

100

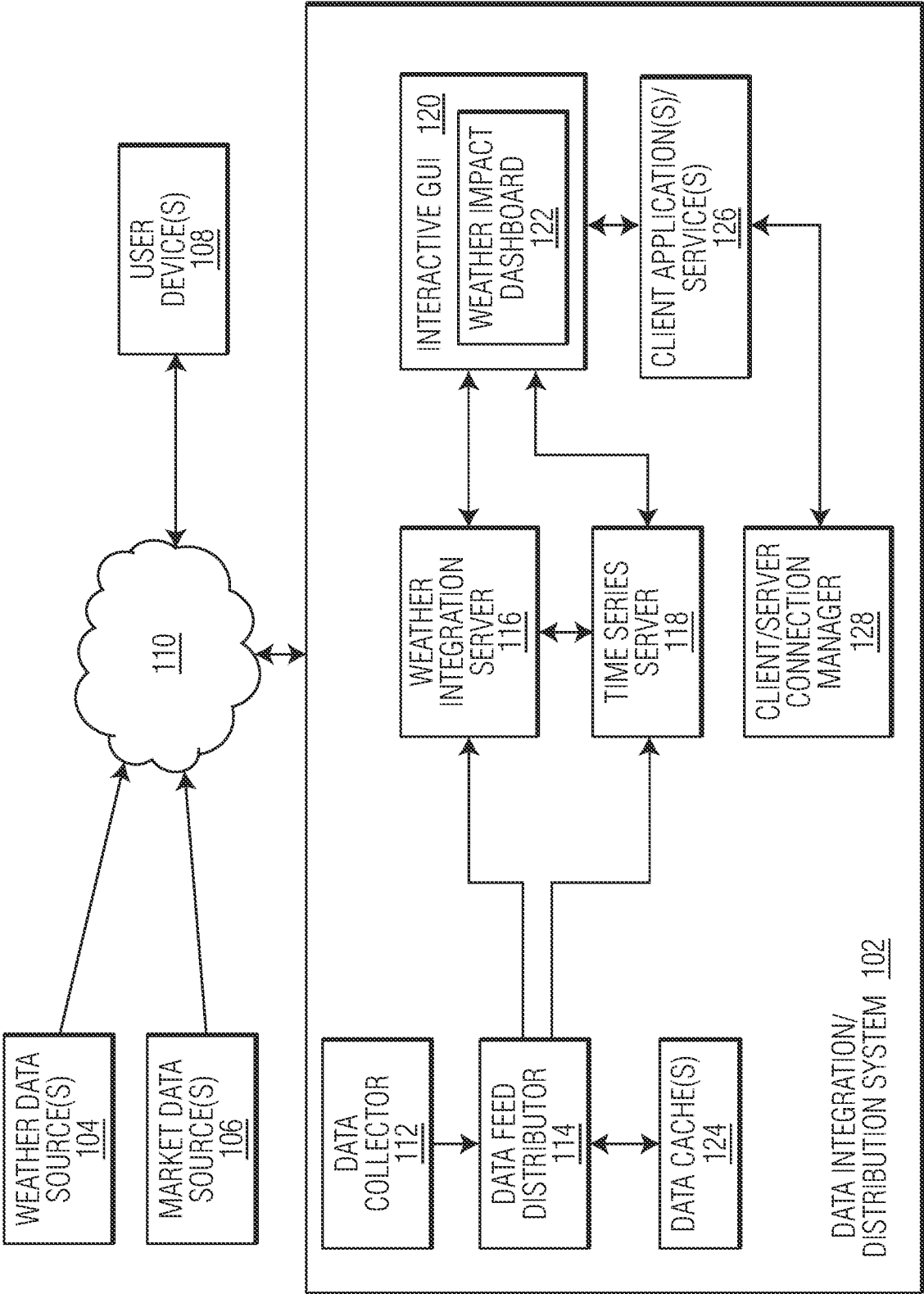


FIG. 1

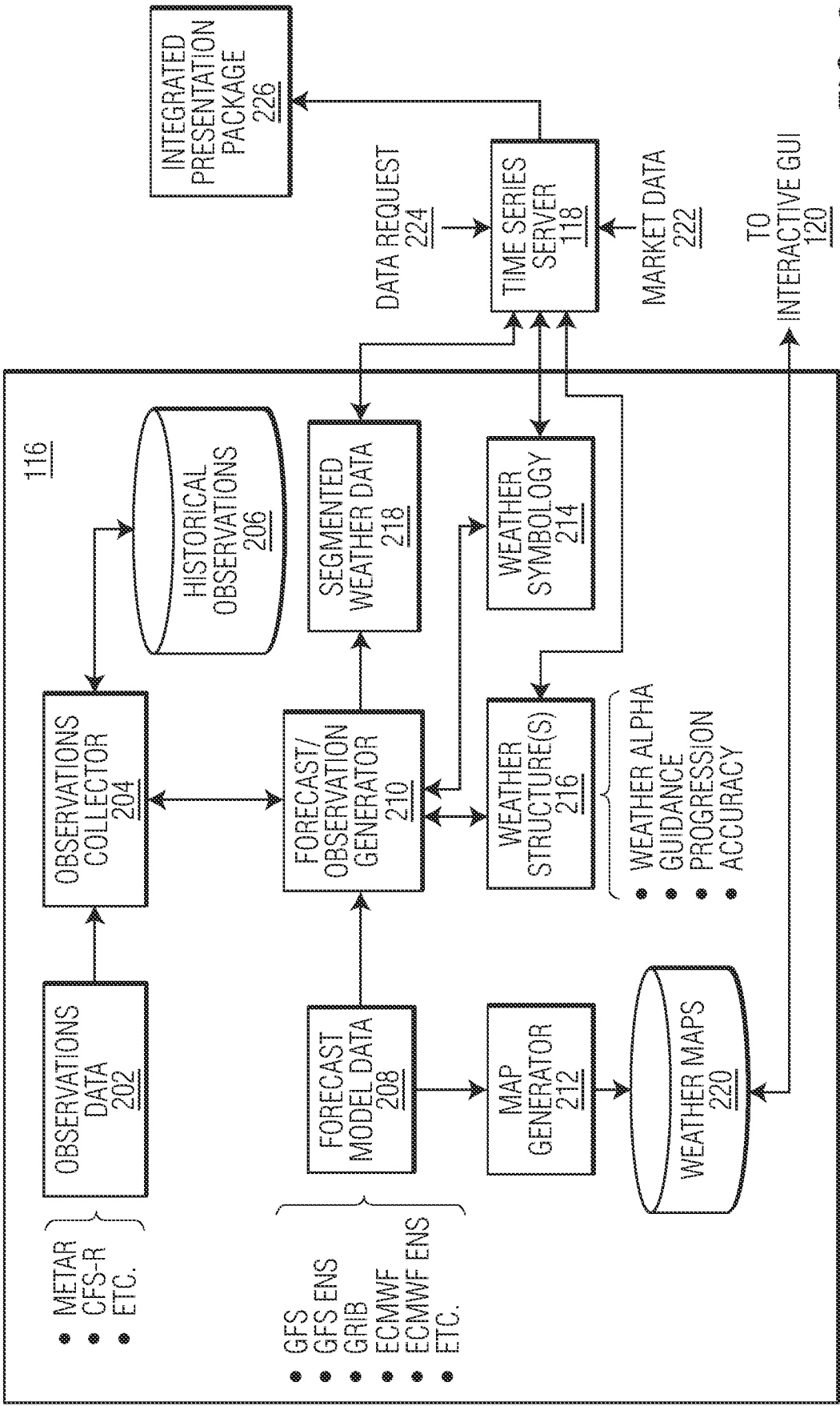
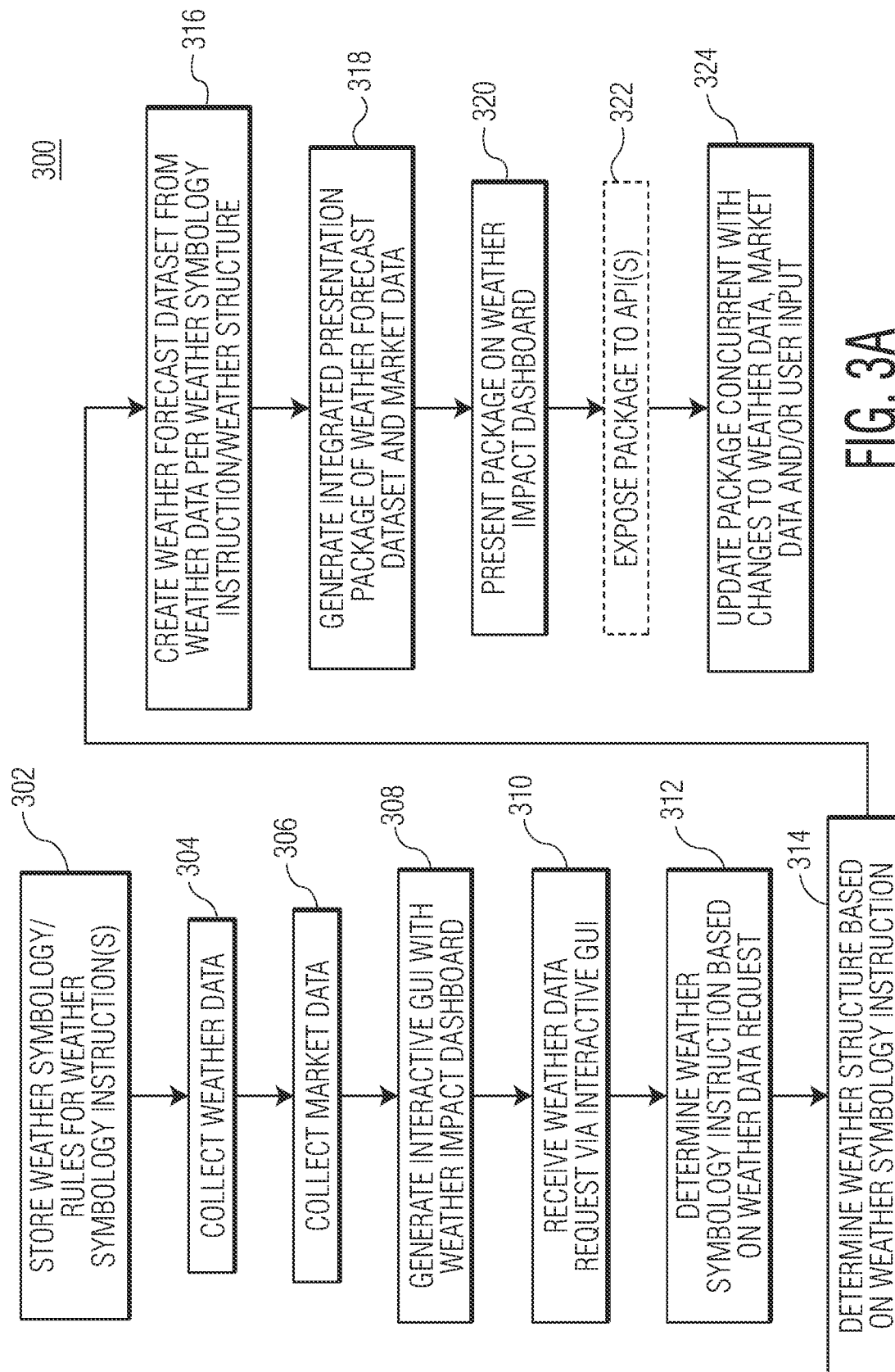


FIG. 2

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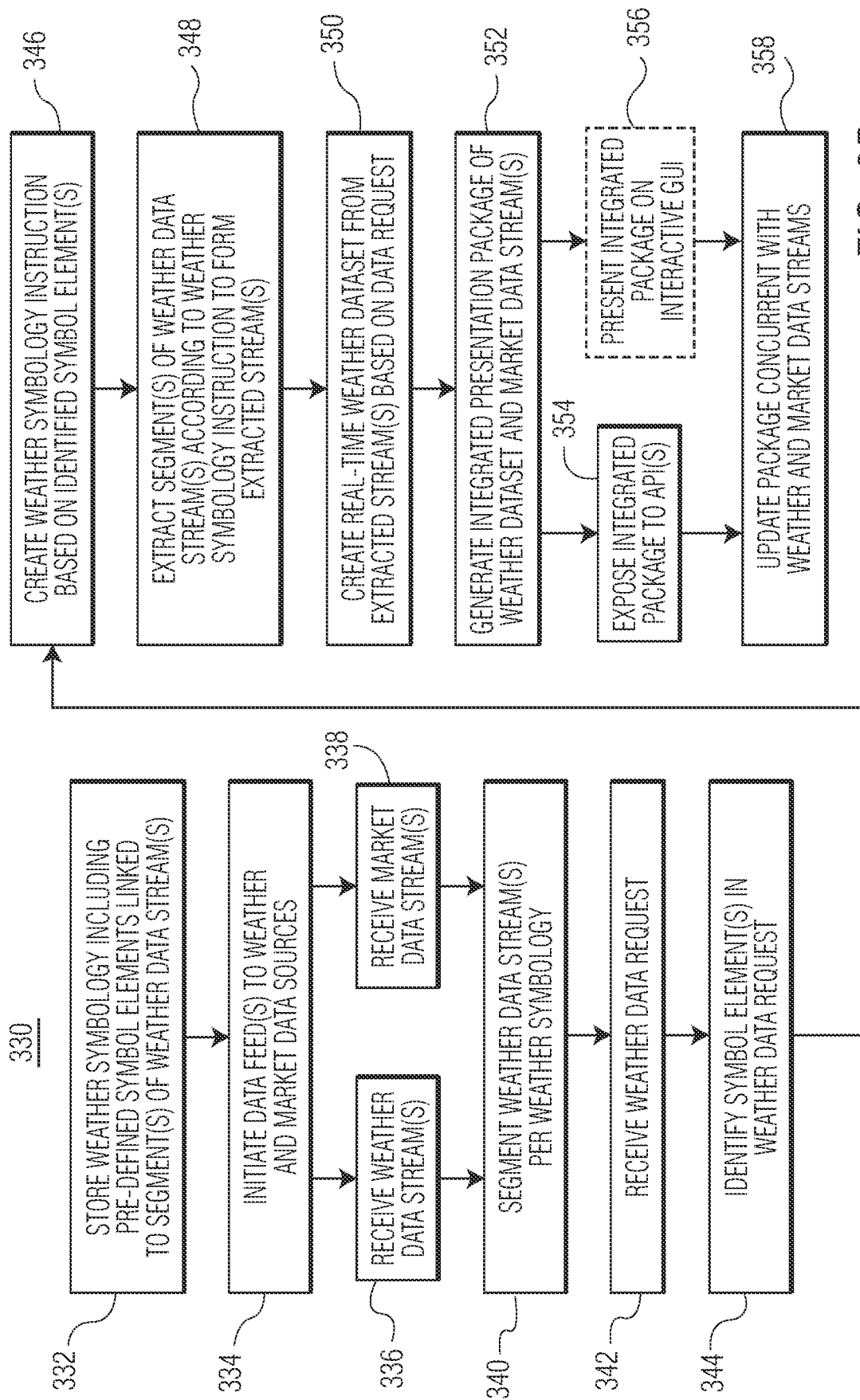


FIG. 3B

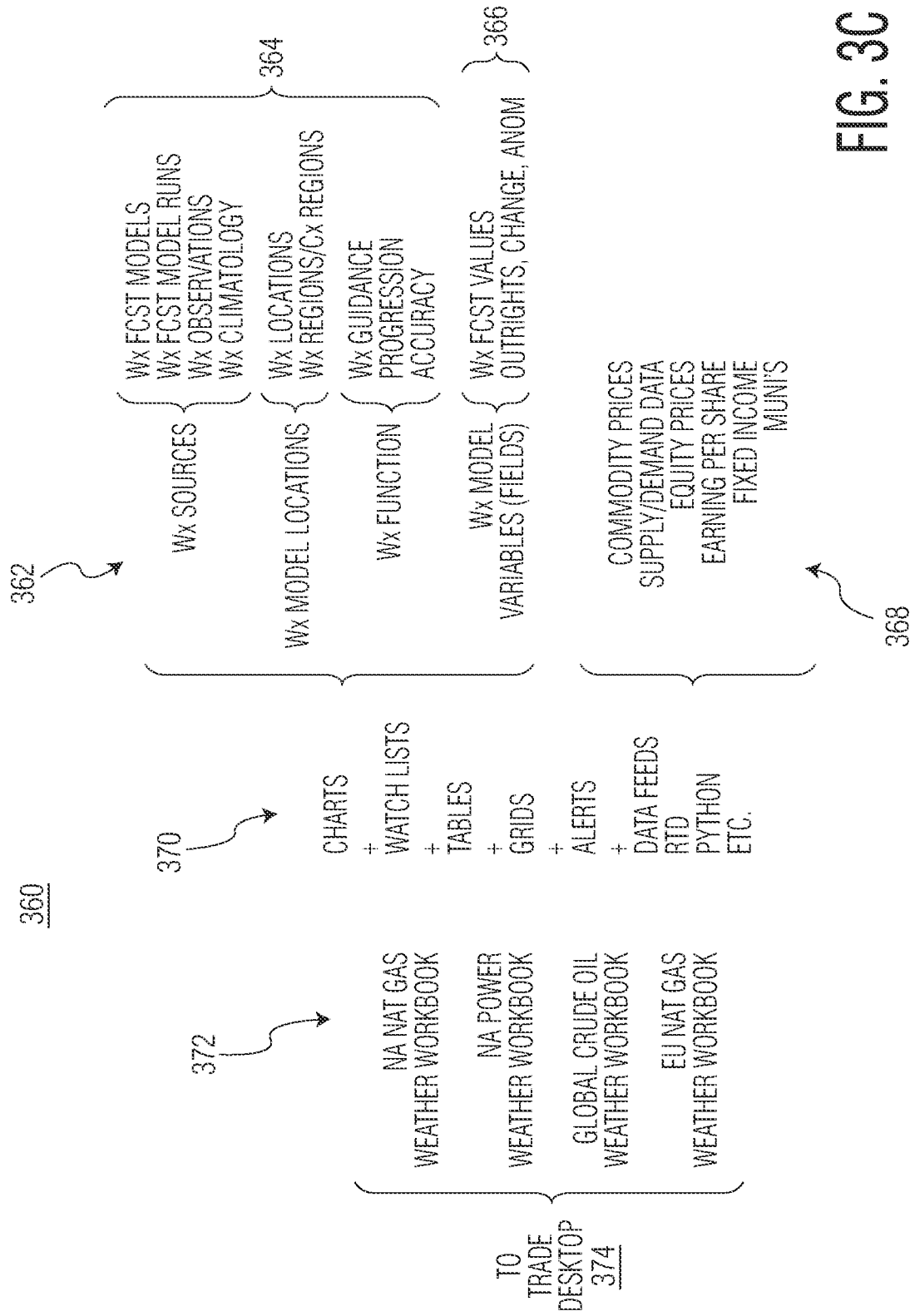


FIG. 3C

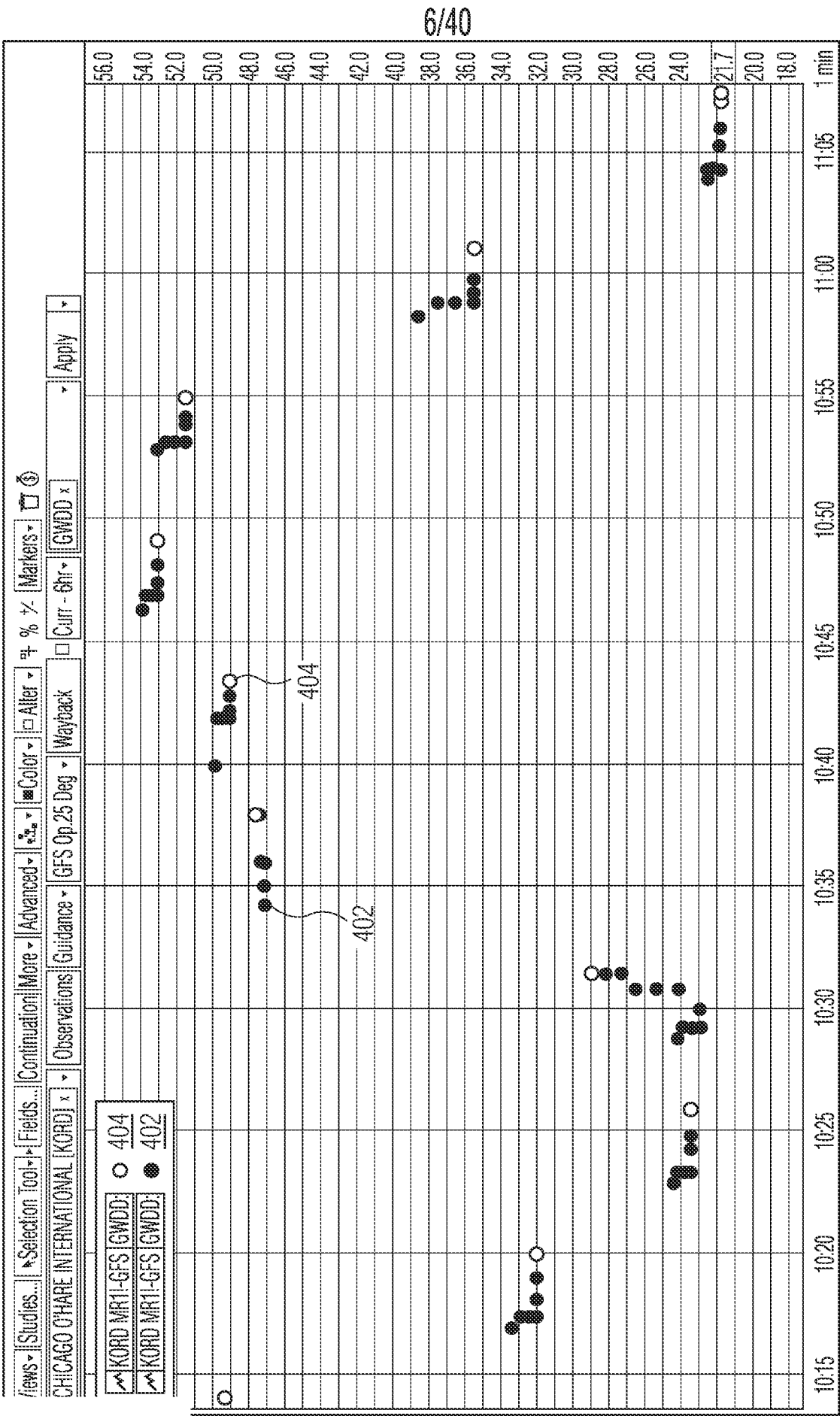
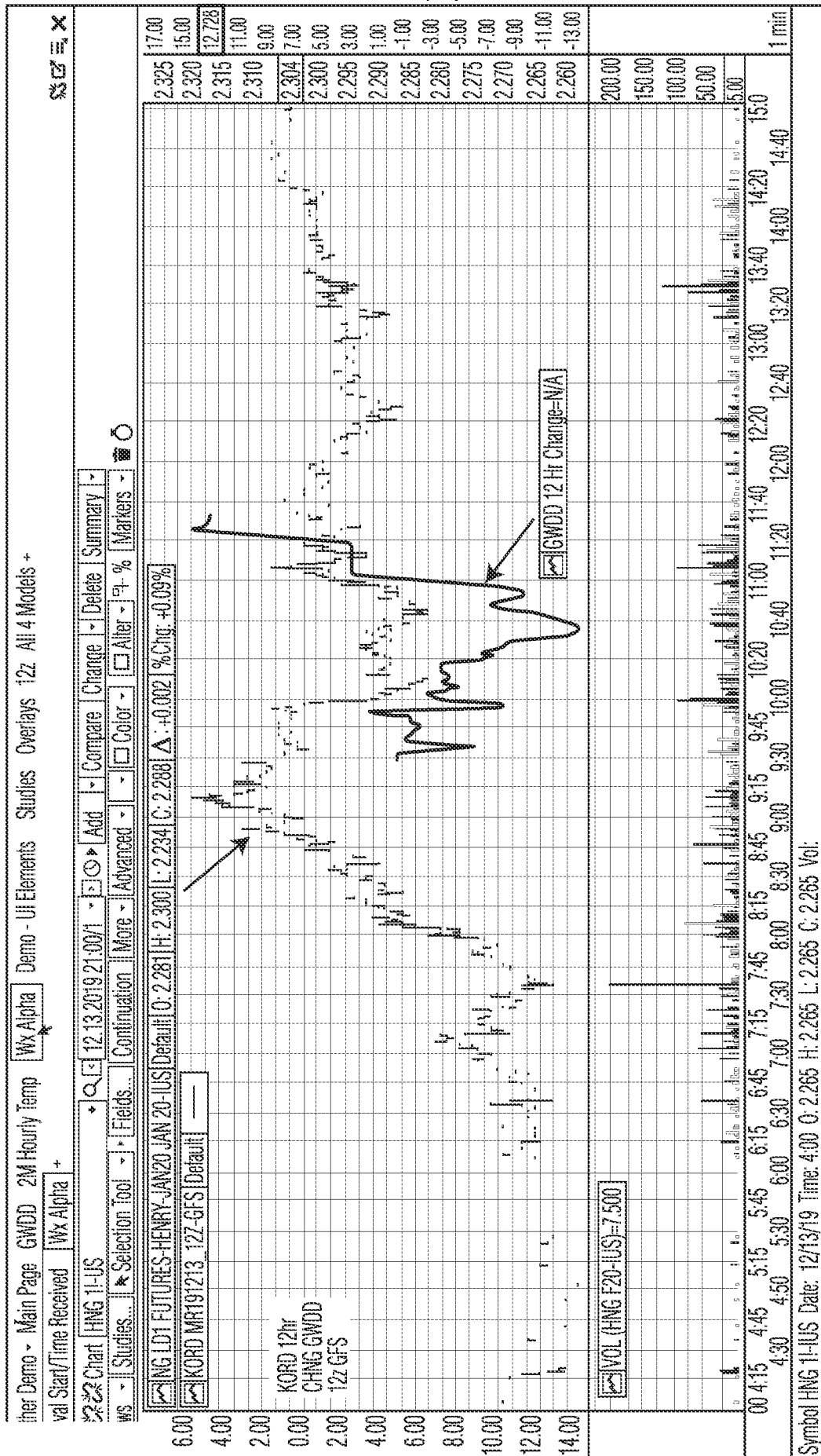


FIG. 4A



34

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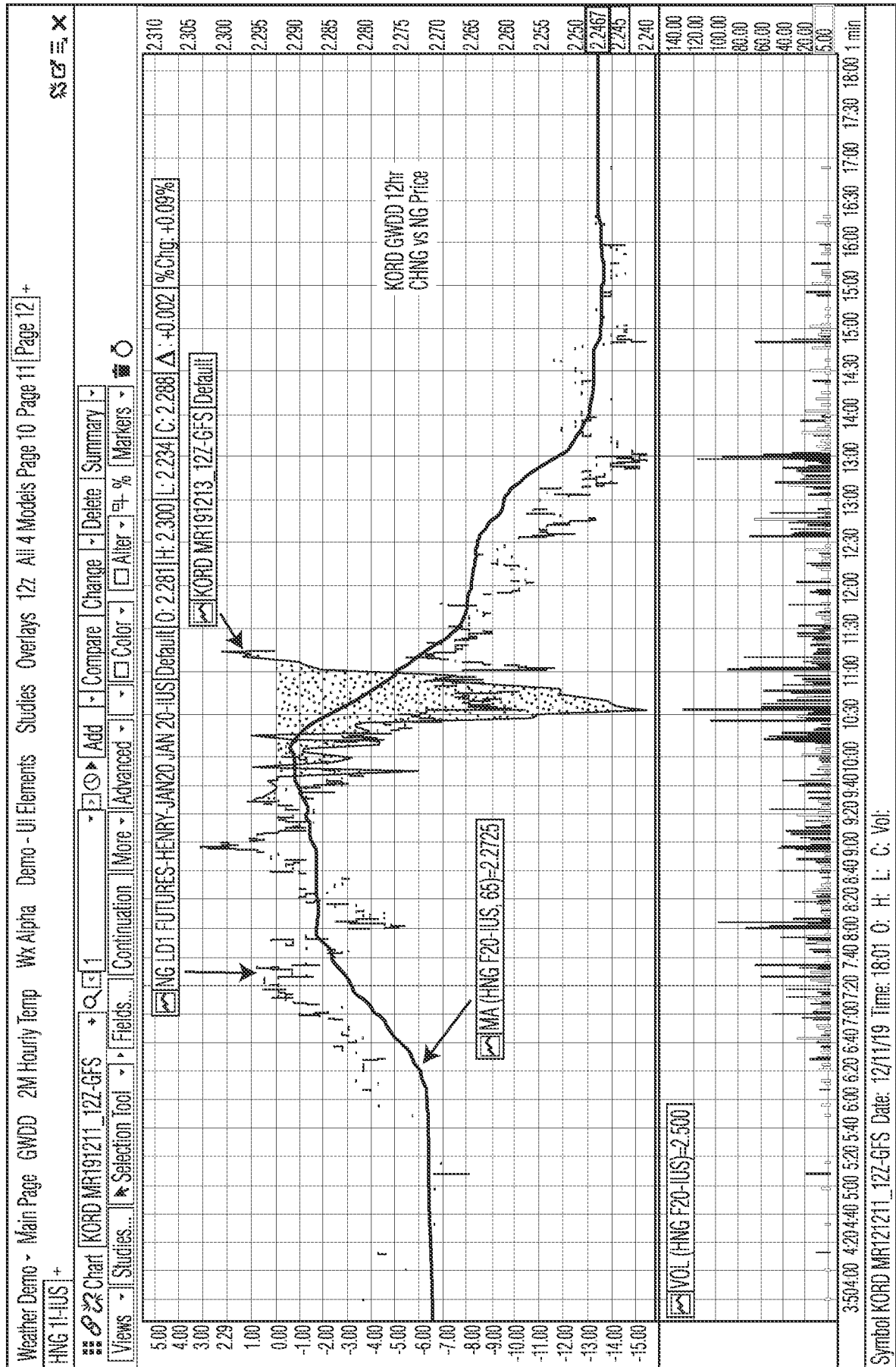


FIG. 4C

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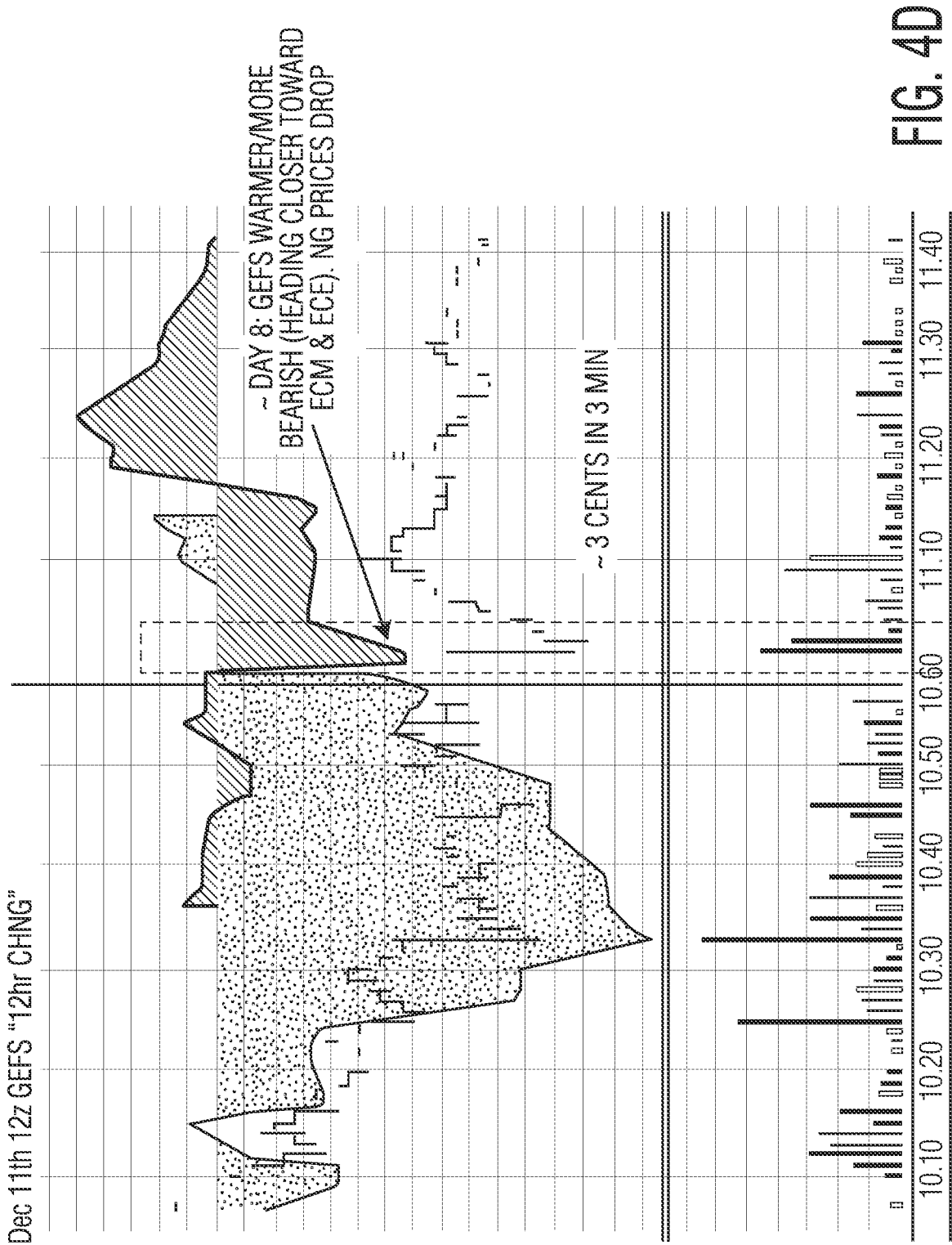
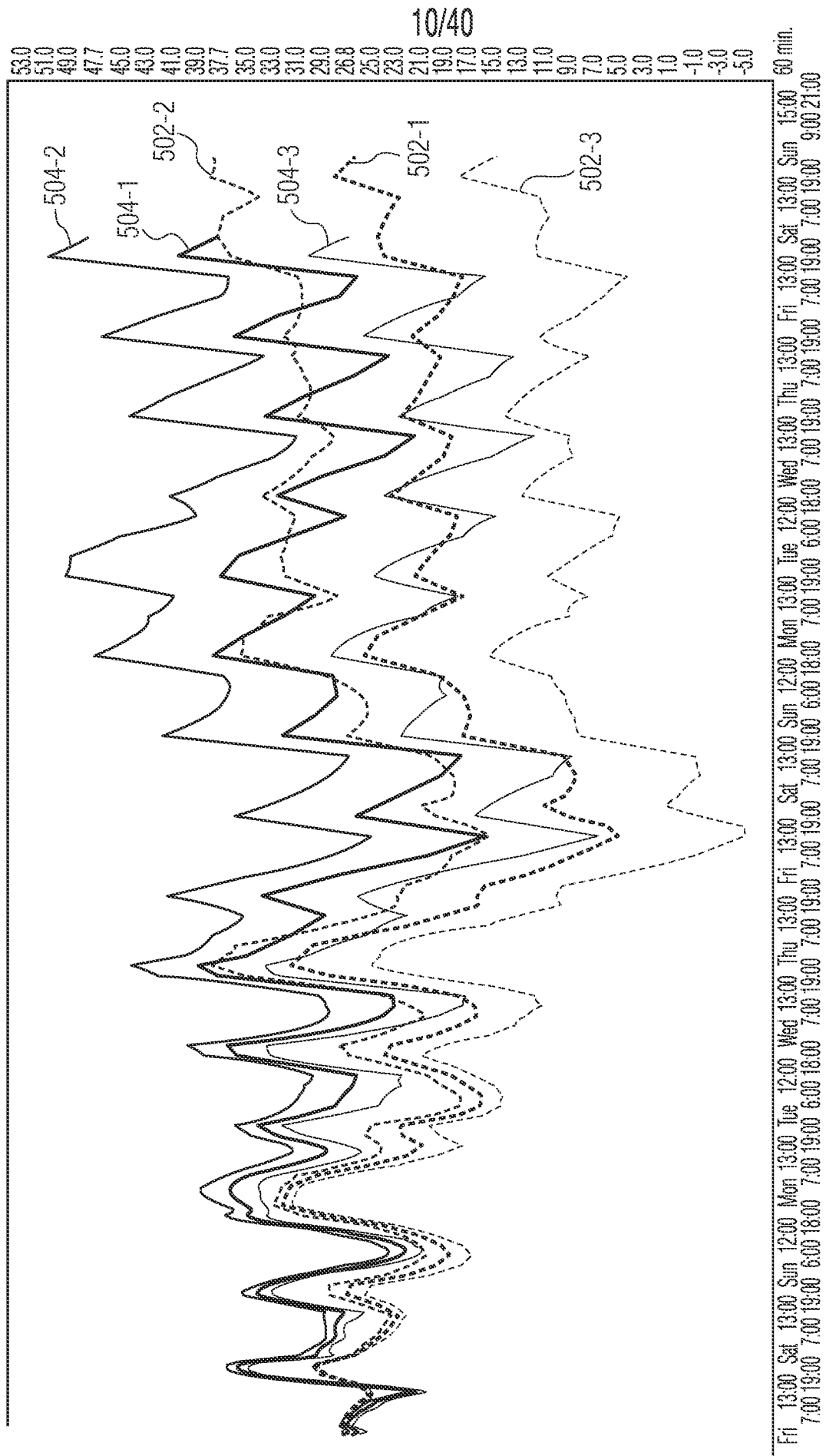


FIG. 4D



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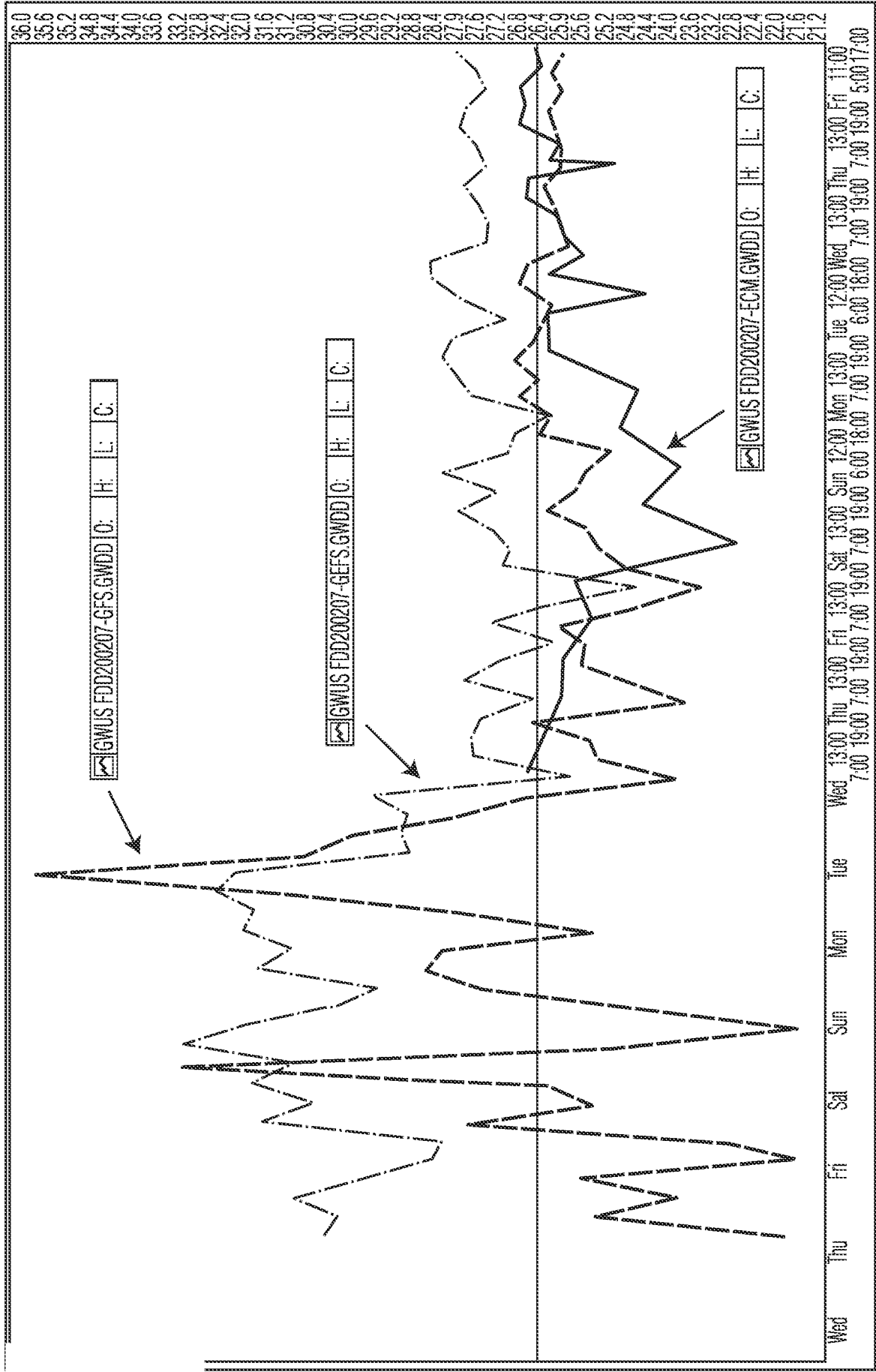


FIG. 6A

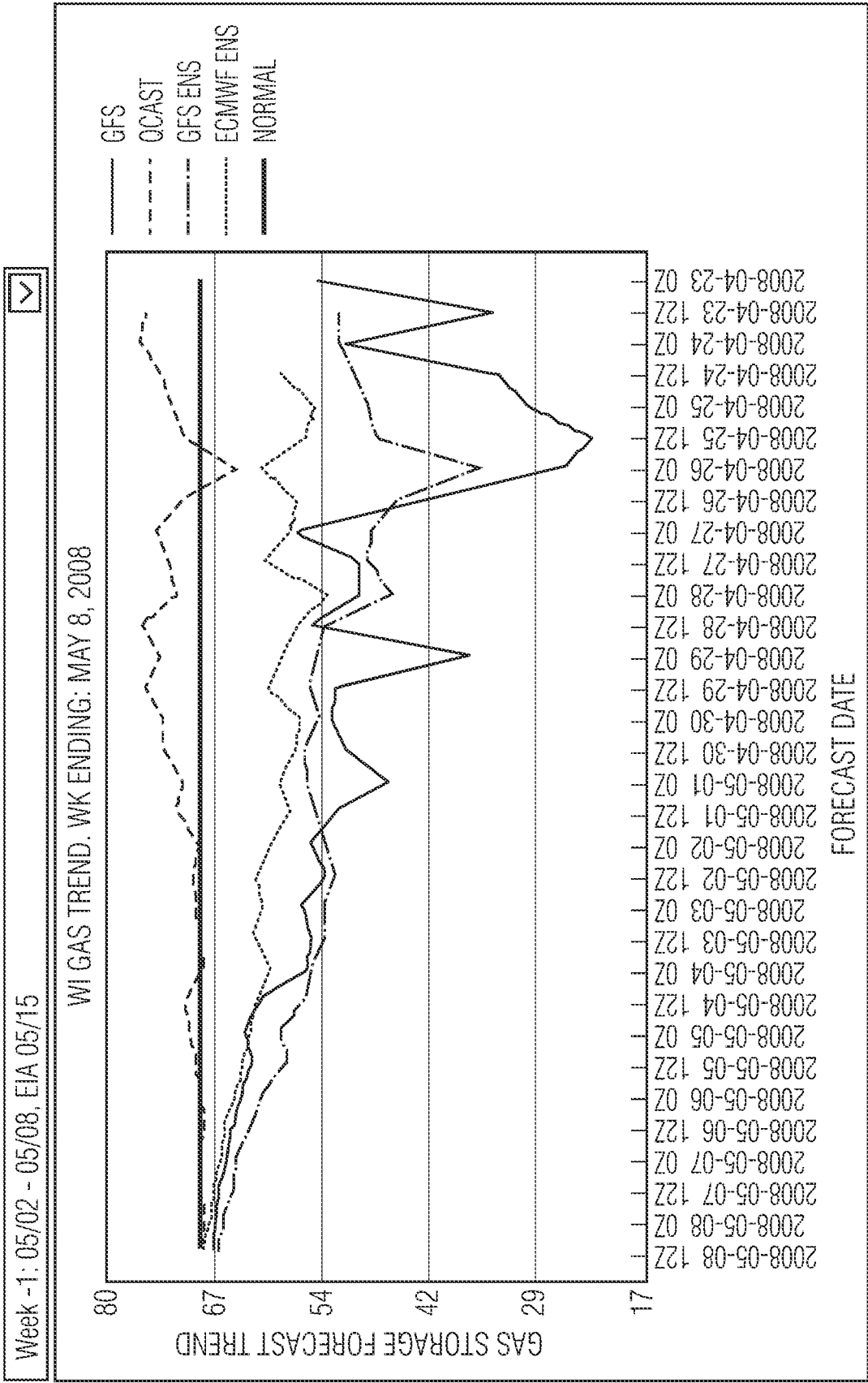
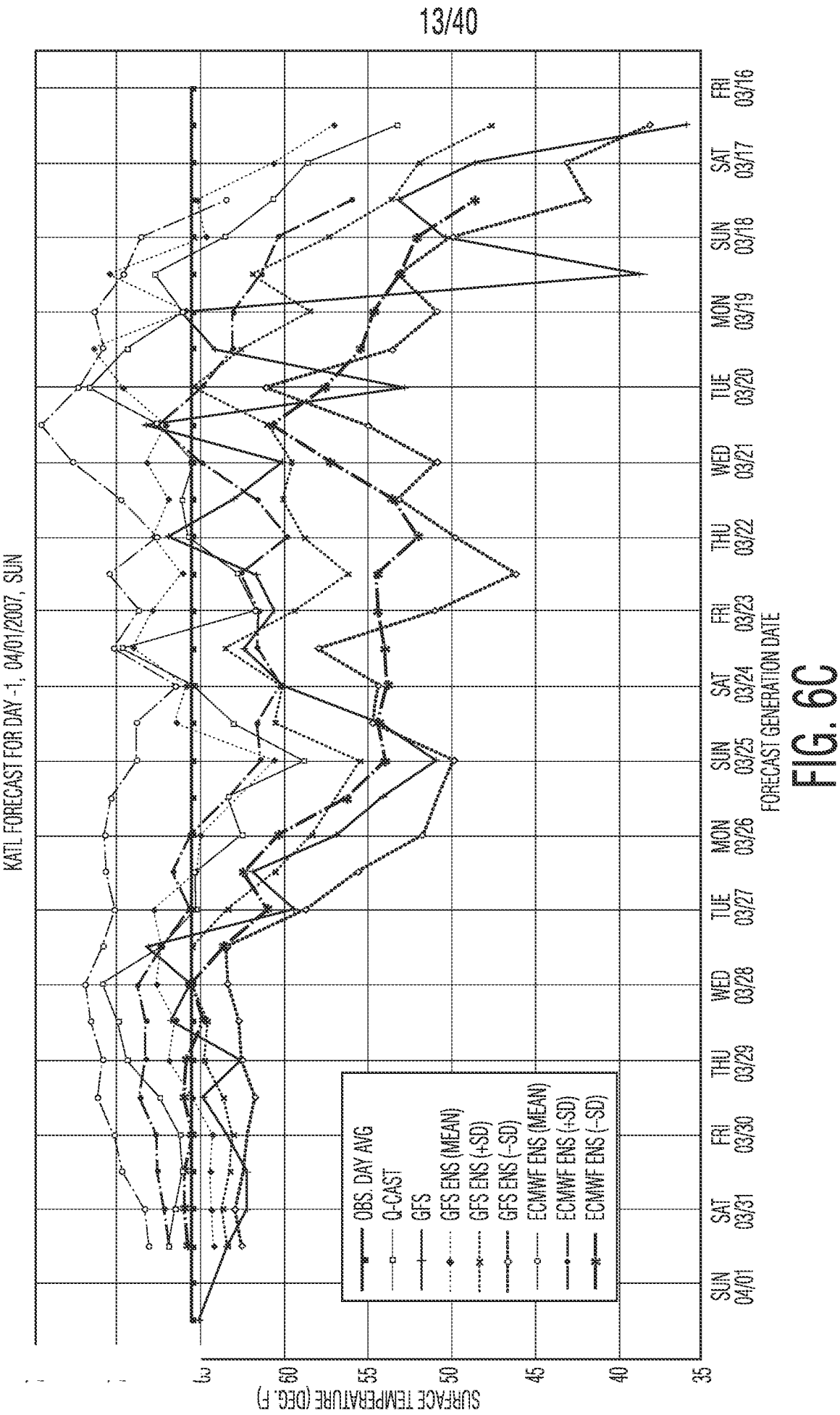


FIG. 6B



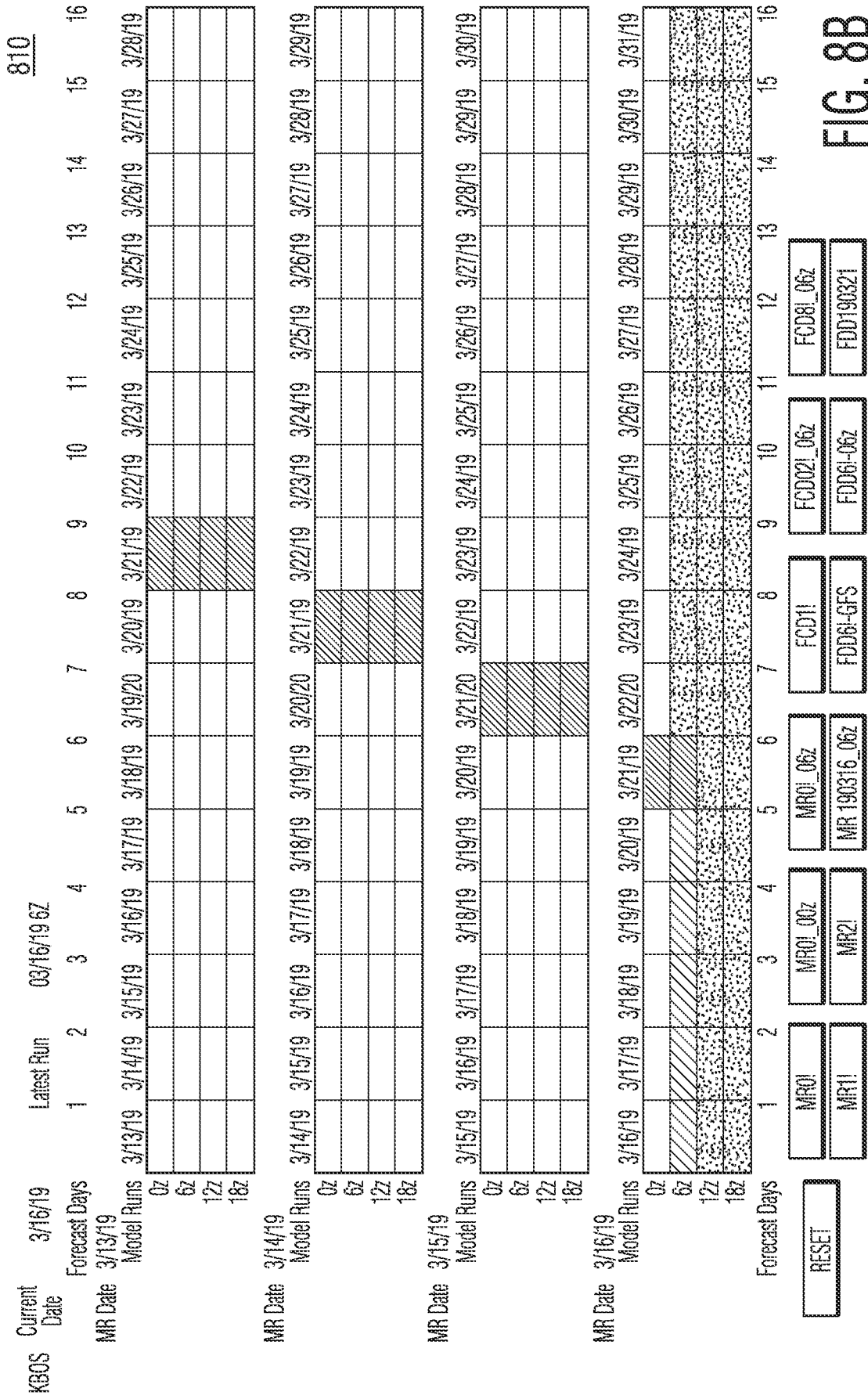
Model Name	select multiple																
Model Runs	select multiple																
FV Date/day	Calendar																
Fast Variable	Max I, Min I, Avg I, GWDD																
Study time	14 days, 7 days, 5 days																
BIAS	14 days																
Models	Runs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
GFS	OZ																
GEFS	OZ																
ECM	OZ																
ECE	OZ																
RMSE	14 days																
Models	Runs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
GFS	OZ																
GEFS	OZ																
ECM	OZ																
ECE	OZ																
ERROR	14 days																
Models	Runs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
GFS	OZ																
GEFS	OZ																
ECM	OZ																
ECE	OZ																
STD OF ERROR	14 days																
Models	Runs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
GFS	OZ																
GEFS	OZ																
ECM	OZ																
ECE	OZ																

FIG. 7A

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Date	FDD	2/20/20	2/19/20	2/18/20	2/17/20	2/16/20	2/15/20	2/14/20	2/13/20	2/12/20	2/11/20	2/10/20	2/9/20	2/8/20	2/7/20	2/6/20	2/5/20	2/4/20
GWESC-METR.GWDD	METR															25.4659	20.6791	10.3266
GWESC FCD1_12Z-GEFS.GWDD	1														26.2	34.465	25.768	12.411
GWESC FCD2_12Z-GEFS.GWDD	2													21.374	27.615	32.101	23.061	12.22
GWESC FCD3_12Z-GEFS.GWDD	3												12.442	22.729	27.582	31.963	24.896	13.528
GWESC FCD4_12Z-GEFS.GWDD	4											15.386	13.084	22.742	27.052	33.589	24.647	13.747
GWESC FCD5_12Z-GEFS.GWDD	5										21.943	17.286	14.756	24.163	26.378	32.353	26.37	12.369
GWESC FCD6_12Z-GEFS.GWDD	6									24.254	21.893	15.858	18.506	24.807	29.189	34.845	21.146	15.091
GWESC FCD7_12Z-GEFS.GWDD	7								23.06	18.299	16.053	14.101	20.382	23.933	30.006	24.951	25.557	16.985
GWESC FCD8_12Z-GEFS.GWDD	8							27.955	19.455	12.05	12.997	14.662	17.667	22.331	25.432	26.349	27.948	17.449
GWESC FCD9_12Z-GEFS.GWDD	9						26.168	29.386	12.041	16.348	13.833	14.516	18.08	21.994	26.572	27.565	26.71	21.061
GWESC FCD10_12Z-GEFS.GWDD	10					19.373	32.39	15.352	21.411	13.655	16.63	14.146	18.221	23.304	24.01	26.828	28.591	23.003
GWESC FCD11_12Z-GEFS.GWDD	11				16.257	27.866	17.228	20.056	16.04	19.377	14.299	15.814	21.911	22.311	23.642	27.907	31.389	21.968
GWESC FCD12_12Z-GEFS.GWDD	12			18.362	24.736	18.718	15.069	15.232	21.119	15.862	18.667	22.231	25.274	22.786	26.01	31.515	30.09	22.735
GWESC FCD13_12Z-GEFS.GWDD	13			21.483	19.803	15.395	14.592	18.986	15.212	22.414	24.099	29.52	23.54	24.084	27.411	30.884	30.73	24.514
GWESC FCD14_12Z-GEFS.GWDD	14	23.068	25.71	19.322	17.766	13.71	18.616	19.457	25.004	28.853	31.969	21.931	23.073	24.318	26.761	29.739	27.931	21.058

FIG. 7B



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FIG. 8B

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904

900

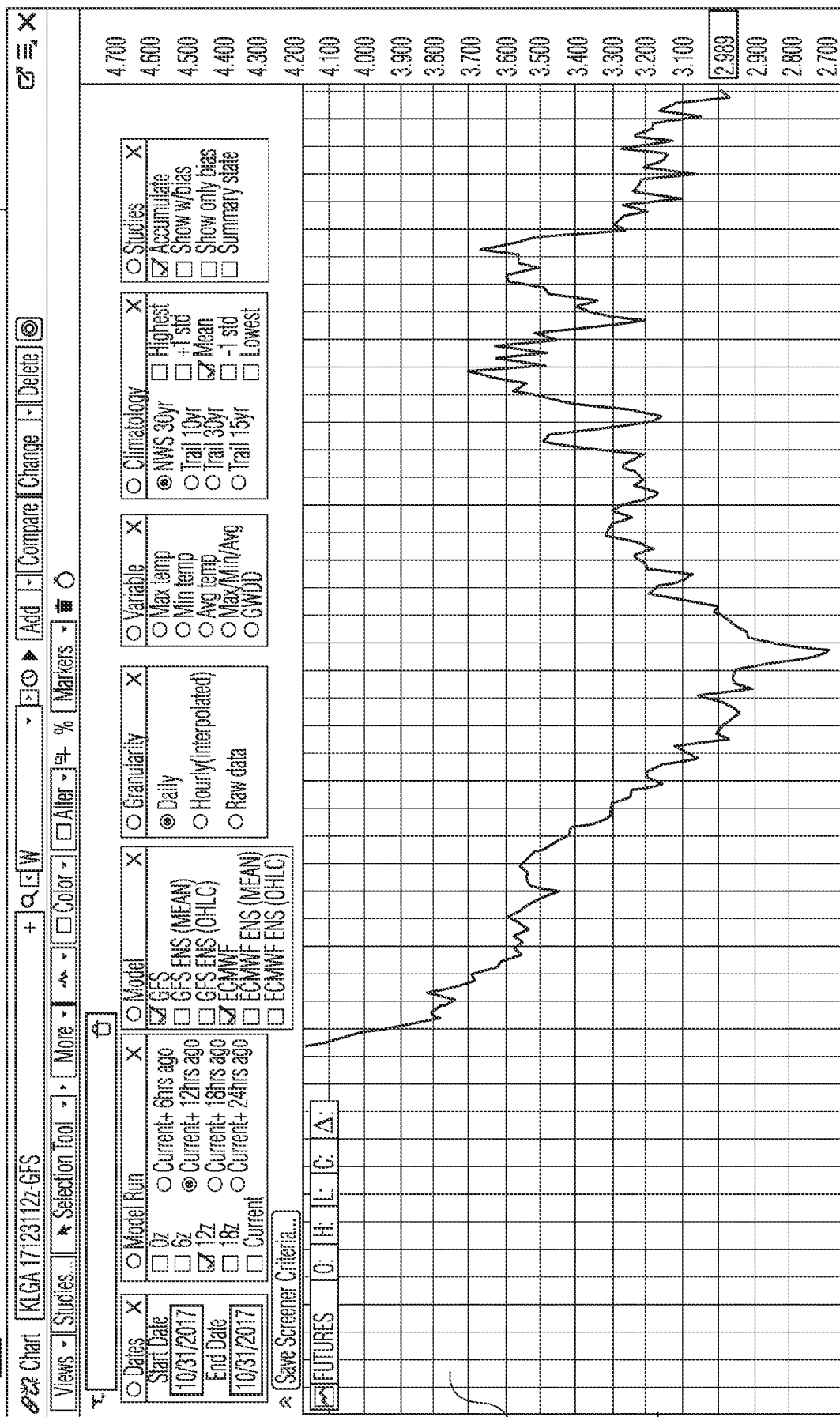


FIG. 9A

908

902

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910

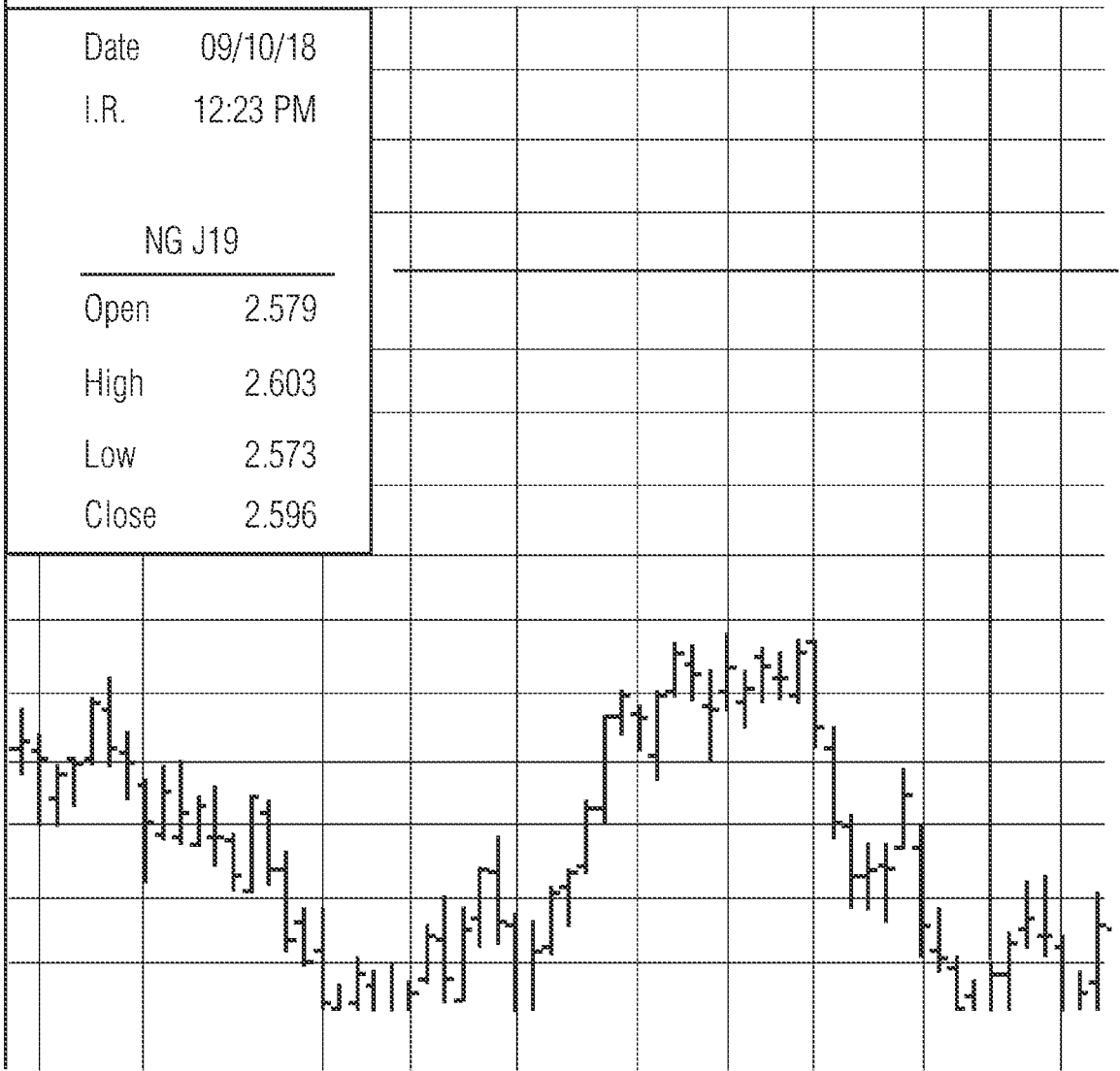


FIG. 9B

912

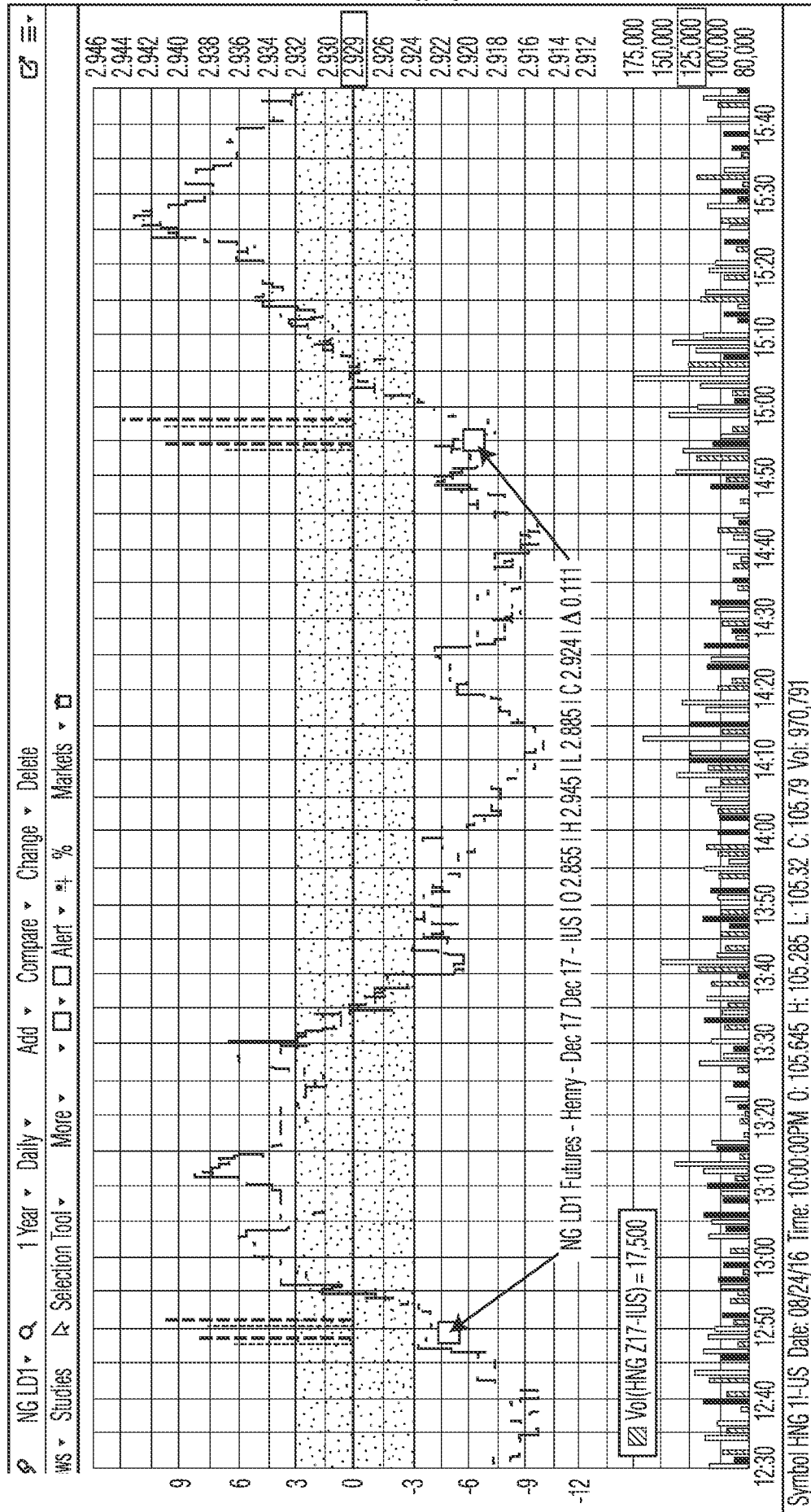


FIG. 9C

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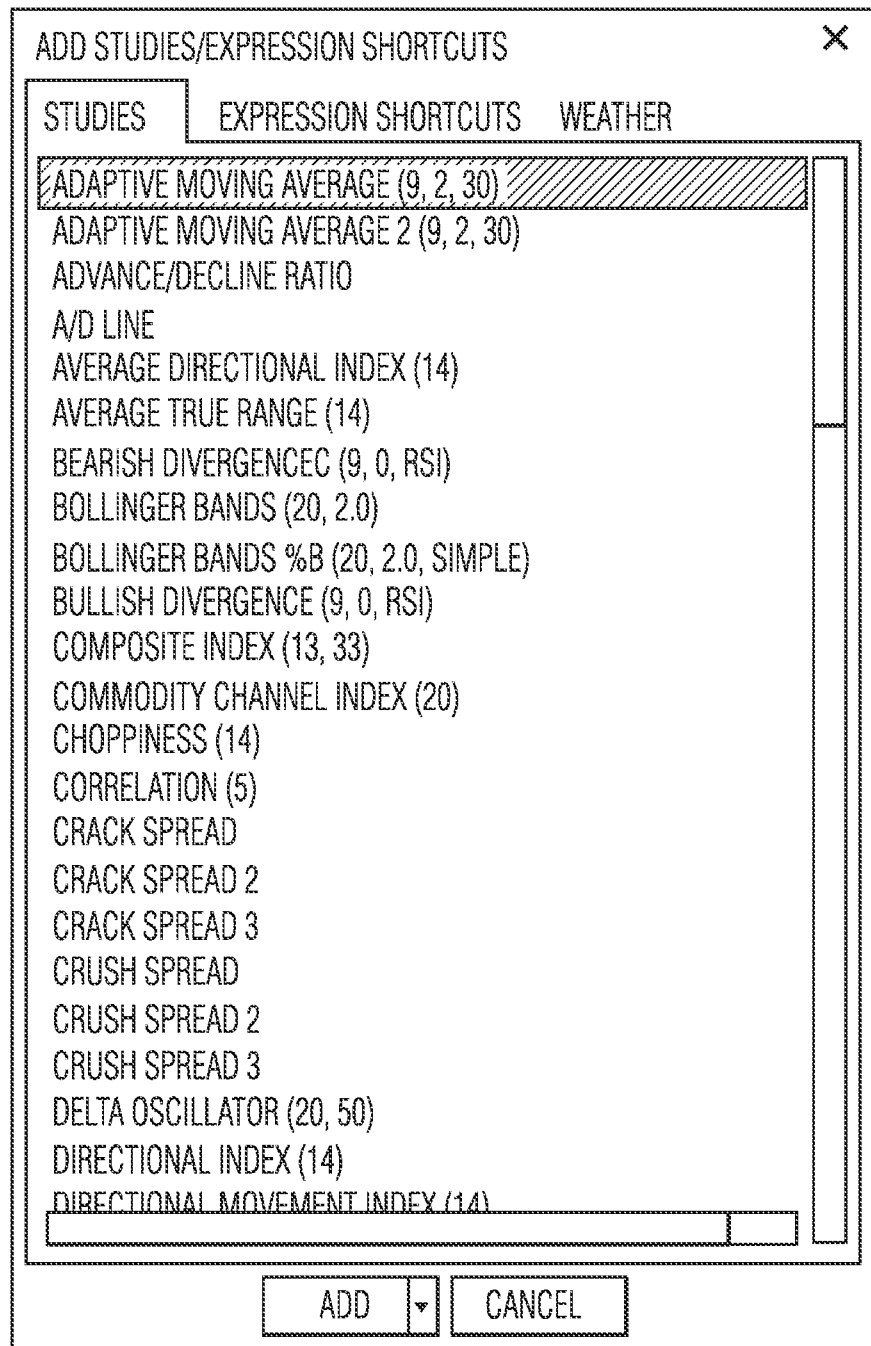
914

FIG. 9D

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916

SYMBOL VALUE MARKER:	ARROW ▼	MARKER LOCATION:	CHART EDGE ▼
STUDY VALUE MARKER:	ARROW ▼	MARKER LOCATION:	PRICE SCALE ▼

FIG. 9E

918

ADD CONDITION ALERTS ×

EXPRESSION:	
COMMENT:	

OK CANCEL

FIG. 9F

920

Chart Views

×

Move Up

Move Down

Rename

Delete

Apply

Close

☒ Apply View with colors

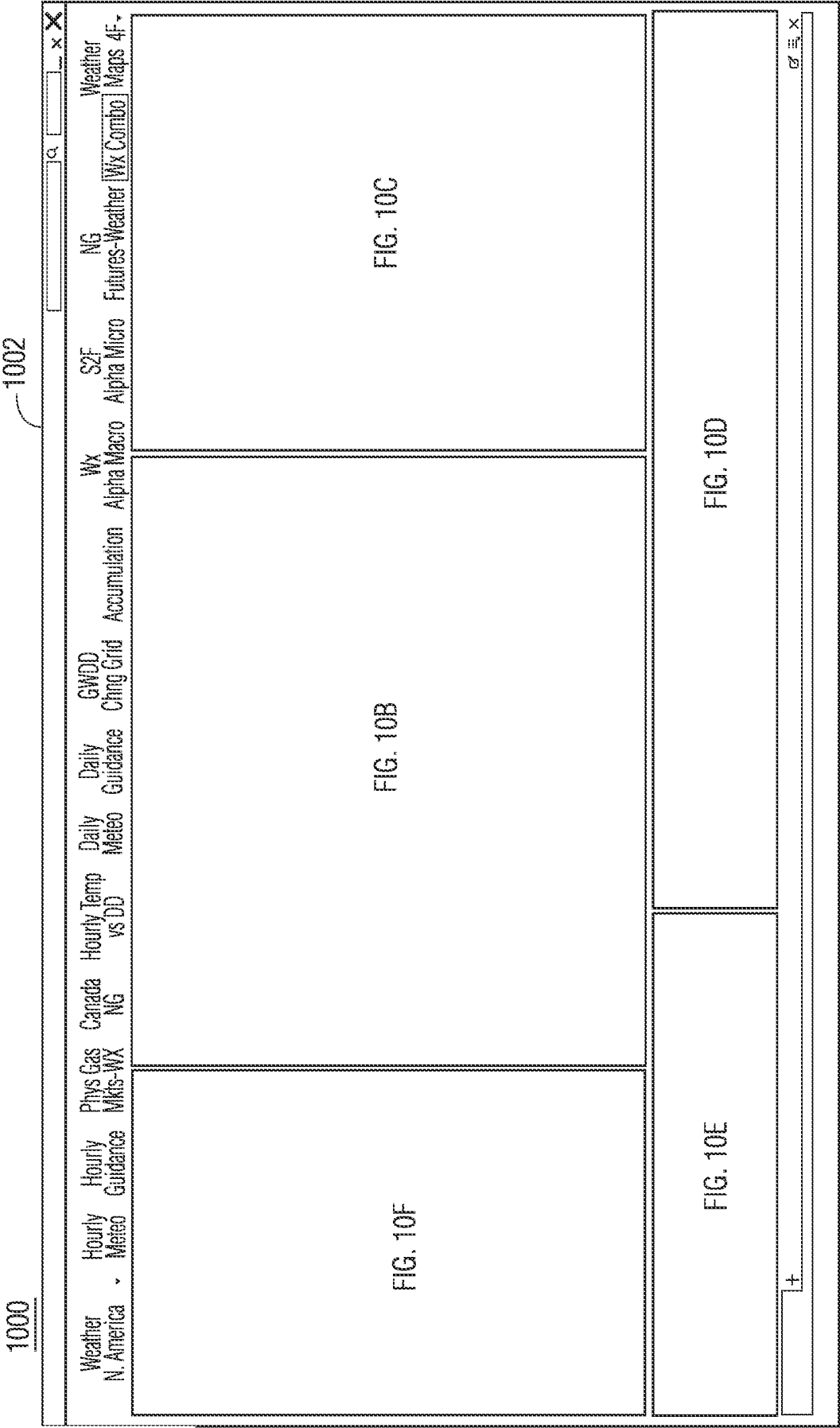
FIG. 9G

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922

GFS 12z				
Model Hr	Model Day	% Comp	Average UTC Time	Local Time
0	0		15:23:41	9:23 AM
3	0		15:26:31	6:02 AM
6	0		15:28:47	6:05 AM
9	0	62.50%	15:30:54	6:07 AM
12	0	75%	15:33:12	6:09 AM
15	0	87.50%	15:34:06	6:10 AM
18	0	100%	15:35:06	6:11 AM
21	1		15:35:55	6:12 AM
14	1		15:36:55	6:13 AM
27	1		15:37:47	6:14 AM
30	1	62.50%	15:38:35	6:14 AM
33	1	75%	15:39:36	6:15 AM
36	1	87.50%	15:40:28	6:16 AM
39	1	100%	15:41:19	6:17 AM
42	2		15:42:13	6:18 AM
45	2		15:43:09	6:19 AM
48	2		15:44:02	6:20 AM
51	2		15:44:58	6:21 AM
54	2	62.50%	15:45:57	6:22 AM
57	2	75%	15:46:51	6:23 AM
60	2	87.50%	15:47:44	6:24 AM
63	2	100%	15:48:40	6:24 AM
66	3		15:49:33	6:25 AM
69	3		15:50:29	6:26 AM
72	3		15:51:26	6:27 AM
75	3		15:52:20	6:28 AM
78	3	62.50%	15:53:19	6:29 AM
81	3	75%	15:54:14	6:30 AM
84	3	87.50%	15:55:04	6:31 AM
87	3	100%	15:56:00	6:32 AM
90	4		15:56:47	6:33 AM
93	4		15:57:47	6:34 AM
96	4		15:58:41	6:35 AM
99	4		15:59:42	6:36 AM
102	4	62.50%	16:00:36	6:36 AM
105	4	75%	16:01:26	6:37 AM
108	4	87.50%	16:02:17	6:38 AM
111	4	100%	16:03:16	6:39 AM
114	5		16:04:21	6:40 AM
117	5		16:05:11	6:41 AM
120	5		16:06:05	6:42 AM
123	5		16:07:10	6:43 AM
126	5	62.50%	16:08:02	6:44 AM
129	5	75%	16:08:53	6:45 AM
132	5	87.50%	16:09:52	6:46 AM
135	5	100%	16:10:26	6:46 AM

FIG. 9H



1004

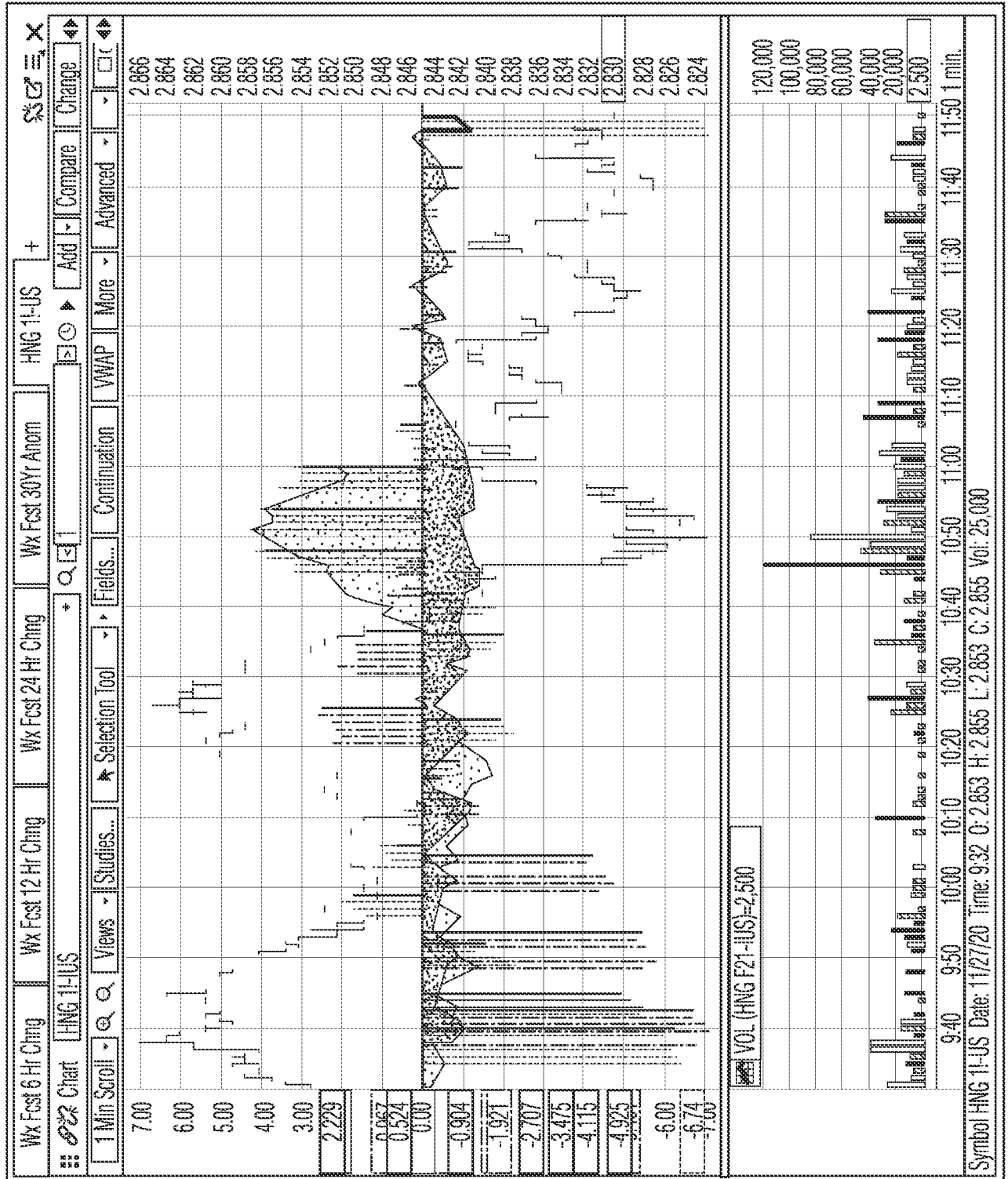


FIG. 10B

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1006

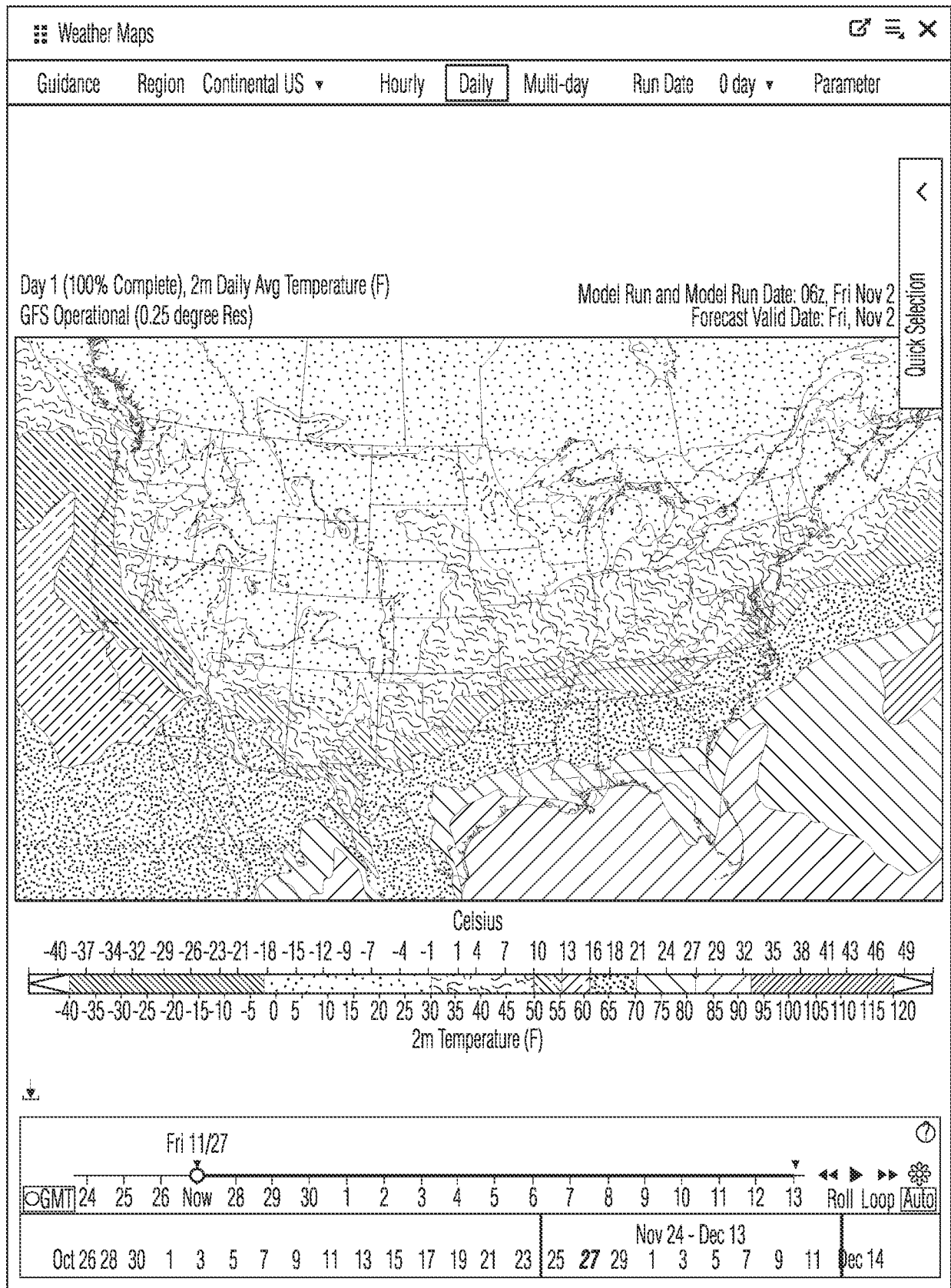


FIG. 10C

1008

Weather Model Status	Real-time status	GFS 12Z	GFS Ens. 12Z	ECMWF 12Z	ECMWF Ens. 6Z	Time Step:	1 hr	3 hr	6 hr	Zulu Offset:	0	
Model Day	% Complete	Date	Day of Week	3am	6am	9am	12pm	3pm	6pm	9pm	12am	
1	100	11/27/20	Fri				0	3	6	9	12	
2	100	11/28/20	Sat	15	18	21	24	27	30	33	36	
3	100	11/29/20	Sun	39	42	45	48	51	54	57	60	
4	100	11/30/20	Mon	63	66	69	72	75	78	81	84	
5	100	12/1/20	Tue	87	90	93	96	99	102	105	108	
6	100	12/2/20	Wed	111	114	117	120	123	126	129	132	
Green = model hour is complete Yellow = model hour late more than 1 standard deviation Red = model hour is missing												

FIG. 10D

☰

Alerts

Add

Action ▼

Export to CSV

☑

☰

✕

Quote Alerts

News Alerts

Condition Alerts

Time Alerts

Weather Alerts

Alert History

Set Date	Fired Date	Location	Condition	Model Name	Model Run	Forecas...	Name
✓ 13:51:36 1...		KORD	2M Daily Avg...	ECMWF, ECM...	12z	1 - 17	KORD 4 and 6...

1014

FIG. 10E

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1010

Regional GWDD		NG Futures Contracts			
Symbol		Description		2...	H... C... 1...
Gas Weighted L-48 - CONUS					
▼ Gas Weighted L-48 - CONUS					
"GWUS" is the code for the lower 48- (a summary of 100 cities) each weig...					
estimated impact on US natural gas consumption					
HDDs + CDDs with adjustments to the traditional degree day formula to...					
GWUS MROI-GFS	*	GWUS CONUS - GFS all runs			
GWUS METR	*	GWUS CONUS - METAR Observation			
Gas Weighted State					
▶ Gas Weighted State [98]					
Gas Weighted Electricity Region					
▶ Gas Weighted Electricity Region [28]					
Gas Weighted Census Region					
▶ Gas Weighted Census Region [18]					
Gas Weighted EIA Storage Region					
▶ Gas Weighted EIA Storage Region [12]					
Gas Weighted EIA Storage Sub Region					
▶ Gas Weighted EIA Storage Sub Region [22]					
▶ Vote to alter list [2]					

1012

Select Natural Gas Contract			
GWUS-METR	HNG 11-IUS ▼	← Select NG Contra	
	12Z ▼		
	GFS ▼		
	MR4I ▼		

FIG. 10F

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1016

Weather Alert ×

Alert Condition

Alert Name

Location(s)

Forecast Parameters (Hover over digit field for UoM)

2M Daily Avg Temp 12 Hr Change	Greater Than	4.0	Or
2M Daily Avg Temp 12 Hr Change	Less Than	-4.0	And
2M Daily Avg Temp official 30yr Anomaly	Greater Than	6.0	Or
2M Daily Avg Temp official 30yr Anomaly	Less Than	-6.0	Or

Add Parameter Threshold Helper

Note

Commodity

Action

Model Settings

Models

	0z	6z	12z	18z
ECMWF	☐	☐	☒	☐
ECMWF ENS Mean	☐	☐	☒	☐
GFS	☐	☐	☒	☐
GFS ENS Mean	☐	☐	☒	☐

Forecast Periods

☐ Days 1-5 ☐ Days 6-10 ☐ Days 1-17
☐ Next day ☐ Days 1-17 ☐ Forecast day To

Forecast When % Complete

Notification

Day of use

☒ Monday	☒ Tuesday	☒ Wednesday	☒ Thursday
☒ Friday	☐ Saturday	☐ Friday	

To change UoM Tools -> Preferences -> Currency and Unit

FIG. 10G

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Add Weather... ×

Type

Guidance
Accumulation
Progression
Alpha Micro
Alpha Macro

Location(s)

KORD ×
▼

☐ Plot Average of Selected Locations

Time Interval

Hourly
Daily

Parameter(s)

2M Hourly Temp ×
▼

Interpolation: Interpolated Data ▼

Preliminary Daily Values: ▼

Model(s)

GFS Op. 25 Deg	GFS ENS Mean	GFS ENS Summary Stats	GFS ENS Percentile Rank
ECMWF	ECMWF ENS Mean	ECMWF ENS Summary Stats	ECMWF ENS Percentile Rank

The ECM, ECE & ECEX data is based on data and products of the European Center for Medium-Range Weather Forecast (ECMWF)

Run(s)

Current	0z	6z	12z	18z
Curr - 6hr	Curr - 12hr	Curr - 18hr	Curr - 24hr	

Climatology

+ 10yr
+ 15yr
+ 30yr
Official 30yr
☐ Add Summary statistics

Observations

☒ Observations Real-time (METAR)
☐ Summary statistics (Convert data to OHLC)

Wayback (Forecast as of): Wayback ☐

Note:
Change Unit of Measure: Tools > Preferences > Currency and Units
Change AM/PM Colors: Chart Display Properties > Text & Colors > Background
Change Wx Model Colors: Chart Display Properties > Plot Colors

Add ▼
Apply ▼
Close

FIG. 10H

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1038

Add Weather...

Type

Guidance
Accumulation
Progression
Alpha Micro
Alpha Macro

Location(s)

GWUS

Parameter(s)

GWDD

Model(s)

GFS
Op. 25 Deg

GFS ENS
Mean

ECMWF

ECMWF ENS
Mean

The ECM, ECE & ECEX data is based on data and products of the European Center for Medium-Range Weather Forecast (ECMWF)

Run(s)

Current

0z

6z

12z

18z

Curr - 6hr

Curr - 12hr

Curr - 18hr

Curr - 24hr

Climatology

+ 10yr

+ 15yr

+ 30yr

Official 30yr

Observations

Wayback (Forecast as of):

Wayback

Period:

10/01/2020

 -

10/31/2021

Note:

Add
Apply
Close

Change Unit of Measure: Tools > Preferences > Currency and Units
Change AM/PM Colors: Chart Display Properties > Text & Colors > Background
Change Wx Model Colors: Chart Display Properties > Plot Colors

FIG. 10I

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1040

Add Weather...

Type

Guidance
Accumulation
Progression
Alpha Micro
Alpha Macro

Location(s)

GWUS

☐ Plot Average of Selected Locations

Parameter(s)

GWDD

Target Date:

-1 day

☐

Model(s)

GFS
Op. 25 Deg

GFS ENS
Mean

GFS ENS
Summary Stats

GFS ENS
Percentile Rank

ECMWF

ECMWF ENS
Mean

ECMWF ENS
Summary Stats

ECMWF ENS
Percentile Rank

The ECM, ECE & ECEX data is based on data and products of the European Center for Medium-Range Weather Forecast (ECMWF)

Run(s)

Current
0z
6z
12z
18z

☒ Observations Real-time (METAR)

Note:

Add
Apply
Close

Change Unit of Measure: Tools > Preferences > Currency and Units
Change AM/PM Colors: Chart Display Properties > Text & Colors > Background
Change Wx Model Colors: Chart Display Properties > Plot Colors

FIG. 10J

35/40

1042

Add Weather...

Type

Guidance
Accumulation
Progression
Alpha Micro
Alpha Macro

Location(s)

GWUS

Parameter(s)

GWDD 12 Hr Change
GWDD official 30yr Anomaly
GWDD
2M Hourly Temp

Interpolation:

Interpolated Data

Preliminary Daily Values:

Model(s)

GFS
Op. 25 Deg

GFS ENS
Mean

ECMWF

ECMWF ENS
Mean

The ECM, ECE & ECEX data is based on data and products of the European Center for Medium-Range Weather Forecast (ECMWF)

Run(s)

Current
0z
6z
12z
18z

Curr - 6hr
Curr - 12hr
Curr - 18hr
Curr - 24hr

Wayback (Forecast as of):

Wayback

Commodity:

HNG 1!-IUS

Note:

Add
Apply
Close

Change Unit of Measure: Tools > Preferences > Currency and Units
Change AM/PM Colors: Chart Display Properties > Text & Colors > Background
Change Wx Model Colors: Chart Display Properties > Plot Colors

FIG. 10K

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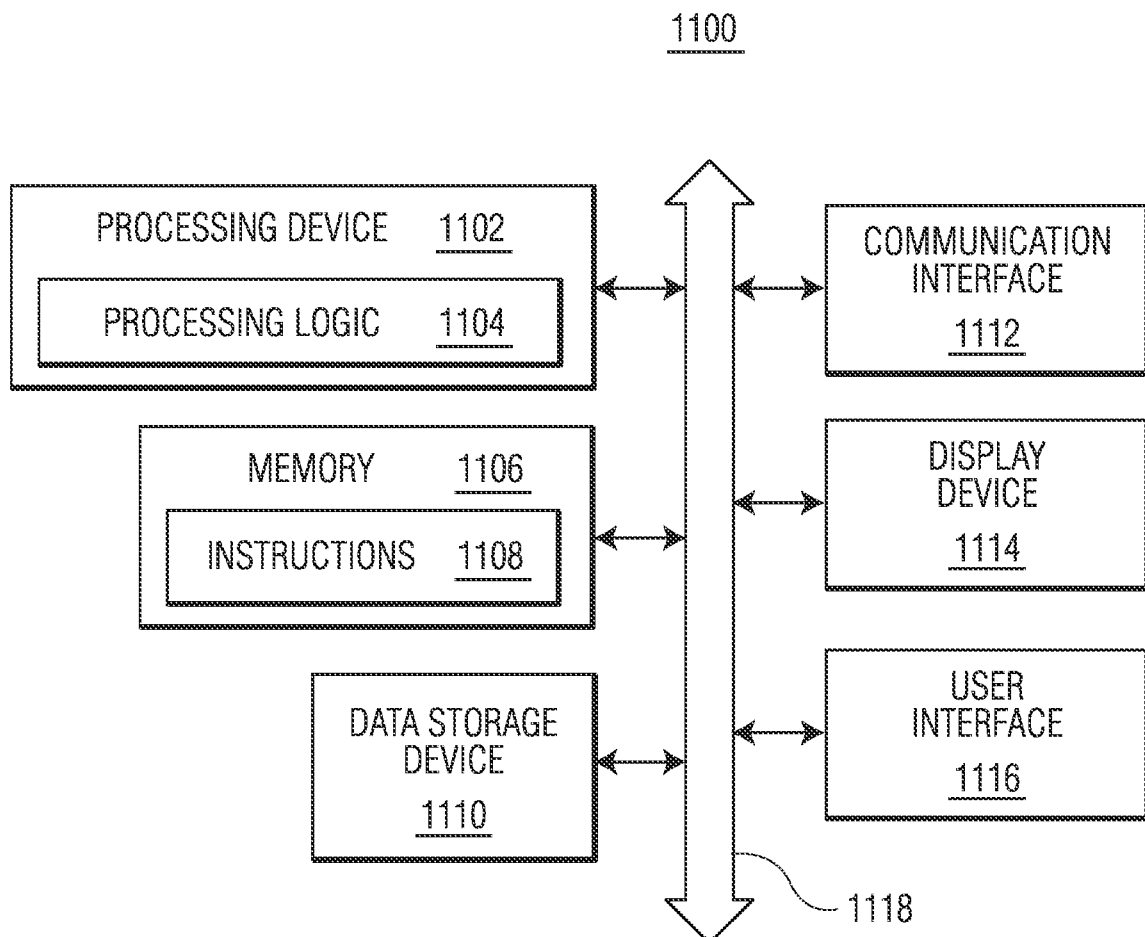


FIG. 11

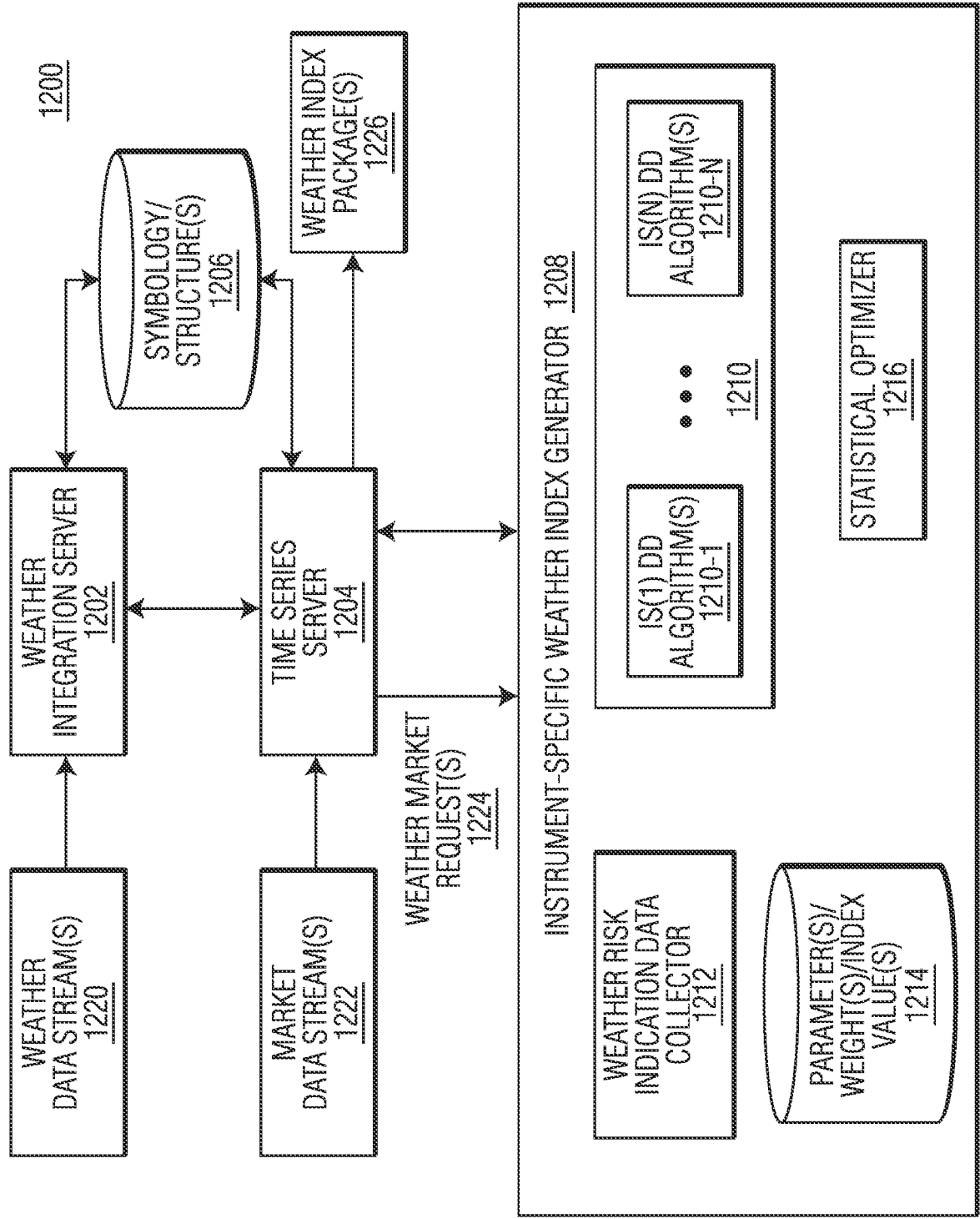
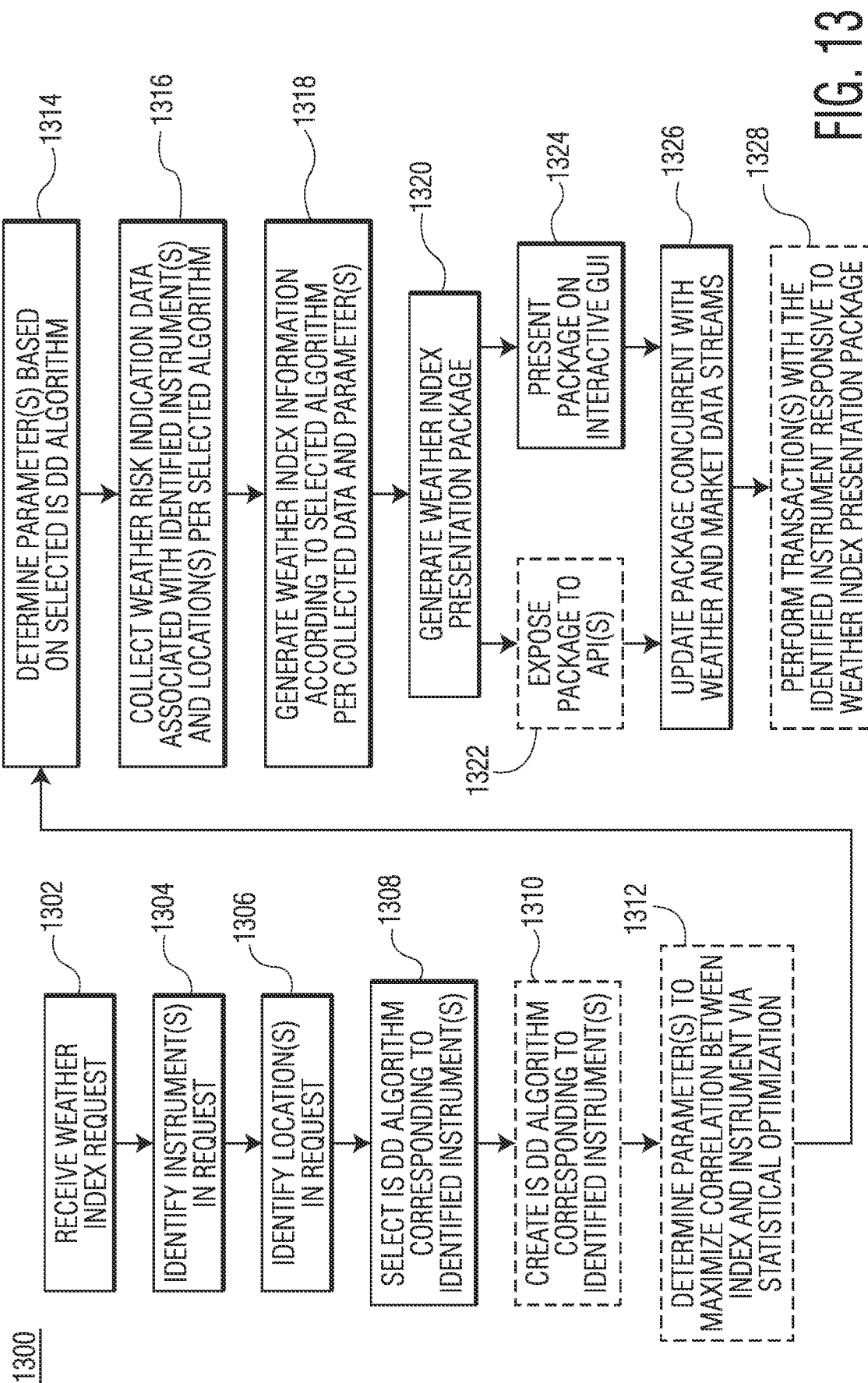


FIG. 12

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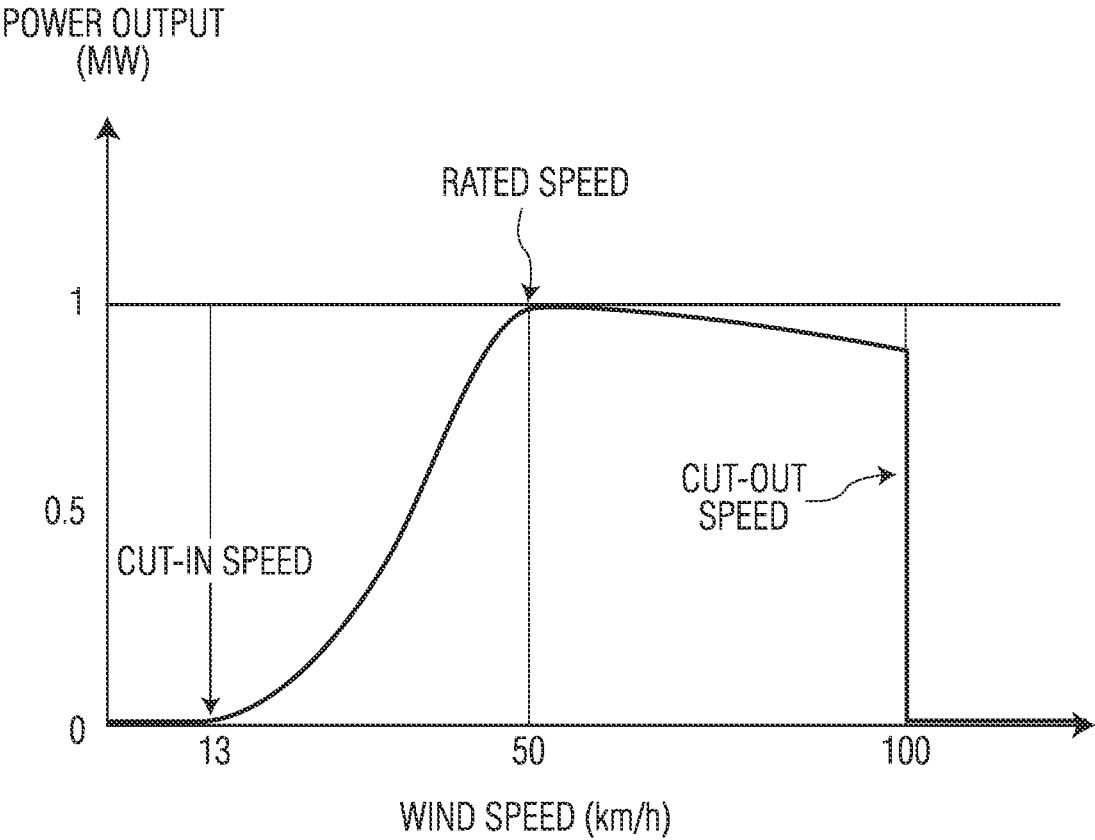


FIG. 14

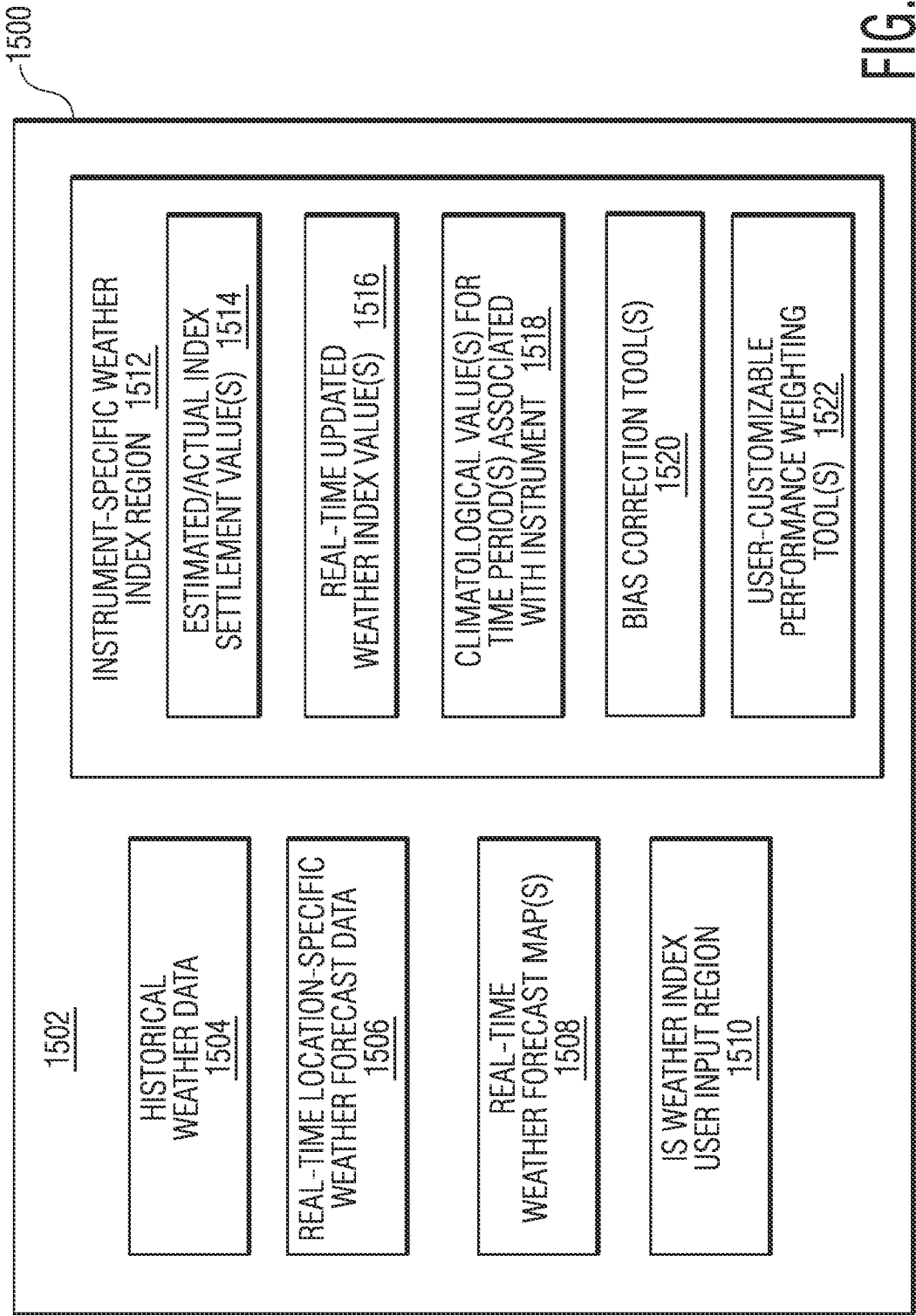


FIG. 15