



## SESSION: GEOSPATIAL TECHNOLOGIES, DIRECTIONS AND STANDARDS

### Speakers:

- Mark Reichardt, President & CEO, Open Geospatial Consortium
- Sanjeev Trehan, Regional Manager-Geospatial Division, SAARC, Trimble Navigation
- Srinibas Patnaik, Senior Director, SAARC, DigitalGlobe
- Dwaipayan Dighal, Regional Manager, Intergraph India
- M.Rajathurai, Technical Manager-Utilities and Mapping, Bentley







## Easing Technology Adoption and Integration in Changing Times

### South Asia Geospatial Forum 9 February, 2015

Hyderabad, India

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## Increasing Global Complexity



- Global Change creates complex problems
- The problems cut across multiple domains
- The effects are local to regional to global in scope
- The integration of Geospatial data and information into workflows is critical to address issues such as climate change, water resource management, and smart / sustainable cities.





## Thousands of Data Sources



- The number of sources of GEO data is increasing geometrically, e.g.
  - UAVS
  - Mobile Devices
  - Citizen Scientists
  - Increase in Space borne and airborne sensors
  - CCTVs, Flood gauges
- In many cases there are untapped resources
- Increasing complexity



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## Today – A myriad of geospatial data sources and producers



**Then:  
Traditional  
GIS**



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**Now:  
All location  
technologies**

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# OGC / ISO Geospatial Standards



**Rapid discovery, access, fusion and application of location information for:**

- Catalogue
- Geography Markup Language
- KML
- Observations and Measurements
- SensorML
- Sensor Observation Service
- Sensor Planning Service
- Web Coverage Service
- Web Feature Service
- Web Map Service
- Web Map Tile Service
- Web Processing Service

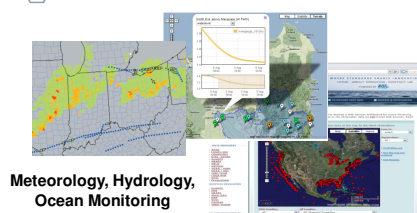


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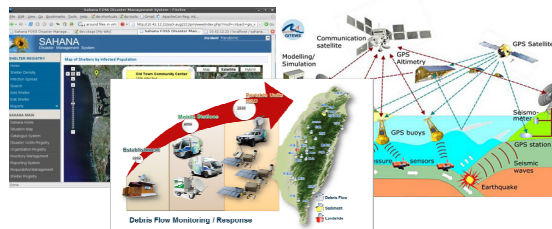
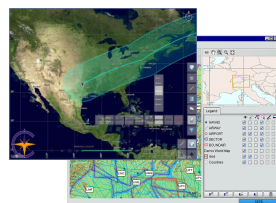
Complete OGC Standards List: <http://www.opengeospatial.org/standards>

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## OGC / ISO Standards Implementation is Global



**Mass Market Real Time Traffic Alerts**



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## Standards Promote Interoperability



- Without interoperability, you have:
  - Missed opportunities for information sharing and improved decision making
  - Greater time and cost
  - Difficulty adding new capabilities
  - Duplication of effort



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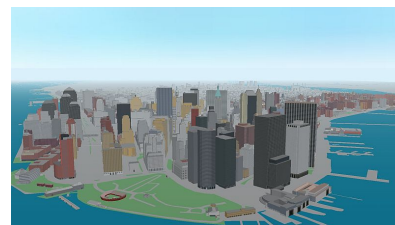
<http://whatweekly.com/2013/01/30/remembering-the-great-baltimore-fire/>

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## Standards – Enabling Smart Cities Urban Resilience



- Urban Planning / Operations
- Emergency Mgt / Response
- Public Safety
- Transportation / Routing / Logistics
- Indoor navigation
- Retail Site analysis
- Sustainable / Green Communities
- City Services Management
- Noise abatement
- Telecommunications placement
- Many other uses...



Source: Thomas Kolbe, Berlin TU

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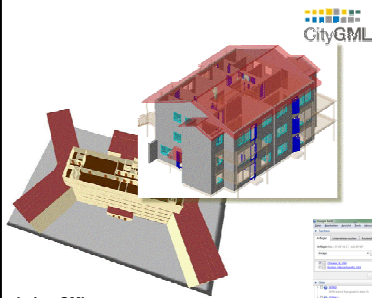
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## Smart City Standards Emphasis - Mobile



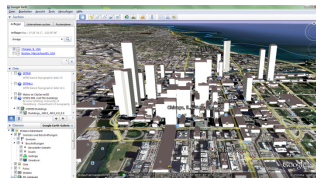
- Geotagged SMS messages
- Augmented Reality Markup Language (ARML) 2.0
- Points of Interest
- 3D Visualization
- Indoor Navigation (IndoorGML)
- Sensors / Internet of Things (IoT)



IndoorGML



Augmented Reality Markup Language 2.0 (in development). Source: Wikitude



OGC W3DS In Google Earth (Chicago)  
Source: Universitat Heidelberg, GIScience



Netduino



NEST

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## Climate Change and Urban Vulnerability



Rank	Country	Urban Agglomeration	Exposed Assets Current (\$Billion)	Exposed Assets Future (\$Billion)
1	USA	Miami	416.29	3,513.04
2	CHINA	Guangzhou	84.17	3,357.72
3	USA	New York-Newark	320.20	2,147.35
4	INDIA	Kolkata (Calcutta)	31.99	1,961.44
5	CHINA	Shanghai	72.86	1,771.17
6	INDIA	Mumbai	46.20	1,598.05
7	CHINA	Tianjin	29.62	1,231.48
8	JAPAN	Tokyo	174.29	1,207.07
9	CHINA	Hong Kong	35.94	1,163.89
10	THAILAND	Bangkok	38.72	1,117.54
11	CHINA	Ningbo	9.26	1,073.93
12	USA	New Orleans	233.69	1,013.45
13	JAPAN	Osaka-Kobe	215.62	968.96
14	NETHERLANDS	Amsterdam	128.33	843.70
15	NETHERLANDS	Rotterdam	114.89	825.68
16	VIETNAM	Ho Chi Minh City	26.86	652.82
17	JAPAN	Nagoya	109.22	623.42
18	CHINA	Qingdao	2.72	601.59
19	USA	Virginia Beach	84.64	581.69
20	EGYPT	Alexandria	28.46	563.28

Table 2: Top 20 cities ranked in terms of assets exposed to coastal flooding in the 2070s (including both climate change and socioeconomic change) and showing present-day exposure  
(Source: Nicholls et al (2007), OECD, Paris)

Source: [www.oecd.org/env/cc/39721444.pdf](http://www.oecd.org/env/cc/39721444.pdf), from "Ranking of the World's Cities Most Exposed to Coastal Flooding Today and in the Future", © OECD

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## OGC Standards Program Domain Emphasis



- Hydrology
- Meteorology
- Oceanography
- Aviation
- Energy and Utilities
- Emergency & Disaster Management
- Defense & Intelligence
- Earth Systems Science
- Security
- Data Quality
- **Big Data**
- 3D Information Mgt
- Mass Market
- Public Safety & Law Enforcement
- Geosemantics
- **Agriculture**
- **Health**
- **Urban Planning (Smart Cities)**
- **Land & Infrastructure**
- Mobile Location Services
- Temporal
- Others

<http://www.opengeospatial.org/projects/groups/wg>



Mountain View CA, USA  
December 2009



Bonn, Germany, March 2011

Green Text = New in 2014

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## Water Observation – In Situ



Time series data at point locations

Water Quantity



Rainfall



Soil Water



Water Quality



Meteorology



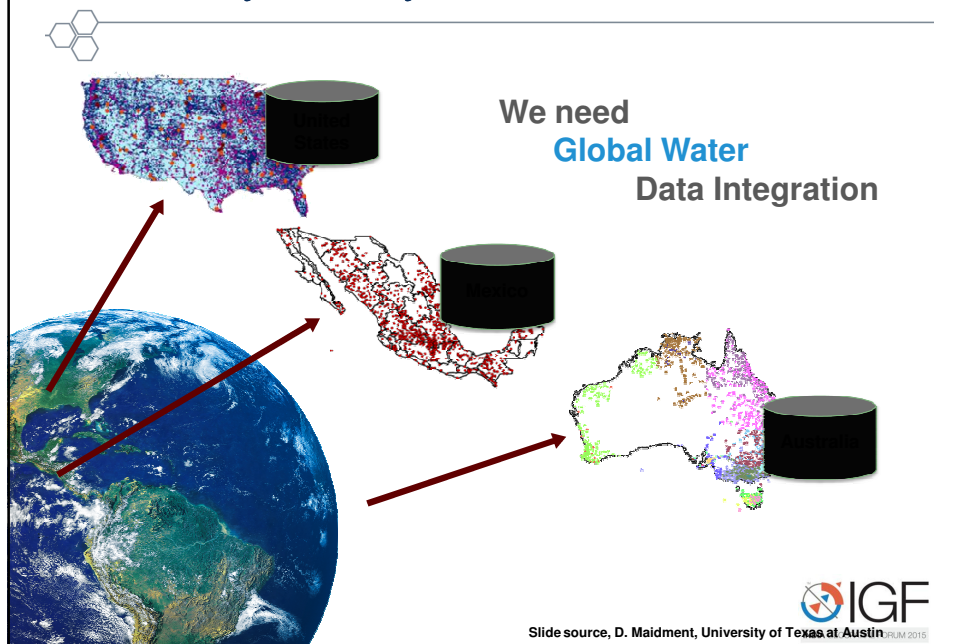
Groundwater



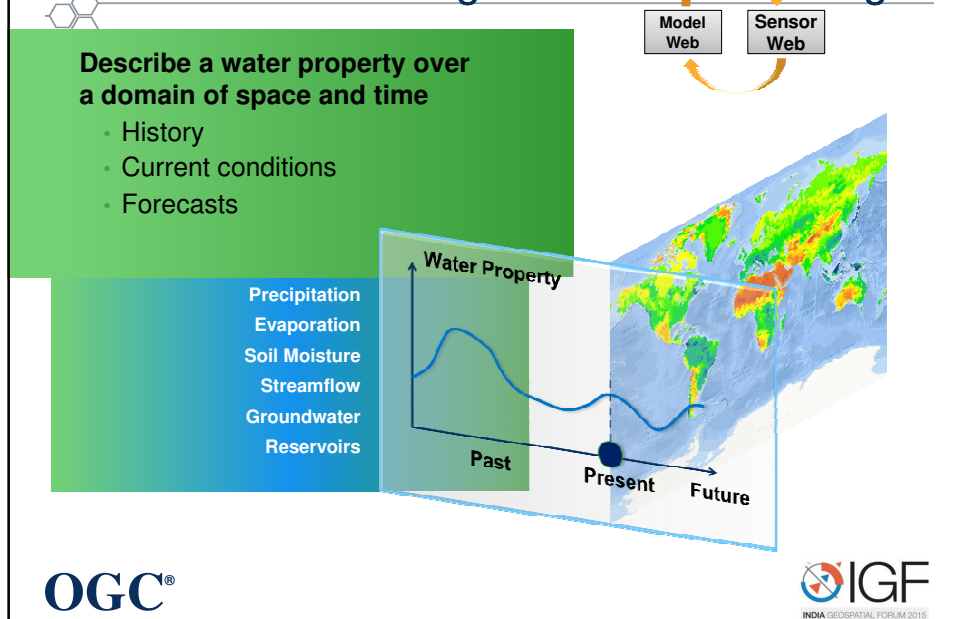
Slide source, D. Maidment, University of Texas at Austin



## Every Country Collects These Data



## Goal – Enhanced Local to Global Water Resource Monitoring and Decision Making





# OGC/WMO Hydrology Domain Working Group



## 4-Year International Effort – WaterML2

A time series for one variable at one location

OGC® WaterML

Hydrology Domain Working Group formed  
OGC at WMO Commission on Hydrology

November 2009

MEMORANDUM OF UNDERSTANDING  
BETWEEN  
THE WORLD METEOROLOGICAL  
ORGANIZATION  
AND  
THE OPEN GEOSPATIAL CONSORTIUM, INC.

Technical Meetings Each 3 Months  
Four Interoperability Experiments  
(Surface water, groundwater, forecasting  
Annual week-long workshops  
Involvement by many countries

Acknowledgements: OGC, WMO, GRDC, CUAHSI,  
BoM, CSIRO, USGS, GSC, Kisters, .....

2008

2009

2010

2011

2012

Slide source, D. Maidment, University of Texas at Austin

## OGC WaterML



### • OGC WaterML 2.0 Standard for data exchange of time series and sample observations

- Community wide international encoding standard
- Based on OGC Geography Markup Language, OGC Observations & Measurements
- Adoption by OGC in 2012
- Recommended for WMO adoption as joint OGC/ISO standard

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Editor: Peter Taylor, CSIRO

Submitting Organizations:

Australian BOM  
CSIRO  
CUAHSI  
USGS  
US NOAA

NR Canada  
Kisters AG  
Deltares  
disy  
San Diego Super Computer Center

German Federal Institute of Hydrology  
Federal Waterways Engineering and Research Institute  
International Office for Water - Sandre



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OGC WaterML 2.0 OGC 18-1261

Open Geospatial Consortium

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Version: 2.0

Category: OGC® Implementation Standard

Editor: Peter Taylor

### OGC® WaterML 2.0: Part 1- Time Series

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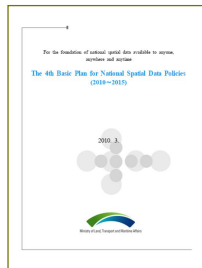
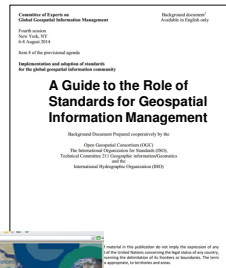
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Document status: Drafting  
Document stage: Approved for Public Release  
Document category: Technical



# Geospatial Standards Policy



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A critical part of managing the complexity!

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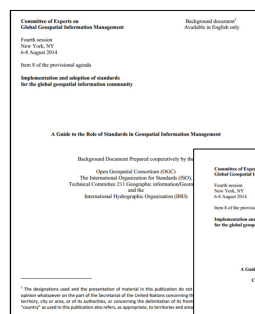
# United Nations Global Geospatial Information Management (UN-GGIM)



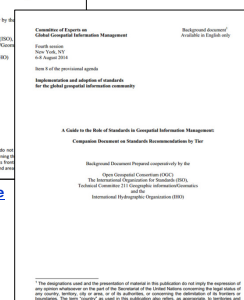
- The UNGGIM Secretariat requested [OGC](#), [ISO](#) & [IHO](#) to create a non-technical guide explaining the role and importance of open geospatial standards for Policy makers.
- The Result:
  - The Guide to the Role of Standards in Geospatial Information Management
  - A Companion technical document



To help everyone better understand what standards to use, when and why



[Link to Standards Guide](#)



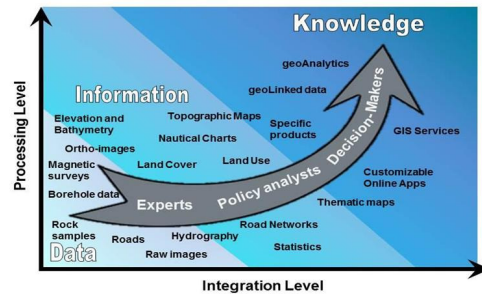
[Link to Companion Document](#)

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## Knowledge from Geospatial Data

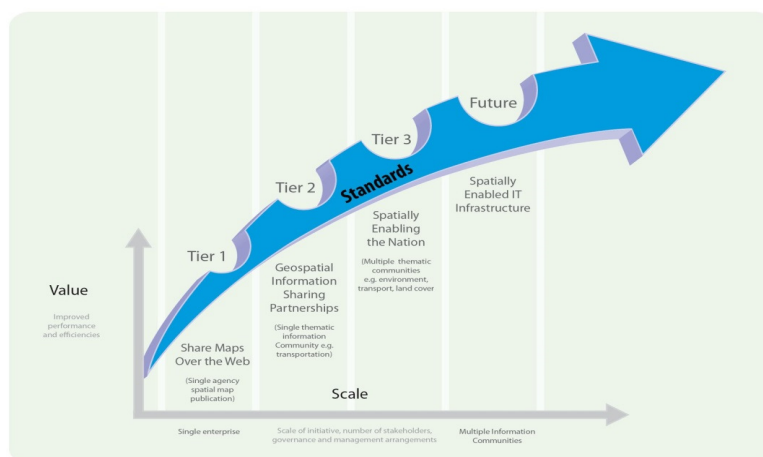


The trajectory from data to geospatial knowledge, enabled by technology and standards

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## SDI Standardisation Maturity Model

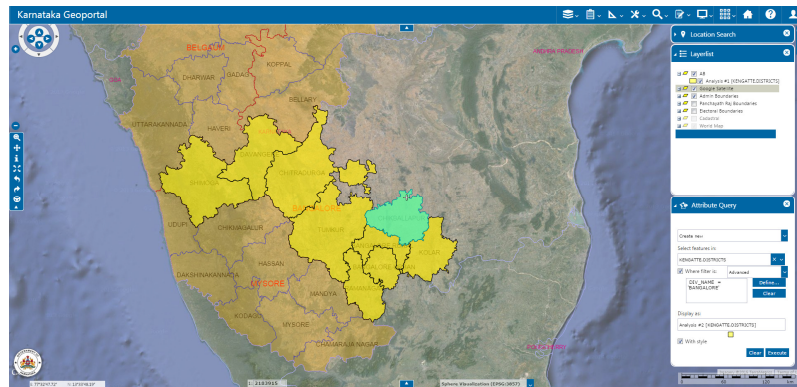


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## Tier 1: Share Maps Over the Web



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## Tier 2: Geospatial Information Sharing Partnerships



OneGeology Portal  
[www.onegeology.org](http://www.onegeology.org)

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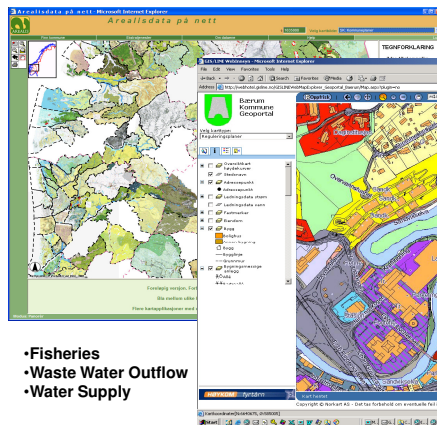
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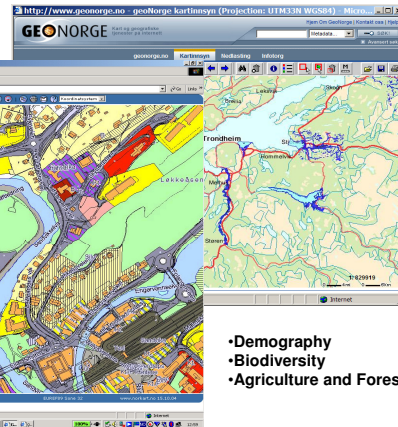
## Tier 3: Spatially Enabling the Nation/Region



### Municipal Areas



### Flood Risk Areas



Example; Norway Digital

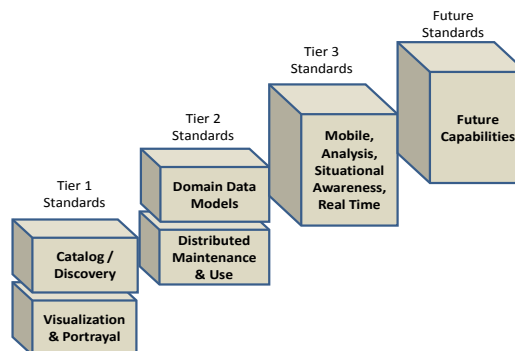
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## The Future; Spatially Enabled IT infrastructure



- Cloud Computing
- Linked Data
- Big Data Analytics
- Semantic web portals
- Mobile devices
- New and dynamic geospatial data collectors
- Social Media / Volunteered Geospatial Information
- The Internet of Everything
- Emerging Standards, Best Practices & Trends



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# Thank You



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<http://www.opengeospatial.org/>



<http://www.youtube.com/user/ogcvideo/videos>

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## Session: Geospatial Technologies, Directions and Standards



### • Speakers:

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- Sanjeev Trehan, Regional Manager-Geospatial Division, SAARC, Trimble Navigation
- Srinibas Patnaik, Senior Director, SAARC, DigitalGlobe
- Dwaipayan Dighal, Regional Manager, Intergraph India
- M.Rajathurai, Technical Manager-Utilities and Mapping, Bentley
- Megha Datta, Industry Manager-NGIOs, Geospatial Media and Communications

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