Questions & Answers Session 4

Please type your questions in the Question Box. We will try our best to get to all your questions. If we don't, feel free to email Amita Mehta (amita@umbc.edu) or Sean McCartney (sean.mccartney@nasa.gov).

Question 1: If you have springs and seeps contributing to base flow, does that mess up the water budget calculations?
Answer 1: Important question. If you consider springs and seeps contributing to base flow, it can contribute positively or negatively to surface water budget, that is true.

Question 2: Is there an API (or script) that allows download of GLDAS data directly from GIOVANNI?
Answer 2: We didn't have time to go through that, but if you go to the download link it shows lineage. That lineage has all the files, you can click on them and download, or you can save the URLs and download. However, those files are not subsetted, they're global. That's why we went through the GESDISC website to subset temporally and spatially. These bulk-download files are in NetCDF. If you want to use them in GIS, you either have to convert them in GeoTIFF, or use Python and R.
In Giovanni if you want to download subsetted files then you must animate GLDAS maps for the desired period. This takes time and also there is a limit on the number of frames one can animate.

Question 3: How to interpret the deficit in the water budget?
Answer 3: Here I would say that we're not looking at the entire water budget because we're not considering ground water or subsurface runoff. When focusing on surface water, you're looking at precipitation, ET, and runoff, so when you say negative, that means in that region there was more ET, maybe more vegetation or barren land, so more evaporation. There is more water lost from the surface (ET plus runoff) than received (precipitation). I would also interpret this as change in surface water storage.

Question 4: How is runoff estimated in the GLDAS example for Parana? Is it a satellite estimate or a closure term? If closure term, then the change in storage (water balance) cannot also be estimated as a closure term…
Answer 4: It's a closure term based on Water Balance.

Question 5: Is there any comparison between remote sensing results with the observation data?
Answer 5: You can definitely find publications that compare remote sensing and observational data. Please visit the following websites for references: https://ldas.gsfc.nasa.gov/gldas/GLDASpublications.php and https://ldas.gsfc.nasa.gov/gldas/GLDASpublications.php#_Validation

Question 6: Is it possible to download GLDAS data for the Teesta River Basin, West Bengal, India? It is located in the foothills of Eastern Himalaya.
Answer 6: GLDAS data are global so it will cover the Easthern Himalaya area. You can go to the HydroSHEDS website to see if you can extract that river basin. Otherwise you may have to use SRTM or ASTER DEM data and do the same. Also, it will be important to validate GLDAS in that region.
https://www.hydrosheds.org/

Question 7: When processing remote sensing data with different spatial resolutions, is it better to upscale or downscale?
Answer 7: Upscale would be better. When you downscale, you would be interpolating data, and we don't think that is correct - precipitation, ET, interpolated in space wouldn't make sense. So (in my opinion) upscaling is better.

Question 8: In some basin of the planet have made comparisons of water balance with satellite images vs field data, how were these? (for example R2 statistical correlation) for planning issues.
Answer 8: Not certain of the answer because there may be several papers that compare remote sensing with in situ observations. Please see the following: https://ldas.gsfc.nasa.gov/gldas/GLDASpublications.php

Question 9: if we want to study the WB for practical decision-making at weekly time scales, what is the finer spatial resolution we can do based on the procedure we saw today?
Answer 9: If you want weekly time periods - GLDAS data are available at 3-hourly time scale, so you can use that to get weekly water budget data.

Question 10: Is the GLDAS soil moisture data validated with some ground truth data?
Answer 10: Yes, they have been validated. There is a new version of the land information system that assimilates soil moisture data from SMAP. That is a newer version that's used by some groups. If you go to the LDAS website there are references and presentations that talk about validation.
https://ldas.gsfc.nasa.gov/index.php

Question 11: If you are not using groundwater data then is it correct to say that this is data for the river and its loss only, and not the river basin? You would need to go into the storage data for that?
Answer 11: Yes, that's what I mentioned earlier. For this webinar's purposes, we focused mostly on surface components. You do need to look at the storage part (soil moisture, ground water, snow depth in mid & high latitudes) and ideally you should have river discharge, lake/reservoir water storage data also. When you have all these components, you can estimate water balance. Annually if you see, it is the precipitation received and water loss to either ground or atmosphere, whatever remains is storage in soil and discharge in the river. So that's how partitioning occurs. On a large scale, annually, precipitation and ET provide first order water balance.

Again, someone who's an expert in hydrology or done hydrological analysis probably has a better idea of how to use these data more effectively. The idea of this training was to introduce these resources that are available and show a few steps you can use to utilize/analyze this data.

Question 12: In the training you are using time average mm/month. This is an average of precipitation in a month, not accumulation? Why not work with accumulation to account for all the water that rains in the month?
Answer 12: It is accumulation, but when you have multiple years, it's the average of accumulated precipitation for a month. In Giovanni it is possible to accumulate data

over a time period. But to demonstrate that, GLDAS data requires unit conversion to get accumulated rain. That's why we used monthly data.

Question 13: When you re-projected to Albers-Equal, what was the grid cell resolution?
Answer 13: When the geographic coordinate system was projected into *South America Albers Equal Area Conic*, the cell resolution in meters was x: 24921.3, y: 28281.4

Question 14: Could you explain what is meant by time-averaged map? The units were given as per second.
Answer 14: Instantaneous GLDAS rain rates are given in Kg/m2/second. Monthly data are just averaged of these data over a month.

Question 15: In the QGIS demo, the deficit is more than the calculated values, as we are ignoring some losses, am I right?
Answer 15: We don't know how subsurface runoff is contributing to surface water balance. Yes, we're not sure this is not absolute deficit or excess, this is just the surface components we're looking at. This is not a complete budget, but for the surface, these are the major components. Of course, there's also the subsurface runoff we aren't taking into account.

Question 16: What is the physical meaning of having a negative water balance (WB) value? I would expect the minimum WB to be zero (because actual ET plus runoff should not exceed precipitation).
Answer 16: Whatever precipitation is there, some runs off, some stays in the soil and percolates all the way to groundwater. In the context of what we showed, if it is negative, it means that evaporation plus surface runoff are more than precipitation received by the area. That's my interpretation.

Question 17: Can remote sensing be used to access water quality data of water supply schemes (spring source and storage tanks) of hilly regions and small areas?
Answer 17: Remote sensing helps in water quality monitoring. The majority of work is done in coastal regions and open ocean. A lot of studies have focused on (larger) inland lakes, but not sure about storage tanks or springs. Generally optical data (Landsat, MODIS) are used for water quality monitoring. MODIS resolution is 500 m to and Landsat resolution of 30 m. If the stream doesn't have 3 clear pixels of any sensor,

it's difficult to estimate water quality. So it depends on the size of the spring or lake. Also, if the bottom of the lake/spring surface and vegetation around the stream is contributing to optical reflectances, then it is difficult to estimate accurate water quality.

Question 18: (Spanish) *Como podrian considerarse los efectos de regulacion de rios en los modelos para la componente de caudal en rios, dentro del balance?, considerando que el ejemplo de la cuenca del Parana es uno de ellos.*

(English) How could the effects of river regulation be considered in the models for the flow component in rivers, within the balance? Considering that the example of the Parana basin is one of them.

Answer 18: That's a good question. What we showed had the natural variability. River regulation is not included in this demo or in GLDAS. If you use a model like SWAT, there is a way to include management practices in different ways. One way to do this is to use remote sensing as forcing to a model like SWAT. Then you can model river regulations in the model and estimate their impacts on basin water balance. Similarly irrigation is not included in GLDAS, but SWAT can include irrigation in the model.