing requirements, gap analysis, and product portal are in place; forecast-center coordination increasing
- Challenges:
  - No single organization coordinates all service centers
  - New service centers need support from existing centers to develop their initial capabilities
  - Research-to-operations effort needs coordination - Combining operational and research objectives can make a compelling case for coordinated international action