IAH network on "Coastal aquifer dynamics and coastal zone management"

QUESTIONNAIRE

IAH national committees, IAH members and non members from all around the world involved in SWI and SGD research and management are kindly asked to fill in the questionnaire in this page with as many details as possible.
A world database will be set up and made available, with basic coastal aquifer main characteristics.
We expect to gather standard and comparable information on the knowledge level and hopefully the state of the art of the research on SWI and SGD, and coastal aquifer management methods adopted around the world.

1)	Location of aquifer (country, more specific location):	Jeju, South Korea
2)	Reported by:	Yongcheol Kim
3)	Type of medium (karst, porous, fracture)	Volcanic
4)	Type of aquifer (phreatic or confined)	Unconfined or Confined
5)	Main lithology - (e.g. gravel, sand and clay)	Volcanic rocks (Basalt, Trachyte, tuff) and sediments (vocanic or reworked marine)
6)	Hydrochemistry: fresh or saline	Fresh and Saline
7)	Saltwater intrusion: lateral from sea or lakes - upconing	Naturally strong saltwater intrusion in eastern part and anthrophogenic saltwater intrusion in western part of the Island due to the difference in subsurface geological characteristics, precipitation condition, land use and intensity of agricultural irrigation
8)	Aquifer geometry: hydraulic characteristics	Generally multi-layered partially confined aquifers with high permeable features such as clinker, lava tube, scoria and hyaloclastite. Bottom of the aquifers are confined by Seoguipo formation which is reworked marine sediment of old tuff cones or by unconsolidated marine clay sediment which is same as marine sediment of the Yellow sea.
9)	Aquifer parameters: storage - annual water pumping - (in MCMA - millions cubic meters, annually)	storage - 1676 MCMA(recharge), 645 MCMA(sustainable yield) ; annual water pumping - 150 MCMA
10)	Depth of aquifer (water level and bottom) - water level 5- 30 m - aquifer depth - 50-200 m	water level ranges from near zero at coast to several hundreds meters at high land, generally following to topographic gradient. Generally roughly saying, the depth to water level is deep which is down about 50 % of its elevation above mean sea level.
11)	Major chemistry (anions - ?; Cations - ?):	anions - HCO3, Cl, NO3, SO4; Cations - Na, Ca, Mg, K
12)	Major salinity sources:	sea water
13)	Population:	680,000 (as of 2017)
14)	Aquifer status: special features - e.g. thermal springs, major faults,...	There are 911 of springs, among which 839 are located at lower than 200 m in elevation. Recharge rate is up to 45% of precipitation thanks to some permeable surface features such as permeable soil, clinker, scoria and lava hole and thick unsaturated zone. Most of the streams are ephemeral having discharge period of average 13 days a year.
15)	Investigation methods - e.g. water level measurements, EC (electrical conductivity profiles), TDEM (geophysical),	There are 168 groundwater monitoring stations, 84 raingauges, 5 tidal monitoring stations, 356 groundwater usage monitoring wells and 47 stream monitoring stations, most of which operated by local government and monitored remotely using data logger and telemetric systems. Water budgets are assessed every ten years using those data and revised every five years. Most of the wells have to report geological logging data to the local government since 1992 and there are more than 1000 borehole logging data.
16)	Numerical hydrological modeling, chemical and isotopic methods, age determination, IR survey, seepage meters (for Submarine Groundwater Discharge, SGD)	There are many researches on chemical and isotopic methods and several in numerical modeling and age determination and a few on SGD in Jeju Island.
17)	Monitoring methods applied and duration - water level measurements, EC (electrical conductivity profiles - seasonal)	There are 168 groundwater monitoring stations, 84 raingauges, 5 tidal monitoring stations, 356 groundwater usage monitoring wells and 47 stream monitoring stations, most of which operated by local government and monitored remotely using data logger and telemetric systems. Groundwater monitoring stations collects water level, EC and temperature at every hour and EC profiles at every 3 or 6 months. Two of the groundwater monitoring stations are equipped with an "Interface Egg" device which is developed by KIGAM and can tracks the location of freshwater and salt water interface location with time.
18)	Management methods:	Groundwater source is treated as public property since 1992 and every new wells have get a permit from the local government after consulted and reviewed of the environmental impact assessment report by the Commision on Groundwater Management. Local government tried to manage the groundwater resources based on scientific knowledges through regular survey, monitoring and water budget analysis and research on hydrogeological cycling system of the island.
19)	Aquifer management actions:	Local government tried to manage the groundwater resources based on scientific knowledges through regular survey, monitoring and water budget analysis and research on hydrogeological cycling system of the island.
20)	Identification of existing or potential problems:	Groundwater level decline at western part of Jeju is problematic by condensed pumping activities for irrigation during dry season resulting sometime in salt water intrusion such as fall of 2013. Groundwater quality at lower area getting worse, specially in NO3 caused by agricultural activities. Coastal springs are gettting lose of their discharg rate or sometimes extincted by the increase of groundwater use at upgradient and land use changes by construction.
21)	Annexes:	-
22)	Observations:	Monitoring wells far from coast show good correlation in both short and long-term trends with precipitation having seasonal fluctuation, whereas those near coastal area show good correation in short term trend with ocean tide also having seasonal variation in long term trend. Recently several researches reported on FSGD, which is not included in water budget analysis so far however it is getting important. More researches should be done on this subject in the future to manage the groundwater resources properly.