proofOfConcept

November 2, 2023

```
Global seed set to 123
100%|                                                |
97/97 [00:35<00:00,  2.75it/s]
```

Config defines the setup of the model and the input data it expects. This will also affect the dataLoader. DataLoader automatically create batches of data and also put the data onto the GPU efficiently.

```
[38]: tensor([[[[-0.6130, -0.6050, -0.5845,  …, -0.5089, -0.5067, -0.5636],
               [-0.5705, -0.5682, -0.5631,  …, -0.5046, -0.5289, -0.5111],
               [-0.5897, -0.6071, -0.6308,  …, -0.4773, -0.4993, -0.4886],
               …,
               [-0.5736, -0.5637, -0.5533,  …, -0.4914, -0.4620, -0.4337],
               [-0.5697, -0.5601, -0.5519,  …, -0.4807, -0.4330, -0.4105],
               [-0.5697, -0.5590, -0.5501,  …, -0.4576, -0.3970, -0.3798]],

              [[-1.5554, -1.5514, -1.5446,  …, -1.1903, -1.1768, -1.1717],
               [-1.5942, -1.5715, -1.5533,  …, -1.2104, -1.1909, -1.1912],
               [-1.6074, -1.5842, -1.5723,  …, -1.2223, -1.2133, -1.2230],
               …,
               [-1.7719, -1.7800, -1.7864,  …, -1.2445, -1.2515, -1.2542],
               [-1.7644, -1.7728, -1.7791,  …, -1.2532, -1.2556, -1.2567],
               [-1.7581, -1.7659, -1.7729,  …, -1.2634, -1.2619, -1.2649]],

              [[-0.5855, -0.5630, -0.4656,  …,  2.8799,  2.3554,  2.3218],
               [-0.5140, -0.5242, -0.4831,  …,  3.0533,  2.6619,  1.9717],
               [-0.4943, -0.5553, -0.5444,  …,  3.0010,  2.4961,  1.2053],
               …,
               [-0.8891, -0.7921, -0.6953,  …,  0.4381,  0.4332,  0.4243],
               [-0.9109, -0.8164, -0.7228,  …,  0.4394,  0.5143,  0.5026],
               [-0.9375, -0.8389, -0.7447,  …,  0.3260,  0.5226,  0.5962]]],


             [[[-0.6016, -0.6190, -0.5918,  …, -0.5399, -0.5323, -0.5810],
               [-0.5848, -0.5743, -0.5878,  …, -0.5424, -0.5502, -0.5225],
               [-0.6031, -0.6004, -0.6142,  …, -0.4990, -0.5099, -0.4941],
               …,
               [-0.5377, -0.5458, -0.5535,  …, -0.1351, -0.1279, -0.1396],
               [-0.5445, -0.5632, -0.5707,  …, -0.0868, -0.1140, -0.1494],
```

```
      [-0.5616, -0.5789, -0.5929,  …,  -0.1304, -0.1891, -0.2197]],

 [[-1.2730, -1.3120, -1.3301,  …,  -1.2176, -1.2109, -1.2138],
  [-1.2362, -1.2679, -1.3077,  …,  -1.2278, -1.2237, -1.2333],
  [-1.1972, -1.2434, -1.2909,  …,  -1.2337, -1.2231, -1.2276],
  …,
  [-0.2754, -0.2840, -0.3028,  …,  -1.1794, -1.1810, -1.1695],
  [-0.2895, -0.2947, -0.3124,  …,  -1.1838, -1.1793, -1.1698],
  [-0.3082, -0.3112, -0.3243,  …,  -1.1918, -1.1791, -1.1717]],

 [[-1.5818, -1.6184, -1.6064,  …,   0.5449,  0.0078, -0.1738],
  [-1.5389, -1.5161, -1.5064,  …,   0.7574,  0.2575,  0.4455],
  [-1.4886, -1.4353, -1.4546,  …,   0.7215,  0.4731,  0.5237],
  …,
  [-0.9239, -0.9037, -0.8812,  …,  -1.5324, -1.4916, -1.4105],
  [-0.9593, -0.9312, -0.9028,  …,  -1.4052, -1.3895, -1.3371],
  [-0.9834, -0.9578, -0.9169,  …,  -1.3958, -1.3261, -1.1850]]],


[[[ 0.2035, -0.0725, -0.0955,  …,  -0.5321, -0.5063, -0.4563],
  [-0.1167, -0.1584, -0.1103,  …,  -0.5354, -0.4812, -0.3825],
  [-0.1345, -0.2068, -0.1283,  …,  -0.4827, -0.4071, -0.2549],
  …,
  [ 0.0358,  0.0191, -0.0083,  …,  -0.1598, -0.1690, -0.1711],
  [-0.0489, -0.0773, -0.0973,  …,  -0.1511, -0.1962, -0.2589],
  [-0.1065, -0.1278, -0.1528,  …,  -0.2053, -0.2755, -0.2773]],

 [[-1.0555, -1.0486, -1.1199,  …,  -1.2687, -1.2297, -1.2102],
  [-1.1202, -1.0940, -1.1403,  …,  -1.2952, -1.2608, -1.2476],
  [-1.1811, -1.1444, -1.1708,  …,  -1.3080, -1.2795, -1.2728],
  …,
  [-0.5124, -0.5319, -0.5526,  …,  -1.2394, -1.2023, -1.1831],
  [-0.5296, -0.5510, -0.5737,  …,  -1.2035, -1.1874, -1.1745],
  [-0.5533, -0.5725, -0.5975,  …,  -1.1952, -1.1835, -1.1739]],

 [[-1.2378, -0.7933, -0.2781,  …,  -1.0421, -0.9973, -1.1126],
  [-1.3694, -0.9664, -0.3615,  …,  -0.9441, -1.2983, -0.9308],
  [-1.2879, -1.0664, -0.5302,  …,  -0.8699, -0.9712, -0.7563],
  …,
  [-0.6532, -0.6923, -0.7308,  …,  -0.3582, -0.5602, -0.6635],
  [-0.5775, -0.6264, -0.6726,  …,  -0.4942, -0.6677, -0.7105],
  [-0.5099, -0.5632, -0.6247,  …,  -0.5840, -0.6261, -0.6655]]],


 …,
```

```
[[[-0.6345, -0.6317, -0.6022,  …,  -0.4818, -0.3936, -0.3421],
  [-0.5878, -0.6052, -0.6082,  …,  -0.4779, -0.4029, -0.4126],
  [-0.6049, -0.6292, -0.6501,  …,  -0.4500, -0.4174, -0.4097],
  …,
  [-0.1294, -0.1068,  0.0310,  …,   0.7224,  0.8597,  0.8995],
  [-0.0605,  0.0255,  0.2897,  …,   0.9642,  1.0446,  0.9814],
  [-0.2291, -0.1147,  0.0302,  …,   0.9530,  1.0715,  1.0976]],

 [[-2.0184, -1.9841, -1.9617,  …,  -1.3426, -1.2667, -1.2058],
  [-2.0733, -1.9942, -1.9584,  …,  -1.2778, -1.2156, -1.1915],
  [-2.0787, -1.9921, -1.9552,  …,  -1.2476, -1.1946, -1.1837],
  …,
  [-0.6215, -0.6120, -0.6010,  …,  -0.9585, -1.0559, -1.1038],
  [-0.6262, -0.6233, -0.6139,  …,  -1.0305, -1.0740, -1.1085],
  [-0.6198, -0.6167, -0.6153,  …,  -1.0433, -1.0911, -1.0999]],

 [[ 0.8111,  0.9445,  1.1447,  …,  -0.9791, -0.8567, -0.5040],
  [ 0.8714,  0.9368,  1.1594,  …,  -1.1032, -0.8455, -0.4263],
  [ 0.8761,  0.9702,  1.1861,  …,  -1.1001, -0.7292, -0.3775],
  …,
  [-0.4545, -0.4538, -0.4552,  …,   1.1174,  0.9086,  0.7524],
  [-0.5566, -0.5566, -0.5630,  …,   1.0546,  0.7212,  0.6661],
  [-0.5751, -0.5949, -0.6104,  …,   1.0695,  0.7180,  0.5659]]],


[[[-0.6275, -0.6238, -0.5953,  …,  -0.5259, -0.4850, -0.5207],
  [-0.5857, -0.5997, -0.6019,  …,  -0.5212, -0.5050, -0.5032],
  [-0.6048, -0.6261, -0.6482,  …,  -0.4790, -0.4809, -0.4741],
  …,
  [-0.6401, -0.6385, -0.6040,  …,  -0.3939, -0.3918, -0.3761],
  [-0.6296, -0.6091, -0.5692,  …,  -0.4006, -0.4024, -0.3999],
  [-0.5155, -0.2894, -0.2517,  …,  -0.4120, -0.4153, -0.4159]],

 [[-1.9392, -1.9183, -1.8963,  …,  -1.4370, -1.3997, -1.3546],
  [-1.9649, -1.9145, -1.8858,  …,  -1.4090, -1.3579, -1.3224],
  [-1.9621, -1.9055, -1.8775,  …,  -1.3976, -1.3323, -1.3275],
  …,
  [-0.9668, -0.9574, -0.9481,  …,  -1.1174, -1.1449, -1.1578],
  [-0.9465, -0.9365, -0.9329,  …,  -1.1410, -1.1541, -1.1602],
  [-0.9240, -0.9226, -0.9287,  …,  -1.1507, -1.1624, -1.1460]],

 [[ 0.7035,  0.7367,  0.8932,  …,  -0.7189, -1.1300, -0.9332],
  [ 0.6980,  0.6560,  0.7963,  …,  -0.4697, -0.7178, -0.7095],
  [ 0.6402,  0.6019,  0.7288,  …,  -0.4535, -0.5868, -0.7961],
  …,
  [ 0.5071,  0.4638,  0.4248,  …,  -0.7275, -0.7390, -0.7821],
  [ 0.4904,  0.4448,  0.3975,  …,  -0.7111, -0.7397, -0.7661],
```

```
              [ 0.4507,  0.4029,  0.3678,  …, -0.7000, -0.7796, -0.7797]]],


         [[[-0.6354, -0.6332, -0.6048,  …, -0.5426, -0.5327, -0.5820],
           [-0.5903, -0.6062, -0.6105,  …, -0.5436, -0.5503, -0.5226],
           [-0.6081, -0.6311, -0.6563,  …, -0.4991, -0.5099, -0.4941],
           …,
           [-0.0811, -0.0929, -0.0996,  …, -0.4974, -0.5021, -0.5062],
           [-0.0056, -0.0265, -0.0512,  …, -0.5204, -0.5214, -0.5249],
           [ 0.1041,  0.0807,  0.0513,  …, -0.5248, -0.5287, -0.5265]],

          [[-1.8439, -1.8540, -1.8384,  …, -1.4945, -1.4856, -1.4458],
           [-1.8516, -1.8542, -1.8394,  …, -1.4530, -1.4310, -1.3950],
           [-1.8623, -1.8593, -1.8399,  …, -1.4198, -1.3740, -1.3917],
           …,
           [-0.1312, -0.1333, -0.1347,  …, -1.2782, -1.2806, -1.2812],
           [-0.1326, -0.1312, -0.1278,  …, -1.2820, -1.2828, -1.2848],
           [-0.1383, -0.1361, -0.1300,  …, -1.2909, -1.2895, -1.2869]],

          [[-0.0212, -0.0789,  0.0085,  …,  0.0288, -0.5431, -0.3953],
           [ 0.0579, -0.1255, -0.0639,  …,  0.3042, -0.0468, -0.1163],
           [ 0.0363, -0.1577, -0.1123,  …,  0.3128,  0.0618, -0.2277],
           …,
           [ 1.3142,  1.3965,  1.4770,  …, -0.5886, -0.5566, -0.5695],
           [ 1.2895,  1.3744,  1.4606,  …, -0.5506, -0.5371, -0.5944],
           [ 1.2830,  1.3330,  1.4279,  …, -0.6682, -0.6440, -0.6335]]]])
```

GPU available: True (cuda), used: True
TPU available: False, using: 0 TPU cores
IPU available: False, using: 0 IPUs
HPU available: False, using: 0 HPUs

LOCAL_RANK: 0 - CUDA_VISIBLE_DEVICES: [0,1]
/silos/conda_packages/boergel/miniconda3_4.12.0/OS_15.4/conda_env/BaltNet/lib/py
thon3.11/site-
packages/lightning/pytorch/trainer/connectors/data_connector.py:442:
PossibleUserWarning: The dataloader, predict_dataloader, does not have many
workers which may be a bottleneck. Consider increasing the value of the
`num_workers` argument` (try 96 which is the number of cpus on this machine) in
the `DataLoader` init to improve performance.
  rank_zero_warn(

Predicting: 0it [00:00, ?it/s]

```
[10]: (<xarray.DataArray 'roflux' (river: 97)>
      array([  33.61064022,   45.5155829 ,  644.76945528,   47.30555665,
               13.02240114,   62.08561069,   23.23847379, 1056.46820224,
               37.35323859,   16.02982998,   19.41510331,    7.7749602 ,
              139.33485787,   27.61420583,   42.08064771,  680.88160428,
```

```
        71.91132178,   72.46768874,   95.00392967,   36.6497767 ,
        83.56748792,  137.50105474,   61.94603035,  848.44849963,
        11.52980993,   63.63357766,   97.43116146,  127.99903246,
       102.67240485,   29.07433139,  613.86810687,   29.15462786,
        37.55781373,   42.92193174,   16.8902669 ,   70.18849514,
        42.28783115,   16.70045765,    5.06827712,  122.62002625,
        58.64941883,   66.70338796,   21.55336848,  520.30996003,
       288.34406503,  964.68548821,  238.4712004 ,   23.00773477,
       457.17208831,   35.16111723,   20.56423863,  136.16178322,
        31.80173507,   29.61480867,   17.32977089,   32.33453867,
      2635.60232717,   37.37990423,   19.44348578,   30.59535106,
       355.3766162 ,  405.73632768,   22.66584814,   11.70168696,
        51.002903  ,  247.98926341,   16.64402169,   31.04838573,
       277.71302585,   11.60822834,  157.63963273,   35.0927784 ,
       399.43266044,  497.16292459,   17.30537981,   98.17243616,
        51.77107018,   62.93633197,  161.50794081,  321.06537065,
        78.66933538,    3.45978952,   27.80483806,   97.4163262 ,
       173.24364161,   18.6525359 ,   82.59273054,   81.91356632,
       397.03600489,  218.33338178,  184.0321911 ,  503.86653313,
        25.01761269,  360.89336001,  480.95107297,  574.80264679,
        54.66342409])
Dimensions without coordinates: river,
<xarray.DataArray 'roflux' (river: 97)>
array([ 29.13182234,   42.90239718,  470.97071518,   38.16079705,
        12.20164581,   60.31228874,   28.49681636,  768.49048341,
        37.74377652,   16.73178117,   13.20047359,    8.96484628,
       128.20500658,   22.53846798,   41.41920977,  491.29077453,
        48.13951702,   43.56132433,   76.57070401,   31.23138475,
        56.77810567,   71.68234416,   40.24665043,  699.27769322,
        20.75454136,   51.4239106 ,   59.96098402,  109.14760346,
       102.70784872,   17.54380599,  107.58068362,   23.24761965,
        29.77792758,   26.99429577,   17.03511498,   72.87106589,
        46.19936664,   15.57231707,   11.94789616,   36.68010362,
        33.44652958,   65.20978185,   19.15065427,  387.66402801,
       569.65324225,  592.97844116,  145.62620777,   20.48194492,
       136.62109438,   37.67493827,   23.58909652,  121.12462384,
        32.13623851,   20.7957558 ,   17.32353495,   25.11304907,
       402.3133141 ,   39.92626492,   21.76819038,   36.03984375,
       158.37831651,  184.42826575,   22.99684133,   14.139052  ,
        55.52871549,  174.47807884,   13.33701067,   24.45497548,
       162.60145404,   10.21843759,  110.60064218,   38.52493418,
       244.19787615,  299.18802871,   20.35731663,  101.86697603,
        53.19270389,   67.83596272,  337.42986936,  255.53273483,
        65.42011338,    9.11044717,   21.48406384,   99.39460381,
       117.79331766,   15.1864797 ,   91.80221216,   93.62951761,
       167.86529485,  196.3520418 ,  191.32713713,  261.58010061,
        35.49294011,  364.21924666,  474.47127659,  418.97677247,
```
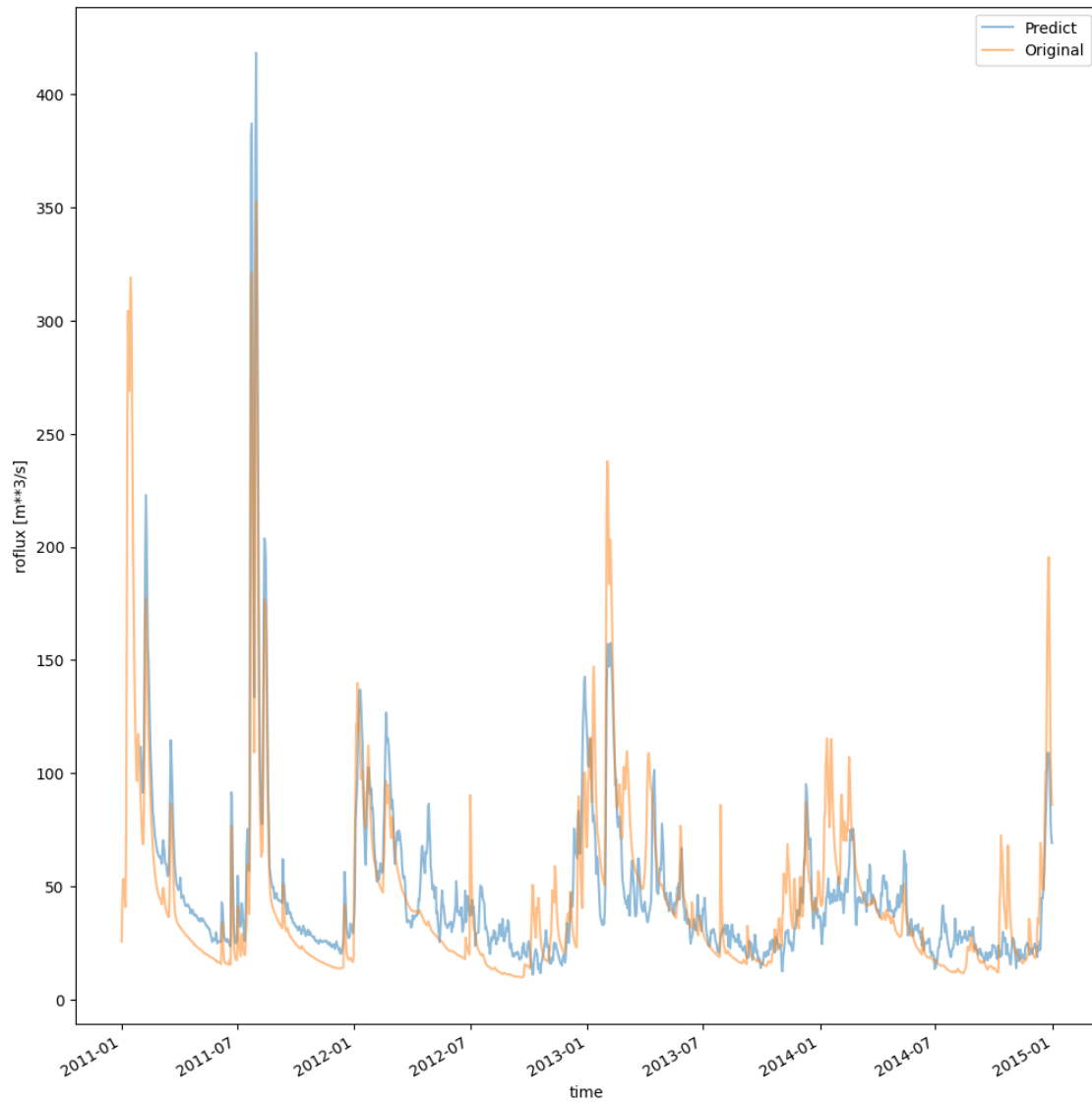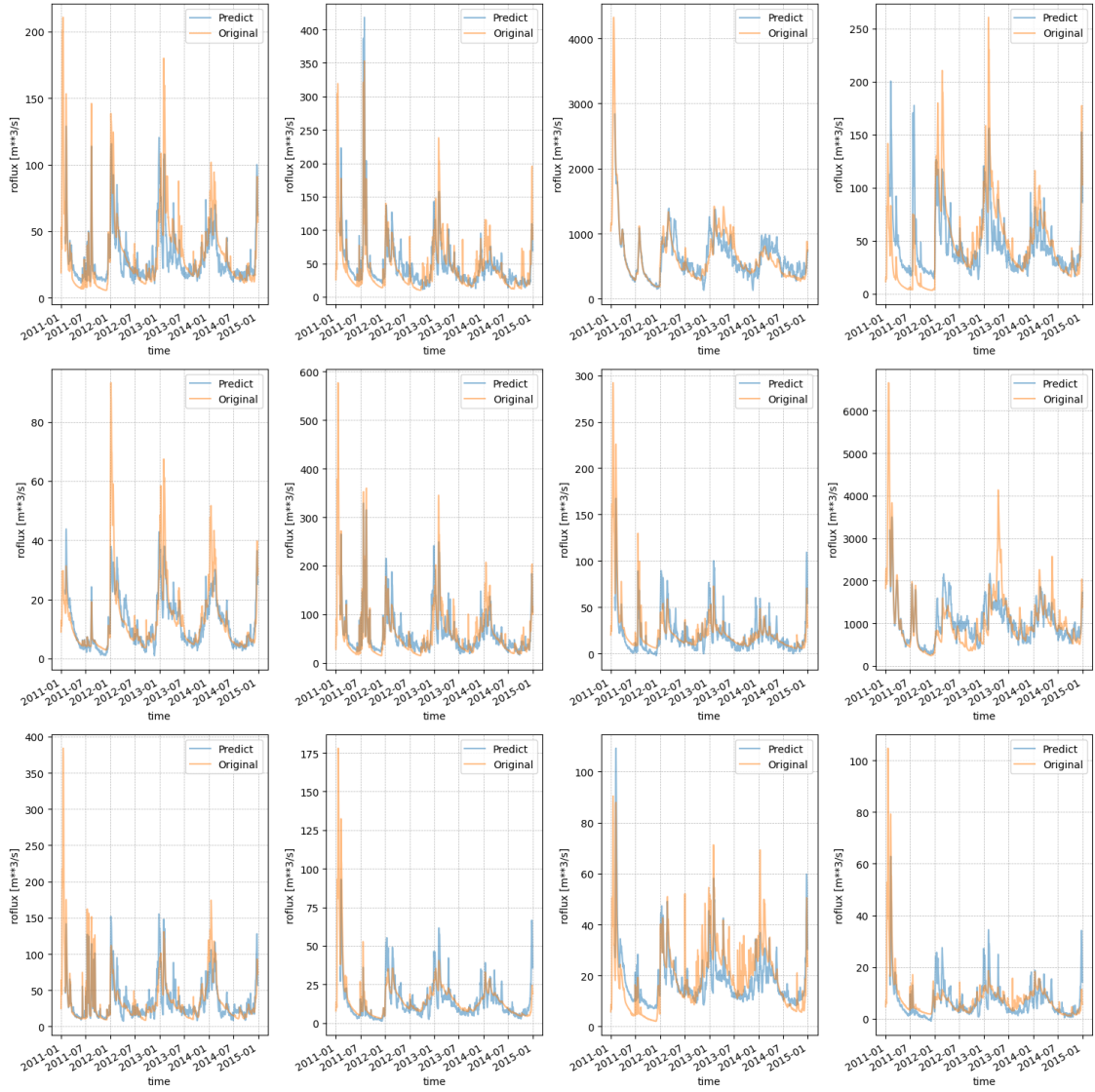
```
           77.93918462])
    Dimensions without coordinates: river)
```

[15]: <matplotlib.legend.Legend at 0x7f626146bc10>

[20]: [<matplotlib.lines.Line2D at 0x7f6261632cd0>]