IMPORTANT: Please fill in the form, following closely the instructions, taking into account the IGCP Operational Guidelines, which are on the IGCP website. For information on the necessary content of an application (e.g., allowable funding), refer to the detailed IGCP Operational Guidelines.

A COPY SHOULD BE SENT AS AN ATTACHMENT VIA E-MAIL TO:

o.adiyaman@unesco.org or ml.faber@unesco.org

Proposals must reach Paris by October 15th in order to be considered for funding for the following year.
1. **Indicate the topic(s) into which the project falls**

For the Annually defined topics - if any - refer to the annual ‘Call for IGCP Project Proposals’.

(i) *Topics of particular interest to IGCP*

- 1.1 Earth Resources
- 1.2 Global Change
- 1.3 Geohazards ✓
- 1.4 Hydrogeology ✓
- 1.5 Geodynamic

(ii) *Annually defined topics*

(iii) *Other relevant topics in basic/applied geoscience*

If this is a Young Scientist Project proposal please tick here

2. **Short title of the project**

The short title of the project should be as brief as possible but still identify its main objective.

Land subsidence in coastal cities

3. **Full title of the project**

The full title should be limited to a maximum of around fifteen words.

**Impact, Mechanism, Monitoring of Land Subsidence in Coastal cities**

(‘IM2LSC’)

4. **Description of the project in layman’s terms**

Provide a maximum 200 words-long, self-contained summary of the project, including its societal benefits. It should be written in plain English / layman’s terms and for the non-specialist using a minimum of terminology unique to the area of study. This text will be used to describe your project on the UNESCO website.

Land subsidence, as a global geohazard, not only reduces the flood control capacity in urban areas, but also brings security risk and damage to buildings, roads, bridges, rail transits, flood control walls, underground lines, etc. The
impact of land subsidence is especially obvious in coastal cities and proximity to shorelines, such as Shanghai and Jakarta, etc., for their low elevation. It’s important and urgent to carry out measures for the prevention and control of land subsidence. In this project, we propose a scientific cooperative program between institutions and researchers to develop better understanding of land subsidence at international level, especially the less developed countries in Asia, Africa and Latin America. IM2LSC plans to research the Impacts of human activities and sea-level rise, hydro-Mechanism and Monitoring methods of Land Subsidence in Coastal cities. The project results will be transferred to sites in other developing countries, and recommendations will be released to play an effective role in the planning, construction, management and security assurance for different coastal cities.

5. PROPOSED BY

Academic titles and names of the proposer(s) should be inserted. Provide also full mailing address(es), telephone, fax numbers, and e-mail address(es). The first listed name will be the focal point for future correspondence. UNESCO and IUGS encourage you to respect gender equality issues and inclusion of experts from developing countries in all new IGCP projects.

(1) Leader: Xuexin Yan, the chief engineer of Shanghai Institute of Geological Survey, Shanghai 200072, P. R. China
   Phone: +86 21 56616889
   Fax: +86 21 56612812
   Email: xuyan@sigs.com.cn
   Web: http://www.silrs.com/team.aspx

(2) Co-leader: Mahmoud Bakr, Associate/Senior Groundwater, Specialist
   Dar Al-Handasah Consultants, Egypt
   10 Dr. El-Batrawy Street, Nasr City, 11371, Cairo, Egypt
   Phone: +201277125427 (mobile)
   Emails: Mahmoud.bakr@dar.com; mahmoud.bakr@gmail.com

(3) Co-leader: Luigi Tosi, Senior Research Scientist at National Research Council of Italy - Institute of Marine Sciences in Venice, Italy (CNR-ISMAR).
   Arsenale Tesa 104 - Castello 2737/F, Venezia 30122, Italy
   Phone: +39 0412407949
   Fax: +39 0412407930
   Web: http://www.ismar.cnr.it
6. Scale of the Project

The scale of the project must be indicated among the choice given.

- sub-continental/regional
- continental
- inter-continental

7. Estimated Duration of the Project

Maximum life-time of an IGCP project can be five years.

- 3 years
- 4 years
- 5 years

8. Full Description of the Project (sections 8.1 through 8.10)

8.1 Aims and background

Describe the aims and rationale of the proposal. Include information on work already undertaken by the proposers that is relevant to the proposal. Maximum length: 600 words, including bibliography.

Land subsidence is the lowering of the ground surface in response to natural and man-induced processes. Natural subsidence is driven by tectonics, sediment load and compaction, and glacial isostatic adjustment through the
Late-Pleistocene deglaciation. Anthropogenic subsidence includes geomechanical processes, such as those induced by subsurface water removal, building and infrastructure loads, and land reclamation. Land subsidence has occurred in more than 150 countries and regions, especially along the coasts, such as China, the Netherlands, Italy, Indonesia, Egypt, US, Japan, Mexico, Thailand, UK, Venezuela, Australia and South Africa, etc.

Land subsidence and sea-level rise act at regional spatial scales and globally, respectively, and superposes, increasing the vulnerability and the hydrogeological hazard in coastal area. Over the last two decades, the research on sea-level rise has shifted from global sea-level rise to regional relative sea-level rise, because of the increased awareness that land subsidence plays an important role in the regional process.

Although significant progress of land subsidence control has been made in more developed countries or regions like Europe, America, Shanghai of China, the control and monitoring of land subsidence and its effects as well as the researches on this process are generally scarce or even received no attention in some developing or less developed countries or regions like Indonesia, Egypt, Iran, etc. This led to a constant deterioration of the natural resources and an increase of the environmental problems and hydrogeological hazard, which severely restrict sustainable development of many economic activities in these regions.

Within this context, the IM2LSC project aims to:

- Study the status of land subsidence in global coastal cities selected, including current rates of subsidence, geological conditions and inducing factors;
- Develop theoretical and technological knowledge and solutions required for prevention and control of Land Subsidence in coastal cities;
- Improve understanding of the interaction between land subsidence, human activities and sea-level rise in coastal cities;
- Improve design and construction standards of Land Subsidence monitoring networks, and promote optimal Land Subsidence survey and monitoring techniques;
- Construct an international researcher network to promote the connection and research capacity among scientists of different disciplines (including geology, geophysics, geomechanics and remote sensing, etc.) from different
countries (developed and developing countries), by means of a seminar, field survey, class training, internet forum, etc.

- Spread the project results through different channels, including participating in conferences, science popularization, propaganda and introduction on project websites, non-technical fact sheets for policy makers and citizens, etc., which aim at enhancing the influence and recognition of land subsidence within the scientists as well as ordinary non-scientific populations. Promote the project results to serve the planning, construction, management and security assurance in global coastal cities that are under the influence of land subsidence, and gain social benefits.

- Provide supports for the safeguard and maintenance of UNESCO’s World Heritage in coastal cities.

References

8.2 Significance
Describe why the project is significant (scientific advancement, international cooperation, knowledge transfer, technological advancement, etc.) and why support through IGCP funding is crucial to its success. Maximum length: 400 words.

a) Promote sustainable development of global coastal cities
Nowadays most of the worldwide coastal regions affected by land subsidence are densely populated and characterized by a quite limited ground elevation with respect to the sea level. The serious loss of ground elevation directly threatens the sustainable development of such regions. There are no indications that neither subsidence nor the resulting damage will be reduced in the near future (Erkens. 2015¹). Scientific advice for planning, construction, security operation,

management of natural resources and other aspects concerning land subsidence is required in coastal cities.

In many coastal cities, one of the important factors causing land subsidence is the exploitation of ground water. With the economic development and increasing population in coastal cities, the water requirements for living and production have been continuously increasing. Another important factor is the large-scale urban construction with the rapid development and population increasing in coastal cities. Land subsidence caused by engineering construction has become a new critical problem, which can significantly threaten public infrastructure security. However, the current research is insufficient.

b) **Facilitate technical/scientific advancement in land subsidence**
- Promote design and construction technologies of land subsidence monitoring network;
- Reveal the mechanism of land subsidence, and develop land subsidence evaluation methods;
- Develop the study of the interaction between land subsidence, human activities and sea-level rise in coastal cities;
- Promote the development of land subsidence research in coastal reclaimed areas.

c) **Promote knowledge transfer and dissemination**
- Implement an international network for researchers to enhance connection between researchers via internet meeting, annual meetings and so on;
- Set up a project website as information communication platform;
- Hold annual project meetings and symposiums to promote exchange of related research findings;
- Participate in international conferences and deliver academic reports;
- Provide trainings on land subsidence for researchers and students in various ways;
- Publish academic papers or monograph;
- Provide non-technical overviews on land subsidence for policy makers and citizens;

d) **Significance of IGCP for this project**
Support from IGCP plays an extremely important role in this project. The implementation of relevant work of the project requires urgently collaboration between scientists worldwide, and especially interaction between developed and
developing countries. The development of a knowledge-exchange project under the umbrella of IGCP will aggregate process knowledge from an extensive research network, and promote awareness and visibility of this geo-hazard within the scientific community.

8.3. Present state of activities in the field of the proposed project
Describe the present state of activities in the field of the proposed project. Include the names of relevant institutions and persons in charge. This should be precisely stated since it reflects the proposer’s awareness of the general state of the proposed research field. Maximum length: 1,000 words.

In many coastal cities land subsidence exceeds absolute sea level rise up. A major cause of this severe land subsidence is excessive groundwater extraction due to rapid urbanization and population growth. Projections until 2100 based on IPCC scenarios expect a global mean absolute sea level rise in a range of 3–10 mm year\(^{-1}\) (Slangen et al., 2012\(^2\), 2014\(^3\)). However current observed subsidence rates in coastal megacities are in the range of 6–100 mm year\(^{-1}\) and projections till 2025 expect similar subsidence rates. Without actions, parts of Jakarta, Ho Chi Minh City, Bangkok and numerous other coastal cities will sink below sea level (Bucx, 2015\(^4\)). Land subsidence causes increased flooding and widespread impacts on roads, embankments, subsurface infrastructure and housing, resulting in damage of billions of dollars per year. Therefore, land subsidence is one of the most concerned research fields currently.

It is understood that land subsidence is a global problem and the occurrence of most land subsidence is closely related to hydrologic process. Therefore, land subsidence was included in the International Hydrological Decade Plan (1965-1974) of UNESCO. A working group of land subsidence (WGLS) has also been established by UNESCO, which organizes work group conference every year and convenes academic symposiums regularly, playing significant role in research and control of land subsidence globally.

i. China
Land subsidence has drawn great concern from Chinese government and academicians. China first started analysis and researches on land subsidence in


IGCP Project Proposal From
Shanghai in the 1960s, and remarkably controlled the land subsidence through implementing a series of effective control measures. After that, the technology was spread to Yangtze River Delta, North China Plain, Fen-Wei Basin and other key land subsidence developing areas. As a result, the average subsidence rate in land subsidence developing areas, of which Shanghai is a representative, has been reduced from 105mm/year in the 1960s to 6mm/year in recent years.

ii. Egypt
Potential land subsidence in Egypt coupled by sea level rise results, among others, in increased flood vulnerability, changing groundwater levels and increased saltwater intrusion. Few studies of land subsidence in Egypt have shown local land subsidence of the coastal zone. Reported values have ranged between 0.4 and 8 mm/year. With no system in place, a project at the National Water Research Centre (NWRC) that have been formulated and proposed by Professor Bakr is now under implementation. The project suggests a formal national plan to monitor land subsidence in the Nile Delta.

iii. Italy
In Italy, the phenomenon of the subsidence began to be a major concern in the 1960s, when a catastrophic storm completely flooded Venice. In the aftermath of that flood, the Italian Government decided to establish a Special Legislation for the Safeguarding of Venice and the National Research Council, launched one of its section, today the Institute of Marine Sciences. Over the last 50 years, the institute has played an international key role in continuous providing new knowledge on land subsidence and its monitoring. Scientists jointed to the UNESCO working group of land subsidence and collaborated with many international institutions.

iv. The Netherlands
Subsidence research in The Netherlands is carried out since the 1950s. The Dutch Ministry of Infrastructure & The Environment is currently exploring the possibility to establish a national information facility (NIB), providing satellite-based high-resolution surface motion data, numerical predictive models, forecast maps and for subsidence relevant lithological and geotechnical data, to help local and regional authorities to deal with the negative impacts of subsidence. Dutch researchers actively participate within the international subsidence community and collaborate with many international institutions. The
10th International Symposium on Land Subsidence (planned for 2019-2020) will be held in The Netherlands.

v. Indonesia

Started in 1997 first land subsidence measurement using GPS technology in some cities in Indonesia beside Jakarta was conducted by Institute of Technology Bandung. InSAR is also tool for monitoring land subsidence in Indonesia. The causes vary between groundwater abstraction, oil and gas exploitation, underground mining, heavy load of infrastructures, and in some places, there are also tectonic subsidence.

The leader and co-leaders of the project, which are well-balanced from both the gender and the representativeness of developed/developing country perspectives, have worked in this subject area individually for many years.

- **Xuexin Yan** is the Chief Engineer of Shanghai Institute of Geological Survey, and Director of the Key Laboratory for Monitoring and Prevention of Land Subsidence, Ministry of Land and Resources. Since 1982, he has been engaging in geological survey and researches on hydrology, urban geology, environmental geology, etc.

- **Mahmoud Bakr** is currently an Associate at Dar Al-Handasah Consultants which is a leading industry firm in consultancy work in the Middle East and worldwide. He is involved in many mega projects (e.g., groundwater characterization and control of Al-Maktoum International Airport) in which land subsidence due to groundwater abstraction as well as due to urbanization play critical role in stability of different infra/structures.

- **Luigi Tosi** is a Senior Scientist at Institute of Marine Sciences – National Research Council of Italy, has always been carried out the research on land subsidence in coastal areas by hydro- geo- morphological multidisciplinary approach. He has conducted many studies in the Venice area and participated to the setup a new integrated subsidence monitoring system that allow to integrate data from levelling, GPS, multi-band SAR-based interferometry.

- **Esther Stouthamer** is an Associate Professor in Physical Geography and Director of the interfaculty and interdisciplinary research programme - Future Deltas. Within the framework of this programme, she has developed a research framework for understanding drivers, predicting impacts and
optimizing solutions for delta subsidence following an interdisciplinary approach.

- **Heri Andreas** is a Lecturer and Researcher in Department of Geodesy and Geomatics, Faculty of Earth Science and Technology, Institute of Technology Bandung, Indonesia. He is member of Subsidence Risk Assessments Program for Offshore Natuna Sea Conoco Phillips Indonesia Oil & Gas Platforms (2014- ), member of Subsidence Investigation for National Committee Integrated Coastal Development (2015), and advisor of Subsidence Monitoring Program for PERTAMINA geothermal fields area (2015- ).

### 8.4 Workplan (items by year)

*The work schedule should be prepared bearing in mind that, as a rule, projects will be accepted for a duration of five years maximum. The work schedule should include field and laboratory work, meetings, capacity building activities or short courses, field trips, conferences, etc. Maximum length: 1,200 words.*

**a) Activities to be carried out under the project**

IM2LSC is planned to be implemented along two parallel directions. The first is to focus on scientific development concerning monitoring, mechanisms, and control of land subsidence in coastal cities. The second is to disseminate the scientific achievement of the project in a large international network of scientists.

**Scientific activities (marked by the letter S):**

- S1. Integrate pre-existing information related to land subsidence in global coastal cities. Investigate and analyse the causes of land subsidence according to pertinent geological conditions, as well as the impacts of human activities and sea-level rise;
- S2. Carry out researches on mechanism, rules and control technologies of land subsidence due to subsurface fluid extraction;
- S3. Carry out researches on land subsidence predictions in coastal reclaimed areas;
- S4. Carry out researches on applications of different land subsidence monitoring methods and technologies, integration of multiple monitoring technologies and methods, and comprehensive design and construction of land subsidence monitoring network.
Activities in terms of dissemination and competence construction (marked by the letter D):

- D1. Set up IM2LSC network, which consists of scientists, ordinary researchers and other relevant staffs, especially researchers from developing countries and members/observers of IHP-UNESCO WGLS;
- D2. Build and maintain a project website including project background, databases, introductions of relevant researchers and institutions, project results, meetings, and forums (blogs);
- D3. Carry out scientific/technical trainings on land subsidence by means of field trainings, distance courses and material mailing for researchers, students and common people;
- D4. Hold annual project meetings, workshops and courses, special sessions in international conferences;
- D5. Attend international conferences, such as International Symposium on Land Subsidence, International Geological Congress (IGC), IAH Congress, IAEG Congress, International Geoscience and Remote Sensing Symposium (IGARSS), Asia-Oceania Geosciences Society(AOGS) and European Geosciences Union (EGU), and deliver academic reports;
- D6. Publish academic papers on international journals or monograph;
- D7. Release comprehensive control guideline on land subsidence, non-technical fact sheet and etc.

b) Annual work plan

- The 1st year (2018-2019)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
</table>
| Field and laboratory: | - Select cities for case studies, investigate and analyze the causes of land subsidence according to pertinent geological conditions, and carry out researches on the mechanism of land subsidence (S1-S2)  
  - Identify coastal cities worldwide affected by land subsidence(S1) |
| Dissemination: | - Implement IM2LSC network of researchers (D1)  
  - Build connection with relevant scientists in case-study cities (D1)  
  - Design, build and launch IM2LSC website (D2).  
  - Distance courses for researchers or students (D3) |
| Reporting:     | - First annual report of IM2LSC Project (D7)  
  - Draw maps of land subsidence occurrence in |
coastal cities worldwide with related metadata (related papers, causes, etc.) (S1)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Meeting/Workshop:</td>
<td>• The first annual meeting (D4)</td>
</tr>
<tr>
<td></td>
<td>• First symposium themed by “Land Subsidence and Ground water” (D4)</td>
</tr>
<tr>
<td>Conference:</td>
<td>• Attend international conferences, such as 13th IAEG Congress, San Francisco, USA, September, 2018; IAH Congress, Asia-Oceania Geoscience Society Meeting and etc. (D5)</td>
</tr>
<tr>
<td>Field trip:</td>
<td>• Shanghai, Tianjin, Zhuhai, Shenzhen cities in China</td>
</tr>
</tbody>
</table>

- The 2nd Year (2019-2020)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field and laboratory:</td>
<td>• Research on the mechanism, rules and control technologies of land subsidence (S2)</td>
</tr>
<tr>
<td></td>
<td>• Research on land subsidence predictions in coastal reclaimed areas (S3)</td>
</tr>
<tr>
<td></td>
<td>• Select new research areas in developing countries and collect useful information (S1)</td>
</tr>
<tr>
<td>Dissemination:</td>
<td>• Enlarge IM2LSC network of researchers (D1)</td>
</tr>
<tr>
<td></td>
<td>• Update and maintain IM2LSC website (D2)</td>
</tr>
<tr>
<td></td>
<td>• Field trainings for researchers or students (D3)</td>
</tr>
<tr>
<td></td>
<td>• Attend or hold related activities on World Earth Day (D3)</td>
</tr>
<tr>
<td>Reporting:</td>
<td>• Second annual report of IM2LSC Project (D7)</td>
</tr>
<tr>
<td>Project Meeting/Workshop:</td>
<td>• The second annual meeting (D4)</td>
</tr>
<tr>
<td></td>
<td>• The second symposium themed by “Land subsidence in coastal reclaimed areas”(D4)</td>
</tr>
<tr>
<td>Conference:</td>
<td>• Attend international conferences, such as 36th International Geological Congress, Delhi, India, 2-8 March, 2020; IAH Congress, European Geosciences Union Meeting and etc. (D5)</td>
</tr>
<tr>
<td>Field trip:</td>
<td>• Damietta City, Egypt, or a developing country to be selected</td>
</tr>
</tbody>
</table>

- The 3rd Year (2020-2021)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field and laboratory:</td>
<td>• Evaluate different monitoring technologies and comprehensive network (S4)</td>
</tr>
<tr>
<td></td>
<td>• Promote monitoring technologies of land subsidence in new research areas (S2-S4)</td>
</tr>
<tr>
<td>Dissemination:</td>
<td>• Enlarge IM2LSC network of researchers (D1)</td>
</tr>
<tr>
<td></td>
<td>• Update and maintain IM2LSC website (D2)</td>
</tr>
<tr>
<td></td>
<td>• Distance courses for researchers or students (D3)</td>
</tr>
</tbody>
</table>
### Activity Description

**Field and laboratory:**
- Promote relevant research achievements in newly selected areas (S1-S4)
- Draw up guidelines to reduce the risk of land subsidence and mitigation of its occurrence (D7)

**Dissemination:**
- Update and maintain IM2LSC website (D2)
- Field trainings for researchers and students (D3)
- Press release (D4)
- Publish comprehensive control guideline for land subsidence (D7)

**Reporting:**
- Publish academic papers on international journals or special issues (D6)
- Final annual project report (D7)
- Release non-technical fact sheets for policy makers and citizens (D7)

**Project Meeting/Workshop:**
- Video conference of project members (D4)
- Final annual work conference and symposium in China (D4)

**Conference:**
- Attend international conferences, such as IAH Congress, World Environmental & Water Resources Congress, European Geosciences Union meeting, Asia-Oceania Geosciences Society meeting and etc. (D5)

**Field trip:**
- Jakarta, Indonesia, or a developing country to be selected

### Results expected

Results expected should be specified as precisely as possible in respect of theoretical and applied science (including general applications where these are foreseen), as well as anticipated societal
benefits. Outcomes should include both those expected at the end of the project as well as those to be achieved at the end of each year for which funding is requested. Meetings and conferences are not considered as results. Maximum length: 1,200 words.

a) In basic sciences

- Theory on mechanism, rules and control technologies of land subsidence;
- Theory on land subsidence predictions in coastal reclaimed areas;
- Evaluation and application of different monitoring technologies and comprehensive network;
- Publish academic papers on international peer-reviewed journals or monograph;

Annual achievements are as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018:</td>
<td></td>
</tr>
</tbody>
</table>
  - Select case-study cities for land subsidence analysis (geological conditions, causes)  
  - First annual project report |
| 2019: |  
  - Theory on mechanism, rules and prevention and control technologies of land subsidence;  
  - Theory on land subsidence predictions in coastal reclaimed areas  
  - Second annual project report |
| 2020: |  
  - Evaluation of different monitoring technologies and comprehensive network  
  - Third annual project report  
  - Publish academic papers on international peer-reviewed journals or monograph |
| 2021: |  
  - Comprehensive prevention guideline for land subsidence  
  - Final Annual Report  
  - Publish academic papers on international peer-reviewed journals or monograph |

b) In applied sciences and technology

- Maps of land subsidence occurrence in coastal cities worldwide with related metadata (related papers, causes, etc.);
- The technologies and methods developed under the project plan to be applied in China, Netherlands, Italy and Indonesia, and are expected to generate referential cases;
- Promote combination of multiple disciplines (such as geology, hydrogeology, geophysics, geomechanics and remote sensing), and enhance connection between scholars and experts from different disciplines and countries;
Set up project researcher network by means of training, symposium, field investigation, lecture, and internet forum.

**Annual achievements are as follows:**

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
</table>
| 2018: | - Analyze the distribution of land subsidence in coastal cities worldwide  
- Draw maps of land subsidence occurrence in coastal cities worldwide with related metadata (related papers, causes, etc.)  
- Establish connection and partnership with relevant scientists  
- Field investigation to case-study sites in China |
| 2019: | - Promote monitoring technologies of land subsidence in newly research areas  
- Select new research areas in developing countries and collect useful information  
- Field investigation to Damietta City in Egypt or a developing country to be selected |
| 2020: | - Develop investigating, monitoring technologies, and integrate monitoring network of land subsidence  
- Promote investigating, monitoring technologies, and integrate monitoring network developed in newly selected research areas  
- Field investigation to the western Netherlands, host country of 10th International Symposium on Land Subsidence |
| 2021: | - Promote relevant research achievements in newly selected research areas  
- Field investigation to Jakarta in Indonesia or a developing country to be selected |

c) **In respect of benefit to society**

Prospective social benefits are as follows:

- Provide suggestion and basis for urban planning of coastal cities;
- Enhance security of urban construction and reduce influence of engineering construction on environment;
- Enhance scientific management of underground fluid, underground space and other resources;
- Improve flood prevention and discharge competence, and also maintain facility operation security;
- Publicize research achievements through symposium, training, project website, and non-technical fact sheet;
- Release non-technical fact sheets for policy makers and citizens.

**Annual achievements are as follows:**

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
</table>
Year 2018:  
- Set up project researcher network  
- Launch project website

Year 2019:  
- Expand project research network  
- Update and maintain project website  
- Distance courses for researchers or students

Year 2020:  
- Expand project research network  
- Update and maintain project website  
- Distance courses for researchers or students  
- Attend or hold related activities on World Earth Day

Year 2021:  
- Update and maintain project website  
- Press release  
- Non-technical fact sheets for policy makers and citizens

8.6 Participation

Provide a list of contributors to the project and the areas to which they will contribute. Applicants should note that an important aim of this program is to encourage involvement of scientists from the developing countries.

a) countries or institutions (or individuals) which have already agreed to co-operate

This implies a formal commitment supported by written confirmation. Names and addresses should be listed.

- Wang Hanmei, Fang Zheng, Yang Jiangang, Yang Tianliang, Xu Yan, Lin Jinxin, Wu Jianzhong, Chen Mingzhong, Yu Junying, Huang Xinlei, Zhu Xiaojuang, Zhang Huan and He Ye from Shanghai Institute of Geological Survey, Shanghai, China
- Cristina Da Lio (cristina.dalio@ve.ismar.cnr.it) from ISMAR-CNR, Venice, Italy
- Paolo Berardino (irea.berardino.p@irea.cnr.it) from IREA-CNR, Napoli, Italy.
- Pietro Teatini (pietro.teatini@unipd.it), Massimiliano, Ferronato (massimiliano.ferronato@unipd.it) from Dept. ICEA - University of Padova, Padova, Italy.
- Francesco Zucca (francesco.zucca@unipv.it.) e and Cludia Meisina (claudia.meisina@unipv.it.) from University of Pavia, Italy
- Gilles Erkens (gilles.erkens@deltares.nl), Ger de Lange (Ger.deLange@Deltares.nl), John Lambert (John.Lambert@Deltares.nl) from Deltares Research Institute, Utrecht, The Netherlands
- Ramon Hanssen (R.F.Hanssen@tudelft.nl) from Delft University of Technology, Delft, The Netherlands (chairholder: Geodesy and Satellite Earth Observation).
• Michiel van de Meulen (michiel.vandermeulen@tno.nl), Peter Fokker (Peter.Fokker@tno.nl) from TNO – Geological Survey of The Netherlands, Utrecht, The Netherlands.
• Hasanuddin Z Abidin, Dina A. Sarsito, Dhota Pradipta, Irwan Gumilar, and Teguh Purnama Sidiq from Geodesy Research Group, Faculty of Earth Science and Technology, Bandung Institute of Technology, Indonesia.

b) countries likely to participate
Estimate the range of participation of those countries who have shown interest in the project but whose written commitment is still awaited.

China
• Chinese Academy of Geological Sciences
• China Institute of Geo-Environment Monitoring
• Tianjin Institute of Geological Survey
• Jiangsu Institute of Geological Survey
• Zhejiang Geological Environmental Monitoring Institute
• Guangdong Geological Bureau
• Nanjing University
• Tongji University
• Shanghai Jiao Tong University

US
• The Water Institute of the Gulf, Baton Rouge, Louisiana, USA (Mead Allison)
• Dept. of Earth and Environmental Sciences, Tulane University, New Orleans, Louisiana, USA (Torbjörn Törnqvist)
• U.S. Geological Survey (USGS), Sacramento, California (Michelle Sneed)

Greece
• National Technical University of Athens, Athens, Greece (Costantinos Loupasakis)
  Patras University, Patras, Greece (Stathis Stiros)

Vietnam
• Division for Water Resources Planning and Investigation for the South of Vietnam (DWRPIS), NAWAPI, MONRE (Pham Van Hung)
• Can Tho University, Dept. of Water Resources, College of Environment and Natural Resources, Can Tho Vietnam (Nguyen Hieu Trung and/or Pham Dang Tri).

c) Which specific measures will the applicants of the proposal take to actively involve scientists from developing countries, young scientists and female scientists at all levels?
Provide approximate participation estimations of the groups mentioned above if possible and be aware that IGCP expects exact numbers of participation of the different groups in each Annual Report.

- When establishing the researcher network, we will give priority to researchers in developing countries, young researchers and female researchers, and lower entry requirements for them;
- Provide professional trainings for researchers in developing countries, young researchers and female researchers participating in this project;
- Choose developing countries as our new research areas;
- Expand influence of this project through workshops, internet publicity, conference promotion and recommendation by participants.

**d) Will there be collaboration with or activities involving other IGCP projects, UNESCO programmes, IUGS Commissions and Task Groups or others?**

The project group plans to cooperate with IGCP 641 project and UNESCO WGLS. Currently, we’ve been closely cooperating with UNESCO WGLS, which provided noble support and guidance for the initiation of this project as well as preparation of proposal.

**8.7 Location of major field activities**
*State the principal locations of any planned field investigations.*

The initial sites planned for the field investigation are the following:
- Shanghai, Tianjing, Shenzhen, Zhuhai cities in China
- Damietta City where highest land subsidence rate in the Nile Delta
- Venice coastland in Italy
- Western Netherlands coastal plain
- Can Tho and/or Ho Chi Minh City in Vietnam
- Jakarta, Java, Indonesia

Then, at the end of the first year, other sites will be selected between the developing countries adjoined to the project depending, for example, on data availability, accessibility, etc.

**8.8 Location of major laboratory research (assured co-operation of laboratories)**
*State names and locations of laboratories that have agreed to conduct laboratory work.*

- Key Laboratory of Land Subsidence Monitoring and Prevention, Ministry of Land and Resources of China
- Deltares Research Institute, Geotechnical Laboratory, the Netherlands.
  Other sites are to be added.
8.9 Project Communication:
Identify plans for future scientific publications (e.g. peer-reviewed journals), informal publications (e.g. abstracts, guidebooks, textbooks) and others (e.g. internet access to data bases, TV programs, exhibits, public briefings for decision makers).

<table>
<thead>
<tr>
<th>Communication</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publish reports</td>
<td>Publish annual reports on project website</td>
</tr>
<tr>
<td>Symposium</td>
<td>Hold annual symposium for exchange of project progress and relevant achievements</td>
</tr>
<tr>
<td>Attend international conferences</td>
<td>Such as International Symposium on Land Subsidence, International Geological Congress (IGC), IAH Congress, IAEG Congress, Asia-Oceania Geosciences Society(AOGS), International Geoscience And Remote Sensing Symposium (IGARSS), European Geosciences Union (EGU) and International Association for Mathematical Geology (IAMG)</td>
</tr>
<tr>
<td>Publish articles</td>
<td>Publish at least 2 articles or papers on peer-reviewed journals</td>
</tr>
<tr>
<td>Publish guidelines</td>
<td>Publish a guideline and a non-technical fact sheet in 2021</td>
</tr>
<tr>
<td>Visit and exchange</td>
<td>Organize and attend mutual visits, video communication and telephone communication between members of the project group</td>
</tr>
<tr>
<td>Generalization of scientific knowledge</td>
<td>Construct display pavilion of land subsidence or add contents of land subsidence in other related museums</td>
</tr>
<tr>
<td></td>
<td>Attend or hold related activities on World Earth Day</td>
</tr>
</tbody>
</table>

8.10 Project Website:
Provide a clear plan for the project website including ongoing maintenance of the site. Give the weblink if the website is already up and running.

The project website will be built and maintained, which includes project background, databases, introductions of relevant researchers and institutions, project results, meetings, and forums (blogs).

<table>
<thead>
<tr>
<th>Construction steps of project website</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domain name registration</td>
<td>2018</td>
</tr>
<tr>
<td>Planning and design</td>
<td>Before July, 2018</td>
</tr>
<tr>
<td>Fabricating and construction</td>
<td>2018</td>
</tr>
<tr>
<td>Test and launch</td>
<td>By the end of 2018</td>
</tr>
<tr>
<td>Maintenance and promotion</td>
<td>2019-2021</td>
</tr>
</tbody>
</table>
8.11 Scientific Legacy: Is there a need for storage of publications, field data, and other results of the project? Do you have a clear vision concerning where the data would be stored and who will be the custodian?

None

8.12 Budget

Outline how the IGCP funds will be spent over the proposed duration of the project. Be sure to specify specific IGCP expenditures (see allowable items in “Guidelines” section 7). List other potential (external) sources of funds and how IGCP funds may help in leveraging funds from other organizations. Provide a realistic estimate of the total cost (including non-IGCP sources) of the project, itemizing expenditures such as fieldwork expenses, laboratory costs, meetings, etc. (even though such costs may not be charged to IGCP).

<table>
<thead>
<tr>
<th>Year and budget</th>
<th>Description</th>
</tr>
</thead>
</table>
| 2018: US$10,000 | • Project meeting, workshop and international conference (travel expenses and accommodation funds to invite students, keynote or international speakers):  
  ➢ 40% (project meeting and workshop in Shanghai, China)  
  ➢ 25% (13th IAEG Congress, San Francisco, USA, September, 2018)  
• Field trip: 15% (organization of the field trip in representative coastal cities in China affected by land subsidence)  
• Secretariat: 10% (administrative activities)  
• Dissemination activities: 10% (website development)  
Field and laboratory expenses (approx. 10,000 US Dollars) will be covered by the individual projects of each participant |
| 2019: US$10,000 | • Project meeting, workshop and international conference (travel expenses and accommodation funds to invite students, keynote or international speakers):  
  ➢ 40% (project meeting and workshop in Egypt or a developing country to be selected)  
  ➢ 30% (36th International Geological Congress, Delhi, India, 2-8 March, 2020)  
• Field trip: 20% (organization of the field trip in representative coastal cities in Egypt affected by land subsidence)  
• Secretariat: 5% (administrative activities)  
• Dissemination activities: 5% (website maintenance)  
Field and laboratory expenses (approx. 10,000 US Dollars) will be covered by the individual projects of each participant |
| 2020:           | • Project meeting, workshop and international conference |
US$10,000

(travel expenses and accommodation funds to invite students, keynote or international speakers):

- 40% (project meeting and workshop in the Netherlands or a developing country to be selected)
- 30% (10th International Symposium on Land Subsidence, the Netherlands)
  - Field trip: 15% (organization of the field trip in the Netherlands, host country of 10th International Symposium on Land Subsidence)
  - Secretariat: 5% (administrative activities)
  - Dissemination activities: 10% (website maintenance, map of coastal cities worldwide characterized by land subsidence)

Field and laboratory expenses (approx. 10,000 US Dollars) will be covered by the individual projects of each participant

2021:

US$10,000

- Project meeting, workshop and international conference (travel expenses and accommodation funds to invite students, keynote or international speakers):
  - 55% (final project meeting and workshop in China)
- Field trip: 25% (organization of the field trip in representative coastal cities in Indonesia affected by land subsidence)
- Secretariat: 5% (administrative activities)
- Dissemination activities: 15% (website maintenance, printed brochures and non-technical fact-sheets)

Field and laboratory expenses (approx. 10,000 US Dollars) will be covered by the individual projects of each participant

8.13 Curriculum Vitae of proposer(s)

CVs of proposed leader(s) should be limited to three pages and include key publications (international peer-reviewed publications only), relevant scientific experience, any previous involvement in IGCP and/or other international research cooperation programs, including the organization of international meetings.

a) Leader:

**Xuexin Yan** is the General Engineer of Shanghai Institute of Geological Survey, Director and academic leader of the Key Laboratory of Land Subsidence Monitoring and Prevention, Ministry of Land and Resources of China, adjunct Professor of Tongji University and Jilin University. Prof. Yan mainly engages in evaluation of environmental geology and control of geological disasters. Through leading a series of major research topics, Prof. Yan and his research team studied on and established a relatively comprehensive management mode for controlling of land subsidence. In combination of the lean requirement on control of land subsidence under comprehensive effect of multi-micro-factors,
he led the team in exploring and developing key technologies of land subsidence control, and by virtue of which, made breakthroughs and accelerated the development of relevant disciplines. He has drawn up several local and industrial specifications, published more than 50 articles on domestic and foreign journals, and co-authored 6 monographs. He was awarded the Second Prize of National Award for Science and Technology Progress, China (ranking 1st) in 2004. He was honoured with the technology leader of Ministry of Land and Resources of China in 2017. He is the former Observer of the UNESCO Working Group on Land Subsidence (WGLS). He organized, chaired and hosted the 1st Int. Symposium on Urban Geology in Shanghai, China, 2017.

Key publications:


b) Co-leaders:

- Mahmoud Bakr is the Observer of the UNESCO WGLS. He is the Professor of Geo-hydrology at the National Water Research Center, Egypt. He is also “Associate/Senior Groundwater Engineer” at Dar Al-Handasah (Shair and Partners). He has a wide experience in both research and industry. His research work includes modelling of coupled subsurface processes of flow, heat, and land subsidence. He has also developed several methods for stochastic analysis and uncertainty propagation for unconditional and conditional simulations of coupled subsurface processes. Mahmoud has developed and contributed to the development of several land subsidence models in the
Netherlands, Ho Chi Minh City (Vietnam), and Jakarta (Indonesia). He has recently started research efforts to measure, characterize, and model land subsidence related to groundwater management in the Nile Delta. He is also involved in several mega construction projects for which he designs groundwater control systems. Prof. Bakr has participated in scientific publishing and editing where he published in several peer reviewed international journals and conferences; and has participated in the review process for several international journals.

Key publications:


- Luigi Tosi is the Senior Research Scientist at National Research Council of Italy - Institute of Marine Sciences in Venice, Italy (CNR-ISMAR). He deals with applied and environmental coastal geology. His main research sectors are: coastal hydrogeology, particularly natural and man-induced land subsidence, relative sea level rise and salt water intrusion, and the development of new monitoring methodologies for effective management of coastal hydro- morpho-geological hazards. His additional research activities are Late Quaternary geology, geological and geomorphological mapping of coastal areas and underwater hydro-geomorphology. Since 1992 he has been the PI of more than 40 scientific researches within about 70 project participations. He has served as reviewer more than 30 ISI journals (earth sciences). He participates to Committee of international experts appointed by the Ministry of Education, University and Research.

Key publications:

About 100 papers indexed in WoS/SCOPUS, 40 book chapters (ISBN), and 4 geological maps. Key publications on land subsidence and sea level rise:

Venice, Italy. SCIENTIFIC REPORTS (NATURE), 7, Article number: 1321.


- **Tosi L**, Teatini P, Strozzi T et al. (2010). Ground surface dynamics in the northern Adriatic coastline over the last two decades. RENDICONTI LINCEI - SCIENZE FISICHE E NATURALI, vol. 21, p. 115-129


Esther Stouthamer is associate professor in Physical Geography at the Global Change Geomorphology group, Department of Physical Geography, Utrecht University. Her fields of expertise are Quaternary geology, delta evolution, subsurface architecture and characterization, subsidence, fluvial and coastal geomorphology. Her work involves quantifying the relative contribution of individual subsidence processes to total subsidence in built-up and rural areas, determining the potential of the subsurface for subsidence in present deltas (Rhine-Meuse delta, Mekong delta), and subsidence modelling with a coupled geological-hydrological-subsidence model, predicting impacts and optimizing solutions for subsidence in deltas. She was a member of the International Conference on Fluvial Sedimentology in 2005 (also in the organizing committee) and 2013. She organized sessions at several international conferences. She is member of the editorial board of AMQ "Alpine and Mediterranean Quaternary" (formerly Il Quaternario), Italian Association for Quaternary Research (AIQUA).

**Key publications:**

Bibliometric data: h index: 13, total number of citations: 669, average citations per year (period 2012-2016): 59. Key publications on land subsidence, delta evolution and subsurface characteristics:


Heri Andreas is lecturer in Institute of Technology Bandung (ITB). He finished his doctoral degree in early 2013. His specialties are in satellite geodesy and advance positioning. He is studying and implementing knowledge and techniques of satellite geodesy (e.g. GPS and GNSS) and advance positioning since 1997. The objects are geodynamic and deformation on volcano, on the earthquake potential areas, manmade structures, etc., creating coordinate reference system and frame, land boundary delimitation and demarcation, positioning using laser scanner, etc. Since 1997 he has been actively doing research on land subsidence in major cities in Indonesia (e.g. Jakarta, Bandung, and Semarang), land subsidence in coastal area, land subsidence in mud volcano area, including land subsidence in peat land area.

Key publications:


confidence to say Jogjakarta Earthquake Trigger LUSI Mud Volcano”. International Seminar on Disaster Management (ISDM), Jogjakarta Central Java Indonesia, 16-18 December 2013.

- **Andreas H., H.Z. Abidin, M.A Kusuma, I.Gumilar (2011).** “After four years of Ground Displacements following LUSI Mud Volcano Eruption”. FIG Congress 2011 (Bridging the Gap between Cultures), Marrakech Morocco, 18-22 May 2011.

9. ATTACH LETTER OF ENDORSEMENT OF IGCP/IUGS NATIONAL COMMITTEE

Every co-leader should obtain a letter of endorsement of its IGCP National Committee or IUGS National Committee, where such National Committees exist.

China IGCP
Prof. Hou Zengqian
Chairperson
Chinese National Committee for IGCP
Institute of Geology, Chinese Academy of Geological Sciences (CAGS)
26 Baiwanzhuang Road, Beijing 100037, China
liudunyi@bjshrimp.cn

Prof. Wu Zhenhan
Secretary
Chinese National Committee for IGCP
Director General of the Department of Science, Technology and International Cooperation, China Geological Survey
Vice President of Chinese Academy of Geological Sciences, 26 Baiwanzhuang Road, Beijing 100037, China
dic@cags.ac.cn
www.cags.ac.cn/igcp-china

Italy IGCP
Prof. Attilio Boriani
Italian National Committee for IGCP
University of Milan, Italy

The Netherlands UNESCO
Ms. Andree van Es
President of the Netherlands National Commission for UNESCO

The endorsement letters obtained were attached as appendices. Two special cases need to be explained here. Because Egypt is not a member in IGCP, our co-leader Prof. Bakr try to contact with the National Commission of Egypt to UNESCO several times, but hasn’t received any reply. In that case, we haven’t got the endorsement letter from Egypt, but we will keep trying. On the other hand, the election of Indonesia IGCP Chairperson would be in the next month, and the endorsement letter from Indonesia has to be arranged after the election. We will manage to get the endorsement letter from Indonesia as soon as possible.
10. Signature Part

It is understood that the project leader will be responsible for the submission of annual progress reports, financial statement(s) on the use of IGCP funds, as well as bibliographic data of all publications dealing with the results or activities of the project, all announcements of international public activities which may be connected with the project, such as conferences, field trips, workshops and courses, and a detailed final report when the project has been finished.

It is understood that the project leader(s) will inform the IGCP and/or IUGS National Committees of its own country about his/her project. The project leader(s) will encourage each project participant to inform their IGCP and/or IUGS National Committees about their participation in the project. The project leader(s) will also always inform the IGCP and/or IUGS National Committees of the country where they will be having a meeting, workshop or other project related activity.

It is further understood that the results of the project will be published, preferably in international peer-reviewed publications.

It is further understood that each publication resulting from the project has to carry, at a prominent place, a statement that it is a contribution to the International Geoscience Programme, specifying the number of the project.

In books resulting from the project, the title page and, when technically possible, the cover should also carry the official logo of the IGCP.

It is also understood that the project shall publish at least one scientific paper in the journal ‘Episodes’.

With this signature I confirm that the co-leaders listed above have officially agreed to participate in this project.

Date:
10th October, 2017

Signature:

Prof. Xuexin Yan
Leader
Shanghai Institute of Geological Survey, China

IGCP Project Proposal From
Prof. Guy Narbonne  
IGCP Chair  
Tel: +613-533-6168  
E-mail: narbonne@queensu.ca

October 10, 2017

Dear Prof. Guy Narbonne,

On behalf of the China National Committee for IGCP, we would like to express our full support to a new IGCP Project entitled “Impact, Mechanism, Monitoring of Land Subsidence in Coastal cities (IM2LSC)”, proposed jointly by a group of scientists headed by Prof. Xuexin Yan from Shanghai Institute of Geological Survey, China; co-led by Dr. Mahmoud Bakr from Dar Al-Handasah Consultants, Egypt; senior research scientist Luigi Tosi from Institute of Marine Sciences in Venice, Italy; associate Prof. Esther Stouthamer from Utrecht University, the Netherlands and Dr. Heri Andreas from Bandung Institute of Technology, Indonesia.

This new IGCP project aims to jointly carry out international academic communication and cooperation, and further the international understanding of land subsidence, especially in coastal countries and regions. Meanwhile, this new project will promote and share advanced technical methods of land subsidence analysis and evaluation. Also, the project will exchange experiences and research results, especially the technological progress, professional talents training and technology education in land subsidence field. Furthermore, such knowledge and experience sharing will be among both developing and developed countries worldwide, and ultimately enhance global land subsidence control capacity and level.

It is expected that the results of this study will provide deep understanding of the driving mechanisms of land subsidence in coastal cities, the different technologies and network for monitoring land subsidence, and the risk of coastal land subsidence at both space-scale and time-scale. Such understanding will increase awareness of coastal cities upon land subsidence they face. Also, promotion of the advanced technical methods, mature experiences and available research results from this new project will help to the public to realistically assess the risk and help them to develop an appropriate management plan for land subsidence, so as to provide basic guarantee for the protection of eco-environment resource and development of economic activities in different countries and regions around the world. Furthermore, through international collaboration, annual meeting, workshops and post-meeting fieldtrips, the project will definitely enhance the training of graduate students and young scientists in
the participating countries, as well as enhance social understanding, knowledge transfer, and cooperation among developed and developing countries.

Prof. Xuexin Yan, leader of the strong leadership team assembled in this project, is the chief engineer of Shanghai Institute of Geological Survey (China) and Director of the Key Laboratory for Monitoring and Prevention of Land Subsidence, Ministry of Land and Resources (China) with extensive research achievement in theory, key technologies and management experience on prevention and control practice of land subsidence. The leader and co-leaders of the project, who have worked in this subject area individually for many years, are internationally recognized researchers in this topic area from leading academic institutions in China, Egypt, Italy, the Netherlands and Indonesia. We believe that Prof. Xuexin Yan and his team are highly qualified for the leadership of the new IGCP project.

In view of the importance of the new project and the accomplishments made by Prof. Xuexin Yan and his team, the China National Committee for IGCP gives full support to this IGCP proposal. We would be very grateful if the IGCP Scientific Board could give strong consideration to funding this important work to help elucidate these growing hazards associated with the construction process in coastal cities.

With our best regards,

Sincerely Yours

Prof. Hou Zengqian  
Chairperson  
Chinese National Committee for IGCP

Prof. Wu Zhenhan  
Secretary  
Chinese National Committee for IGCP
Dr. Margarete Patzak  
IGCP Secretariat  
Division of Ecological and Earth Sciences  
UNESCO  
1 rue Miollis  
75732 Paris Cedex 15, France  
(email: m.patzak@unesco.org)

Subject: IUGCP- Italian National Committee Support for “Impact, Mechanism, Monitoring, of Land Subsidence in Coastal cities (IM2LSC)”, by Xuexin Yan (Leader), Esther Stouthamer, Mahmoud Bakr, Heri Andreas, Luigi Tosi, submitted to IGCP for Consideration –2017 Proposal Process.

Dear Dr. Patzak,

The subject proposal aims to enhance the scientific understanding of Land Subsidence in Coastal cities, and globally disseminate the knowledge to increase resource-management capabilities for mitigating these phenomena occurring in developed and developing countries alike. Currently, the hazards generally are under recognized and poorly understood in many developing countries.

Luigi Tosi, one of the co-leaders of the strong leadership team assembled on this proposal, is a senior scientist (geologist) with the National Research Council of Italy – Institute of Marine Sciences with extensive research experience in land subsidence monitoring and analysis.

The Italian National Committee of IGCP endorses the subject proposal and urges IGCP to give strong consideration to funding this important work to help elucidate these growing hazards associated with the development of the world’s groundwater, oil and gas resources. Please contact me if you have any questions regarding this endorsement. Thank you.

Sincerely,

Prof. Attilio Boriani  
Italian National Committee for IGCP  
University of Milan – Italy
To whom it may concern,

With this letter, the Netherlands Commission for UNESCO would like to express its support to the IGCP proposal titled "Impact, Mechanism, Monitoring of Land Subsidence in Coastal cities (IM2LSC)”. We recognize the added value of the IM2LSC project in helping to develop evidence-based recommendations to find solutions for land subsidence related challenges that coastal cities face in developing as well as developed countries.

The proposed project aims to establish an international scientific collaboration between institutions and researchers to develop a better understanding of land subsidence, and plans to research the impacts of human activities and sea-level rise, hydro-mechanism and monitoring methods of land subsidence in coastal cities. The research results will play an effective role in the planning, construction, management and security assurance for coastal cities, contributing directly to solutions for subsidence.

Dr. Esther Stouthamer, one of the co-leaders, is associate professor in physical geography at Utrecht University, The Netherlands. She has ample experience in setting up, carrying out, and leading scientific land subsidence research in near coastal deltaic areas following an interdisciplinary and systems approach.

Stouthamer has been collaborating with other Dutch partners in monitoring, unravelling mechanisms and predicting impacts of land subsidence in deltas. They form the core group of the Dutch consortium of this research proposal. This group will organize the 10th International Symposium on Land Subsidence (TISOLS), mentioned as activity in year 3 in
the proposal (p. 20). The other co-leaders are internationally recognised researchers from leading academic institutions in China, Egypt, Italy, and Indonesia.

The Netherlands Commission for UNESCO believes that the proposed IGCP research project would make a valuable contribution to increasing our understanding of the different mechanisms underlying land subsidence, which has thus far been poorly understood, in order to take efficient and sustainable measures regarding subsidence challenges in coastal cities world-wide.

Yours sincerely,

Ms. Andrée van Es
President of the Netherlands National Commission for UNESCO