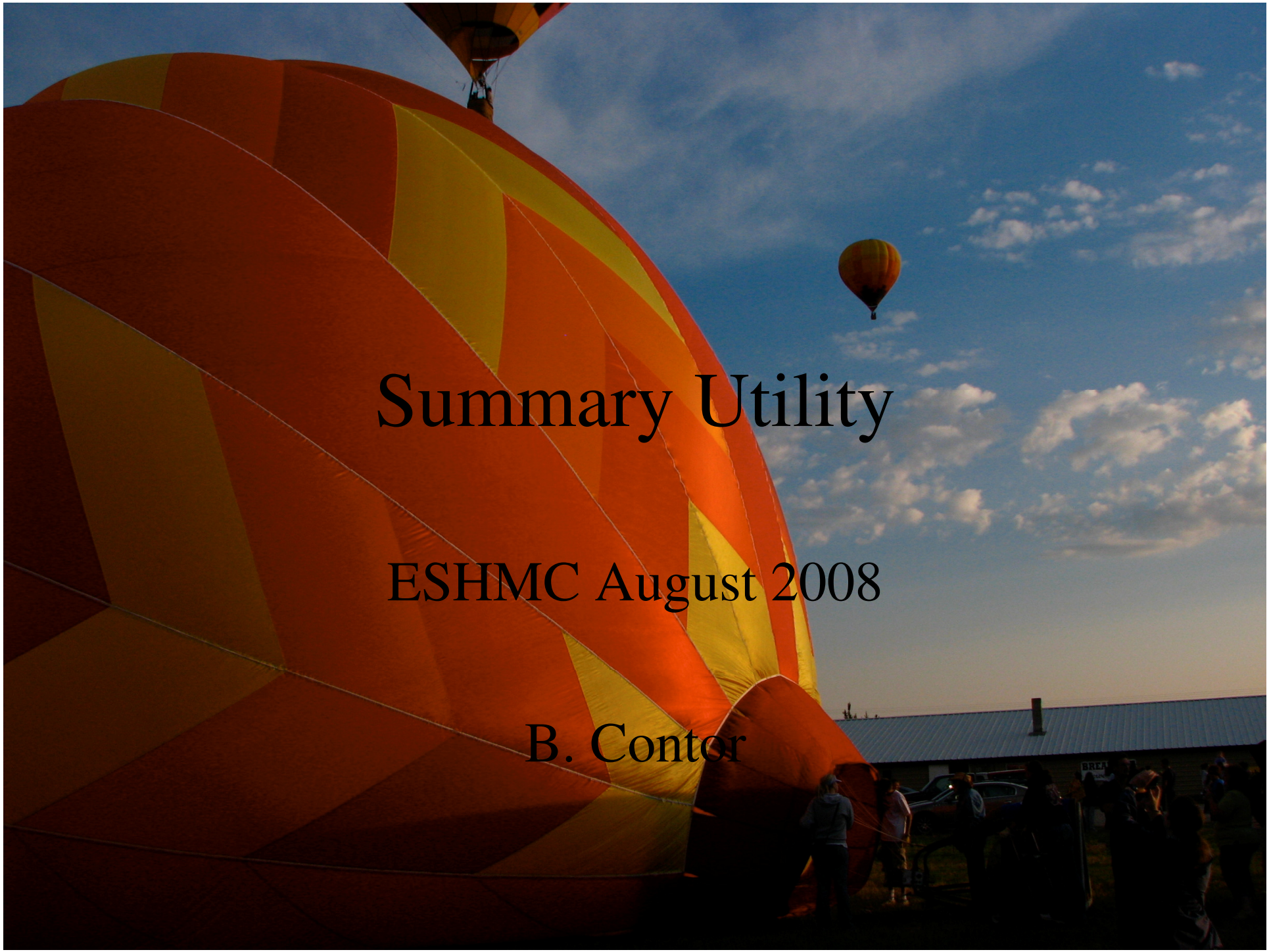


Summary Utility

ESHMC August 2008

B. Contor

Background

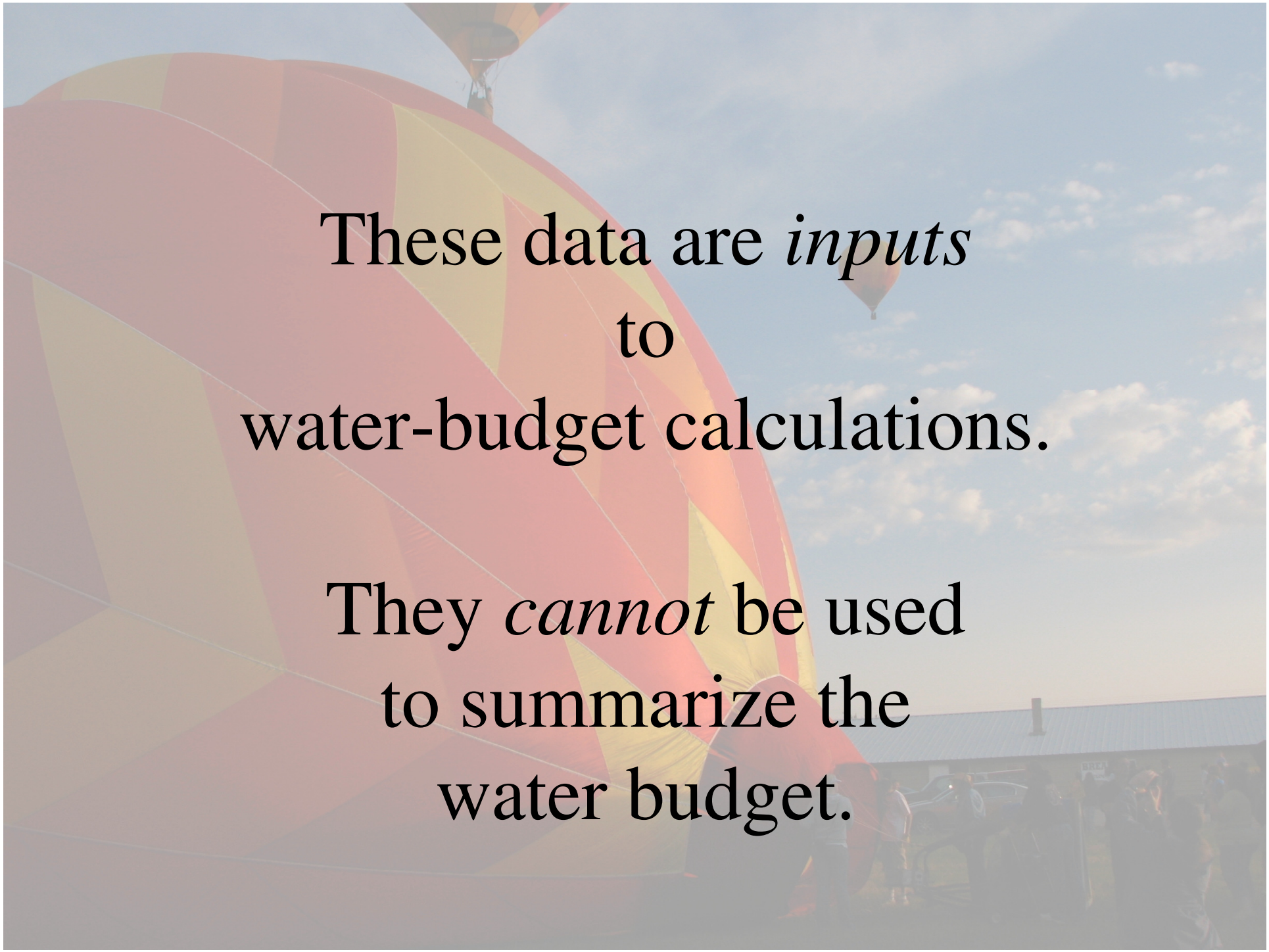
- ESPAM.exe produces intermediate text files
  - *.cel model cell dimensions & status
  - *.cnl canal leakage fractions
  - *.div diversions and returns
  - *.ent entity data
    - water source
    - ET adjustment factor
    - sprinkler percentage

Background

- *.eti irrigated ET depth
- *.fpt fixed-point pumping
- *.iar irrigated lands by model cell
- *.mdl basic simulation information
- *.nir non-irrigated recharge depth
- *.off offsite pumping

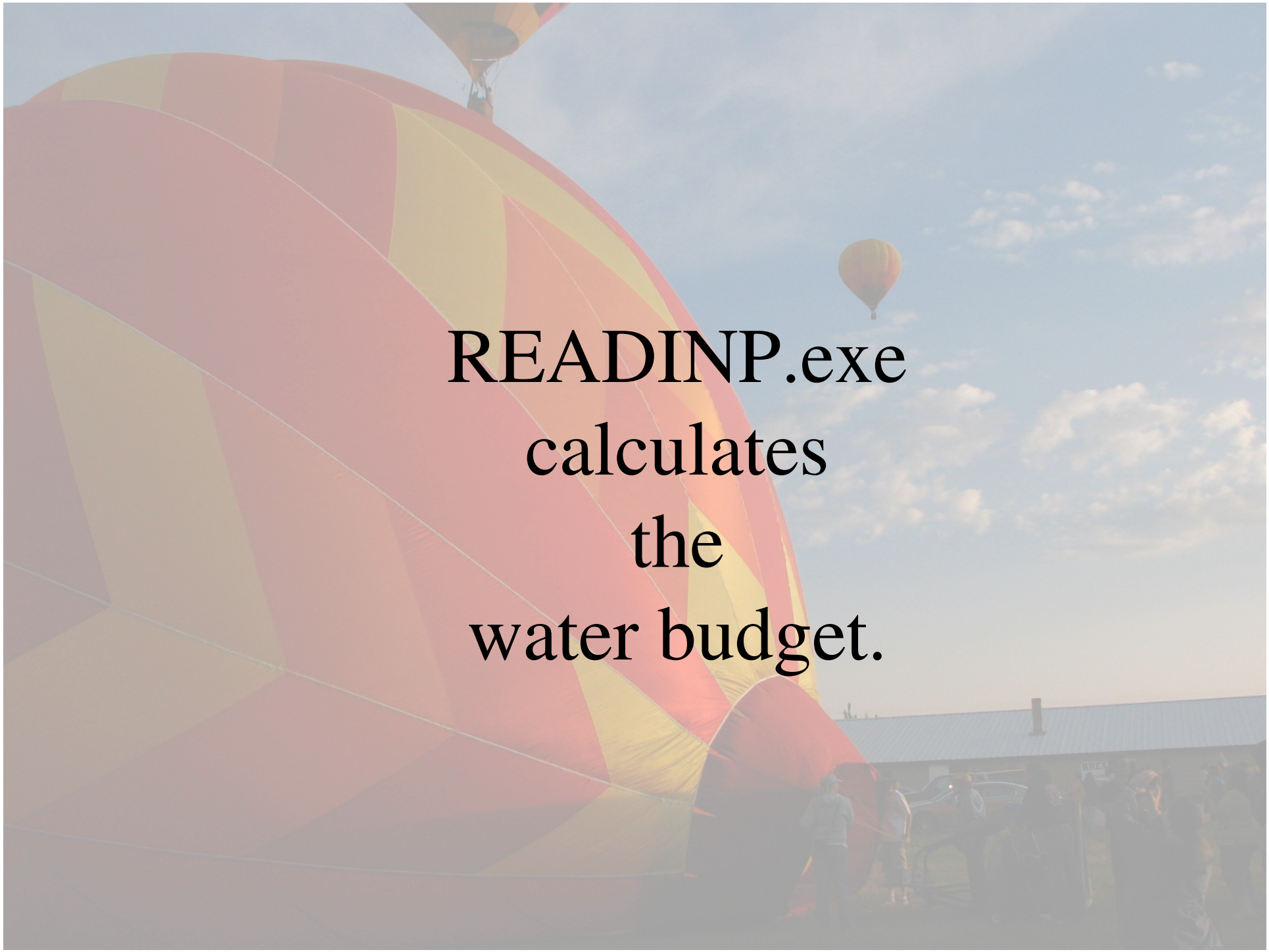
Background

- *.pre — precipitation depth
- *.red — reduction for non-irrigated inclusions
- *.sol — soil type by model cell
- *.spt — scenario-point pumping
- *.trb — tributary-valley underflow



These data are *inputs*
to
water-budget calculations.

They *cannot* be used
to summarize the
water budget.



READINP.exe
calculates
the
water budget.

Background

- READINP.exe produces
  - Non-target fluxes in two formats (same data in each):
    - *.RCH (ASCII or binary)
    - *.WEL
  - Suite of intermediate files for review purposes
    *.AGW ground-water irrigated area

Background

- *.AIR total irrigated area
- *.ANI non-irrigated area
- *.ASW surface-water irrigated area
- *.EGW evapotranspiration on ground-water irrigated lands
- *.EIR evapotranspiration on all irrigated lands
- *.ESW evapotranspiration on surface-water irrigated lands

Background

- *.PRI precipitation on irrigated lands
- *.PRN precipitation on non-irrigated lands
- *.PRT total precipitation
- *.RGW net extraction on ground-water irrigated lands
- *.RNI recharge on non-irrigated lands

Background

- *.RSW recharge on surface-water irrigated lands
- *.SWV net surface-water deliver to irrigated lands[1]
  - + diversions
  - + offsite pumping
  - - returns
  - - canal seepage
- *.WTM well-term values in alternate format

[1]also includes some GW from offsite & fixed-point wells

Background

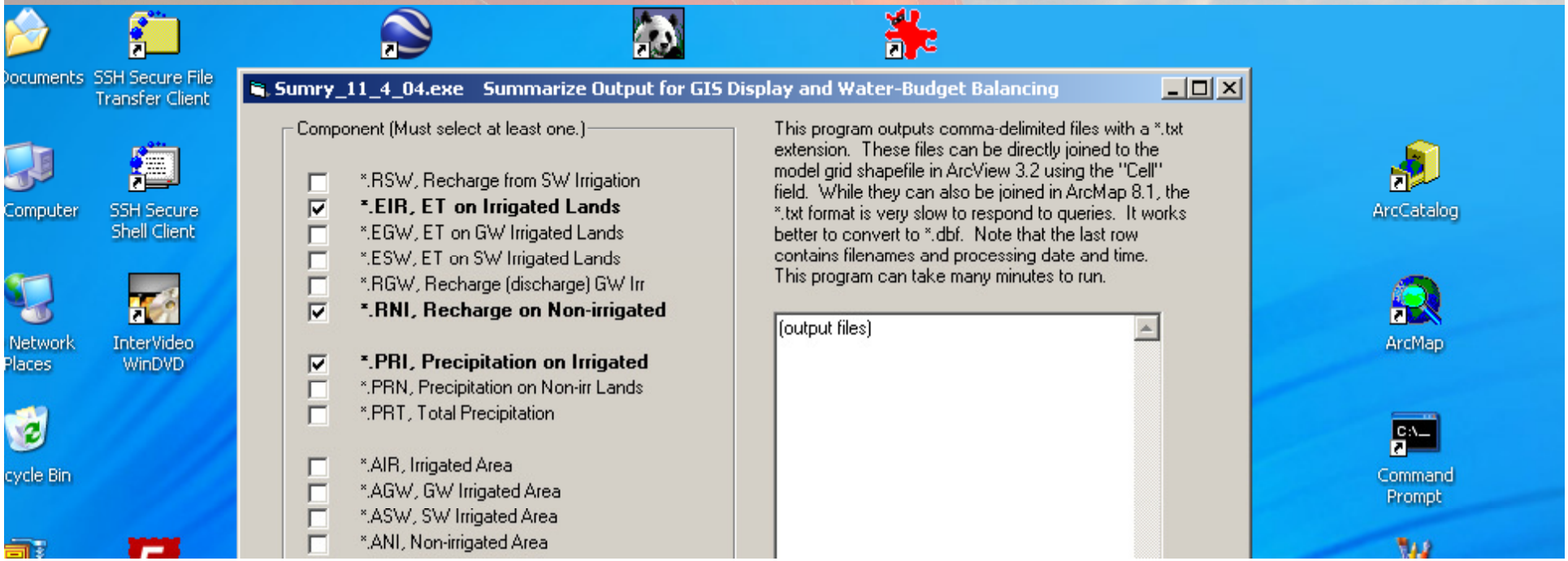
- Soup-to-nuts log and summary
  - *.OUT

Background

- Intermediate files are in formats designed to be read by FORTRAN
  - not amenable to GIS viewing
  - not amenable to time-series plotting in spreadsheet
  - some redundancy; some files are input to other budget-component calculations
  - no dedicated summary for pass-through items *even if PEST has touched them*

Background

- For ESPAM1.1 we made a little utility to summarize for GIS & spreadsheet viewing



Background

- ESPAM1.1 utility has shortcomings:
  - misses PEST multipliers on pass-through items
  - confusing
    - units
    - sign convention
    - redundancy
  - limited to 255 stress periods
    - due to limitations of ArcGIS & older spreadsheets
- ESHMC members want "well-term" format

Proposal: New Summary Utility

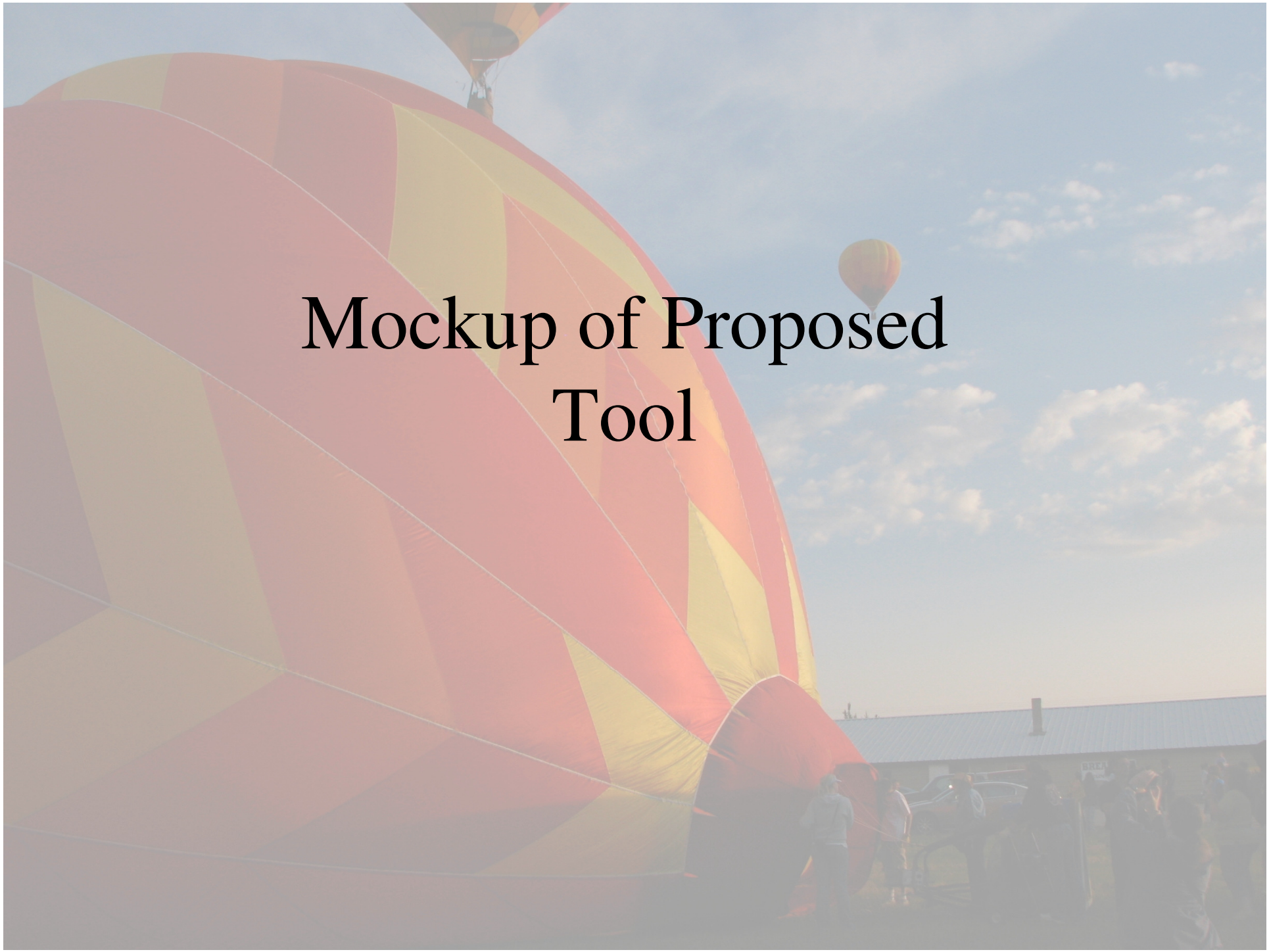
- Coding by ISU Geospatial Lab
  - better, faster & more cost-effective than IWRRI
- Eliminate sources of confusion
  - no redundant content
  - uniform units
  - uniform sign convention

Proposal: New Summary Utility

- Allow up to 360 stress periods
  - change in output format
- Include effects of PEST multipliers
  - do this by referring to *.OUT file

Proposal: New Summary Utility

- Three kinds of output
  - Well term for each water-budget component
  - GIS-joinable tables for each water-budget component
    - cell-by-cell value for each stress period
    - two tables per component to work around ArcGIS9 limitations
  - Single summary table
    - component-by-component sum
    - work around spreadsheet limitations
      - switch from columns to rows



Mockup of Proposed Tool

1: Mockup of well-term output

off2_EIR.wel - Notepad

File Edit Format Help

```
# Evapotranspiration on irrigated lands ft^3/day, sim. off2
23
23
1,1,1,-21398.4
1,1,2,-65758.2
1,1,3,-71935
1,1,4,-54756.1
1,1,5,-74418.4
1,1,6,-94535.5
1,1,7,-96438.6
1,1,8,-36103.8
1,2,1,-72005.3
1,2,2,-126163
1,2,3,-126192
1,2,4,-126523
1,2,5,-126556
1,2,6,-126719
1,2,7,-111802
1,2,8,-8372.23
1,3,1,-21139.1
```

2: Mockup of GIS-joinable output

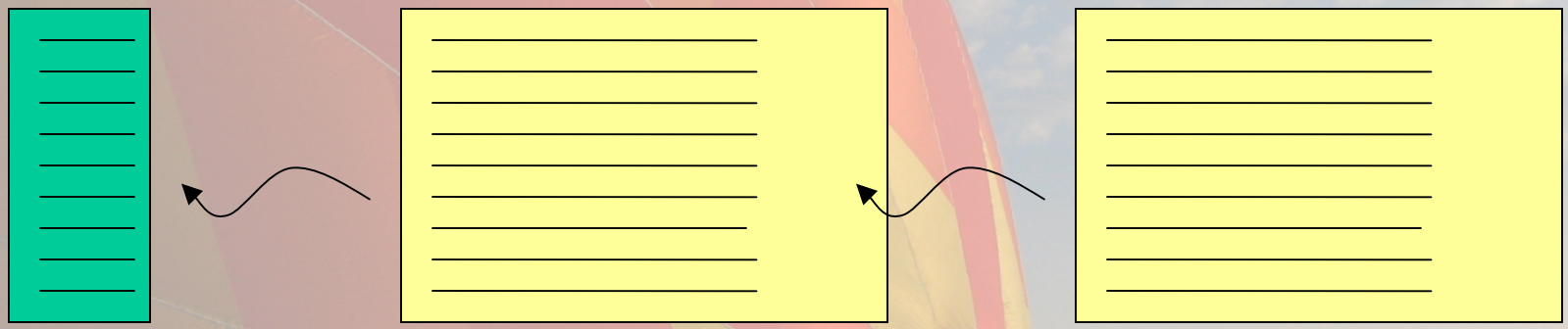
Microsoft Excel - off2_EIR_A.txt

	A	B	C	D	E	F	G
1	Cell	S001	S002	S003	S004	S005	S006
2	1001001	-2151420	-2140080	-2151420	-2361469	-2223297	-217367
3	1001002	-6579830	-6576540	-6579830	-6875854	-6638170	-694639

Microsoft Excel - off2_EIR_B.txt

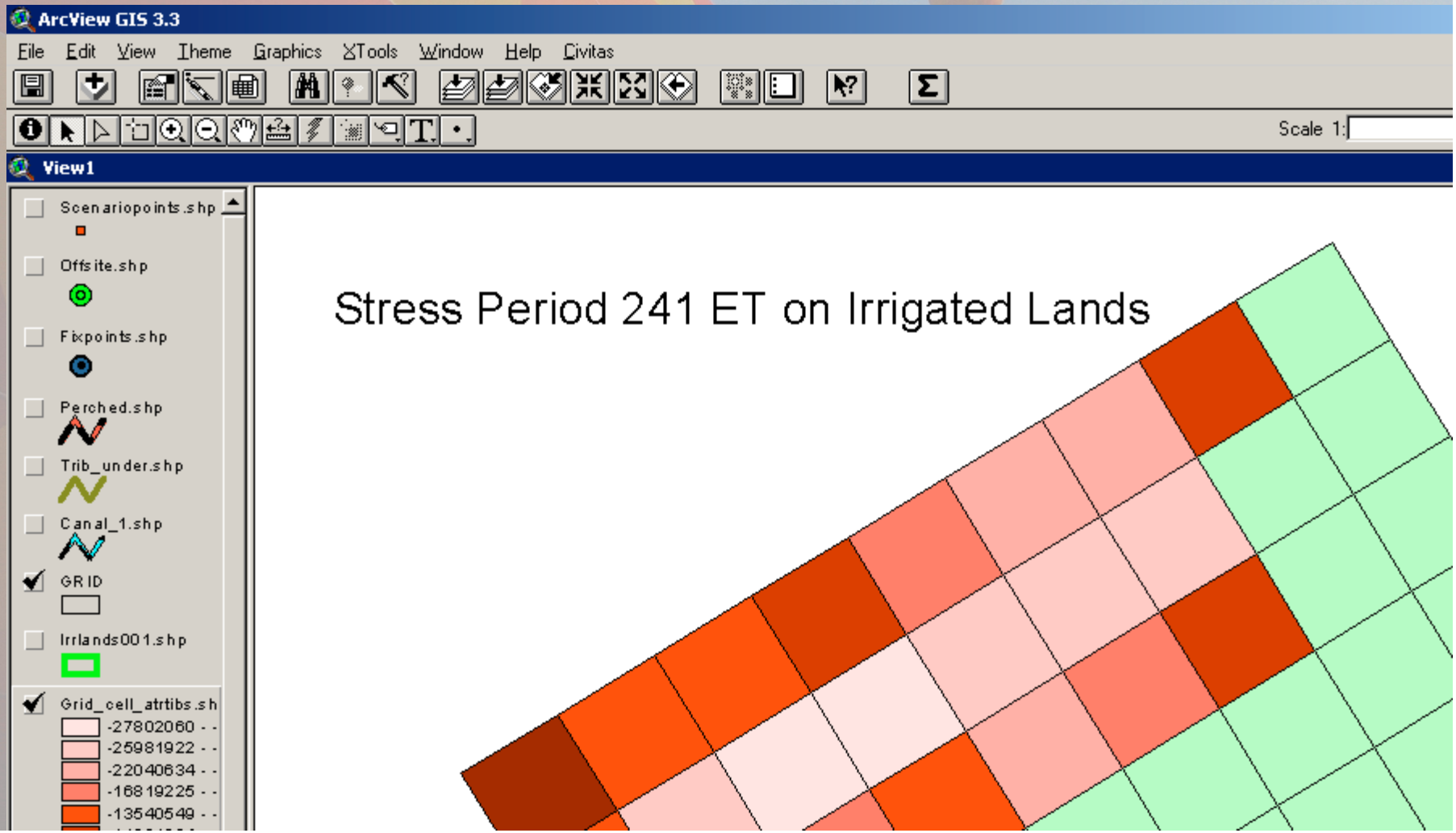
	A	B	C	D	E	F
1	Cell	S201	S202	S203	S204	S205
2	1001001	-2151420	-2140080	-2151420	-2186627	-215180
3	1001002	-6579830	-6576540	-6579830	-7011019	-706800

2: Mockup of GIS-joinable output



Daisy-chain tables in GIS for display
- tested w/ ArcView3.x and ArcGIS9.2

2: Mockup of GIS-joinable output



3: Mockup of time-series output

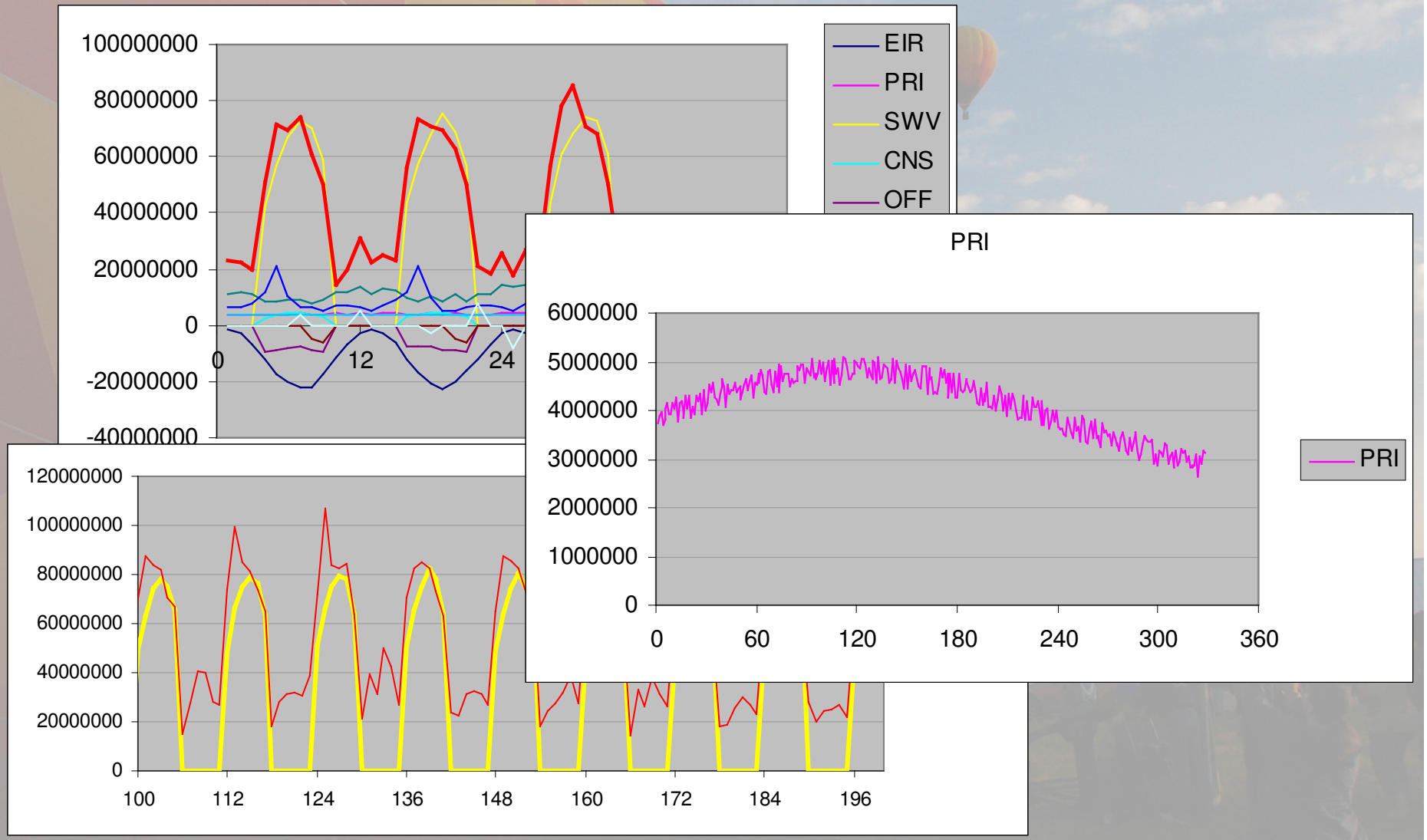
Microsoft Excel - TimeSeriesMockup.csv

File Edit View Insert Format Tools Data Window Help

A1 = Water Budget from Simulation Fake_For_Display 8/6/2008 2:51:37 PM

	A	B	C	D	E	F	G	H	I	J	K	L
1	Water Budget from Simulation Fake_For_Display 8/6/2008 2:51:37 PM											
2	Input file E:\Snake_Aug_08\SummaryTool\MockOutput\Fake_For_Display.mdl											
3	Units are ft^3 per stress period											
4	StressPd	EIR	PRI	SWV	CNS	OFF	FPT	RNI	PCH	TRB	SPT	SUM
5	1	-1293774	3734334	0	0	0	0	10897443	6425608	3500000	0	2326361
6	2	-2707443	3903358	0	0	0	0	11647473	6219391	3500000	0	2256277
7	3	-6623538	3949486	0	0	0	0	11154044	7557843	3500000	0	1953783
8	4	-1.2E+07	3713563	42294097	2651818	-9276629	0	8595625	11803214	3500000	0	5109760
9	5	-1.7E+07	3815911	57021944	3827134	-8877314	0	8226033	21140971	3500000	0	7154013
10	6	-2E+07	4055989	66767710	4621310	-8476206	0	9085720	10569712	3500000	0	6974865
11	7	-2.2E+07	4144134	72545521	4449092	-7588974	0	9278035	6372122	3500000	3753590	7414832
12	8	-2.2E+07	3921006	70398696	3902904	-8687604	-5000000	7930948	6658603	3500000	0	6078213
13	9	-1.8E+07	3934794	58646739	3235585	-9219583	-6000000	8856684	5006751	3500000	0	5031397
14	10	-1.2E+07	4156359	0	0	0	0	11520219	6893563	3500000	0	1456993
15	11	-6514983	4044541	0	0	0	0	11783650	6946938	3500000	0	1976014
16	12	-2604147	4266247	0	0	0	0	14039862	6194199	3500000	5436446	3083260
17	13	-1292362	3764171	0	0	0	0	11076715	5140810	3500000	0	2218933
18	14	-2729560	4135908	0	0	0	0	13138676	6935988	3500000	0	2498101
19	15	-6454195	4184759	0	0	0	0	12718925	8826152	3500000	0	2277564

3: Mockup of time-series output



QUESTION FOR ESHMC

- Do we split *Precip on Irrigated Lands* into *Precip on GW Irrigated Lands* and *Precip on SW Irrigated Lands?*

QUESTION FOR ESHMC

- If we do it, here's how it could be done:
  - *.PRI gives precipitation volume on irrigated lands in every cell
    - this is calculated from the average precipitation depth across the entire cell, used in recharge calcs.
  - *.AGW gives the ground-water irrigated area (ft^2) in each cell.
  - *.ASW gives the surface-water irrigated area in each cell

QUESTION FOR ESHMC

– Calculation of PRG (precipitation on GW lands) and PRS (precipitation on SW lands):

$$PRG = PRI * [AGW / (AGW + ASW)]$$

$$PRS = PRI - PRG$$

- If we split precipitation we will also separately report ET on GW- & SW-irrigated lands (using existing files)

QUESTION FOR ESHMC

- Pro:
  - We will be able to ***almost*** separate GW impact & SW impact within sub regions

QUESTION FOR ESHMC

- Con:
  - The separation is only ***almost:***
    - Offsite & some Fixed Point pumping are for GW irrigation but they end up included as part of *.SWV.
      - » Overestimates recharge from SW irrigation
      - » Overestimates net impact GW pumping
      - » One could adjust for this but most of us won't
      - » Even if we did would we get it right?
    - Water budget & spatial representation are correct; the imprecision comes in the *parsing* process
  - The calculation is complicated enough that it might cause confusion & lack of confidence

Summary

- What won't change
  - existing ESPAM.exe & READINP.exe output
    - well term for model use
    - recharge array for model use
    - all existing summary & intermediate files
- What will change: New summary tables
  - well term for each water-budget component
  - GIS-joinable tables
  - Whole-model summary table

Summary

- What we can do
  - plot spatially by water-budget component
    - whole study area
    - any desired sub-area
  - plot time series by water-budget component
    - whole calibration period
    - any temporal subdivision

Summary

- What we can do
  - sum spatial sub-areas by component & time period
    - requires spreadsheet manipulation of tables exported from GIS query
      - easy to do
      - most GIS technicians already have done similar exercises

Summary

- What we cannot do
  - extract complete water budget for sub-areas
    - inter-cell flows calculated by MODFLOW aren't available for summary
    - no way to link dependent components
      - offsite or fixed-point pumping outside of sub-area might contribute to incidental recharge inside
      - pumping inside might contribute to incidental recharge outside
  - completely separate GW & SW influences

Summary

- Question for ESHMC
  - do we parse precipitation on irrigated lands?
    - would allow closer accounting of impacts by water source
    - opportunity for confusion & lack of confidence?
    - would not remove all ambiguity between SW & GW impacts

Ron Pa
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Paul
2008
THE GLOBAL WARMING
CRISIS IS A LIE
Paulul
Ron